

GRIMM: the choose your own story language

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1. Introduction

The programming language GRIMM is designed to allow the user to easily create a “choose your own adventure” story for children. Although simple, the language is flexible and powerful enough to create complex, text-based adventure games. GRIMM is named in honor of the brothers Grimm, a pair of famous authors of children’s stories.

Using GRIMM, the programmer is able to quickly and naturally create a story with characters, items, and choices for the player using the programmers own images. GRIMM allows the programmer to create a personalized story with an ending chosen by the child. The experience is interactive, making it much more engaging than reading a bedtime story. The child will have choices, and therefore will direct the progression of the story until they reach their own ending. The language is designed so that less technical users, such as parents and teachers, are able to quickly create programs and detailed stories even if they lack extensive programming experience.

1.1 Motivations

GRIMM came out of our interest in creating a children's storytelling language, text-based game creation language, and FSM modeling language. We wanted to create a language that interested us and also allowed the programmers to create something unique, provide entertainment or educate the end user of the application. Combining these interests, it is easy to see how we arrived at a “choose your own adventure” storybook language.

After researching the programming languages created by groups from previous years, we decided we wanted to create a language that allows the programmer to do something that is not already implemented in an existing language. Our language shares some features with the eMuse language. eMuse was designed to allow the programmer to create a screenplay and visualize it before getting actors involved. However, GRIMM allows the user to directly interact with the story in an open-ended, non-deterministic environment.

Lastly, we wanted a language that would allow the user of a created application to be entertained or educated in some way. Initially, we considered implementing a tool that would help students in school by using our language to visualize a problem. However, the creation of a story would be entertaining for a child and inspire them to create their own stories. Therefore, this meets our two-fold objective: to entertain the child and expose them to programming while advancing their education by facilitating them to write their own stories.

1.2 Goals

Inherent in the programming of all text based, role playing games are a number of common concepts. These include creating characters, items, and a space in which these characters and items exist. Using a non-domain specific language, such tasks are non-trivial. Our goal was to create a language with these constructs built in, allowing the programmer to concentrate on the creative aspects of building their adventure.

By taking advantage of the common software aspects of these items and locations, GRIMM requires the developer to merely specify a few details for each new entity they wish to introduce in their story. So, instead of wasting time writing code to implement a front door, the developer can create such an object quickly, then move on to determine what happens when the character passes through.

GRIMM takes the developers focus away from the programming details, and puts it back to where it should lie, in the story. By doing so, the programmer can create a much richer and more intricate plot, making the adventure much more appealing. Additionally, GRIMM gives those unfamiliar with the aspects of programming an easy interface on which to create the stories they may dream up.

1.3 Features

GRIMM: A simple, intuitive, flexible, object oriented, interactive, visual, fun language.

Simple

In order for teachers and parents to use the language it must be simple for them to learn and use. These types of people are busy enough without having to undertake learning a programming language, especially if they are not already involved in application development. Therefore we wanted to create a language that would be easy for non-technical people to understand and use. We are offering these people a language that does the image processing and placement, scene creation and movement, and choice implementation and execution without requiring the writer to know about the intricacies of programming. The keywords are straightforward and easy to recall and use. The language is also small and basic. The programmer can make the stories as simple or complex as they feel comfortable with by choosing how many scenes to have, how many objects to use, and how many options the user will have.

Intuitive

For non-technical people to use GRIMM it must loosely resemble English to make story-board creation intuitive. Languages such as C++ and Java are hard for non-technical people to understand because the syntax is unfamiliar. With GRIMM, users will understand the keywords and control structures because they will be described using English-based conventions. New story-board creators should be able to easily program-by-example by examining other stories. This will enable non-technical parents and teachers to quickly learn and start writing stories in GRIMM.

Flexible

There are many aspects to a story including: scenes, items, characters, descriptions, and open-ended choices. We allow the writer to completely create their own world within our framework. The writer can assign attributes to scenes, such as interesting characters and items. Additionally they can associate images with scenes that will be shown at runtime. This

allows the writer to create stories involving their own surroundings as well as make-believe items using basic predefined data types such as character, scene, and item. This flexibility allows there to be an endless number of possible stories with GRIMM.

Object Oriented

GRIMM has many objects, each with their own specific attributes. There are various basic data types that are used to describe a story. One example is a “scene”. Each scene must be created and then assigned values to its attributes such as name and description.

We thought initially that non-technical people could be confused by the idea of Object Oriented, but we feel that grouping all aspects of a data type will instead be helpful to them due to its clear organization. For example, all of the attributes of the scene “hallway” are directly attached to the scene instance:

```
scene hallway
hallway name "Hallway"
hallway description "You're in the hallway now."
hallway picture "hallway.jpg"
hallway exit bathroom is hidden
hallway exit kitchen
hallway contains item key
```

Object Orientation will help the writer organize objects and their attributes and therefore facilitate the creation of a story.

Interactive

Once a GRIMM program is created and presented to a child the possibilities are endless. The child has several choices in every scene to perform actions such as going to another scene, manipulating items, and interacting with characters. For example, if there is a glass on the table, the character is allowed to pick it up. The scene choices are entered through the exits of a current scene that the programmer defines for the user. In some cases an exit may be hidden and the only way the user can find it is through talking to a character. In other cases the user may need an item to get through an exit. This allows the programmer to define many options for the user to interact with in order to move through the story. The open-ended world is a robust feature that makes GRIMM so enjoyable for children. The child’s interest will be captured while they are working within the story. Aside from the child being able to make choices, the child gets to decide how the story progresses and ends based on the choices that they make.

Visual

A special feature of GRIMM is the ability for the programmer to input any images of their creation into the story. Each scene in the story has the ability to display a visual element. This allows the story to become more personal for the child who is exploring through the world. As the user moves throughout various scenes, images will be displayed as a

background. We feel that the visual capabilities of GRIMM will help the writer and user to enjoy the experience.

Fun

GRIMM allows the writer to create any story with an unlimited number of possibilities. We want people to have fun with the flexibility, interactivity, and visual aspects in order to engage a child in an interesting story. Both aspects of the program should be enjoyable: development and usage. We want the writer to be engaged in the development by making the language intuitive and simple. Its flexibility allows the writer to be creative. The child will become engaged because of the engaging nature of the stories and perhaps partake in the development of new ones.

1.4 Summary

The GRIMM language will open up programming to the programming novice, taking away the intimidating syntax and replacing it with intuitive, domain specific keywords. We have also provided a flexible tool, such that games and stories can be created as simple or as complex as the developer desires. GRIMM also brings a new education aspect to the classroom or the home, one in which skills translate directly into an adventure both teacher and student can enjoy. And finally, GRIMM stops the wasted time spent by previous developers in coding the same basic concepts for every game or story they create.

However, in spite of all these advantages, the most important aspect of the GRIMM language is that of allowing the programmer to focus on what is important. GRIMM redistributes the programmer's effort to where it belongs - on the story, not on the code.

2. Language Tutorial

2.1 Writing a GRIMM program

There are two main sections of a GRIMM program: the declaration & assignment section and the statement section. You must have at least one statement in the file for it to be a valid GRIMM program. We give you three examples increasing in difficulty.

2.1.1 Hello World

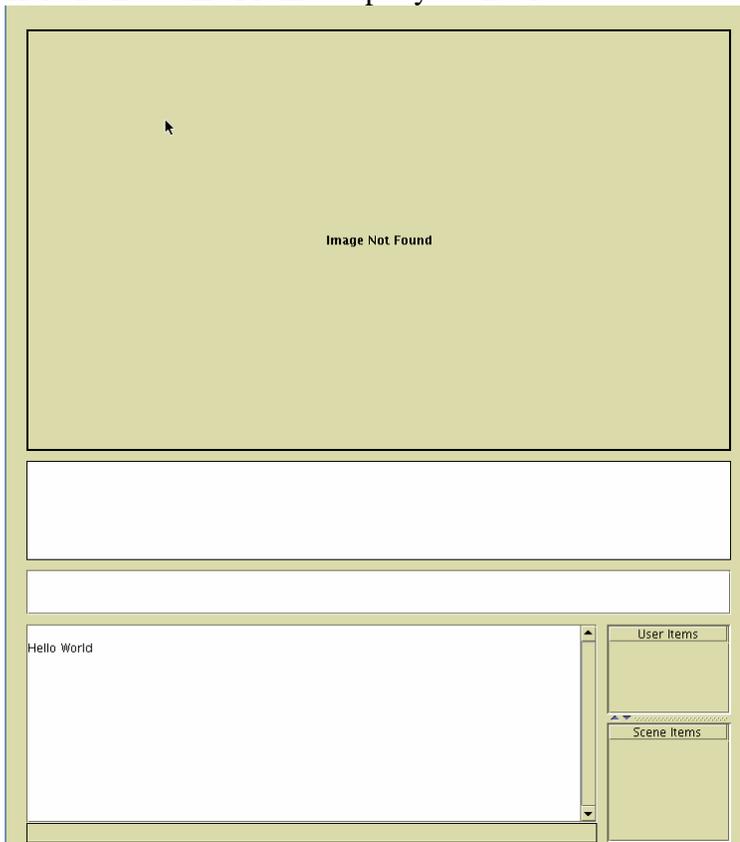
This simple program shows how to use comments and a single statement in the GRIMM language.

Create a file named “hello.gmm” and type in the following example:

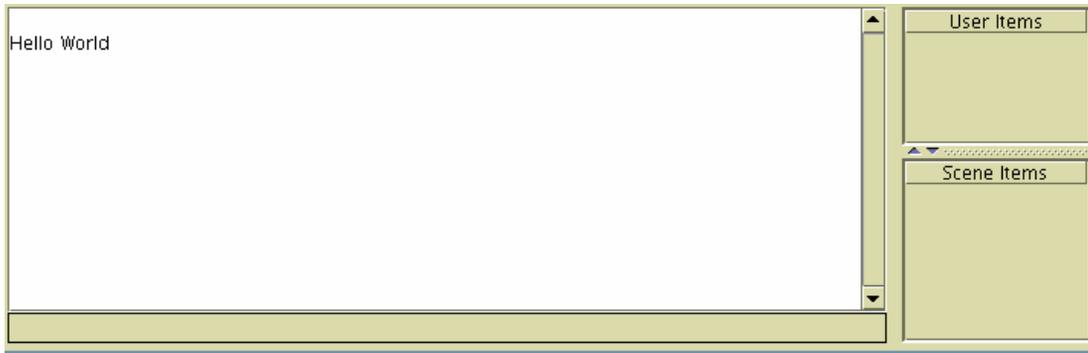
```
:note: My first GRIMM program  
say "Hello World"
```

Then follow the compilation instructions below.

Here is the Game Frame output you should see:



The program simply outputs “hello world” on the terminal and then ends.



2.1.2 A Simple Room Example

This example shows the simplest use of a room. **NOTE:** each room must have a name

Create a file named “simple.gmm” and type in the following example:

```
:note: a simple GRIMM file with one room

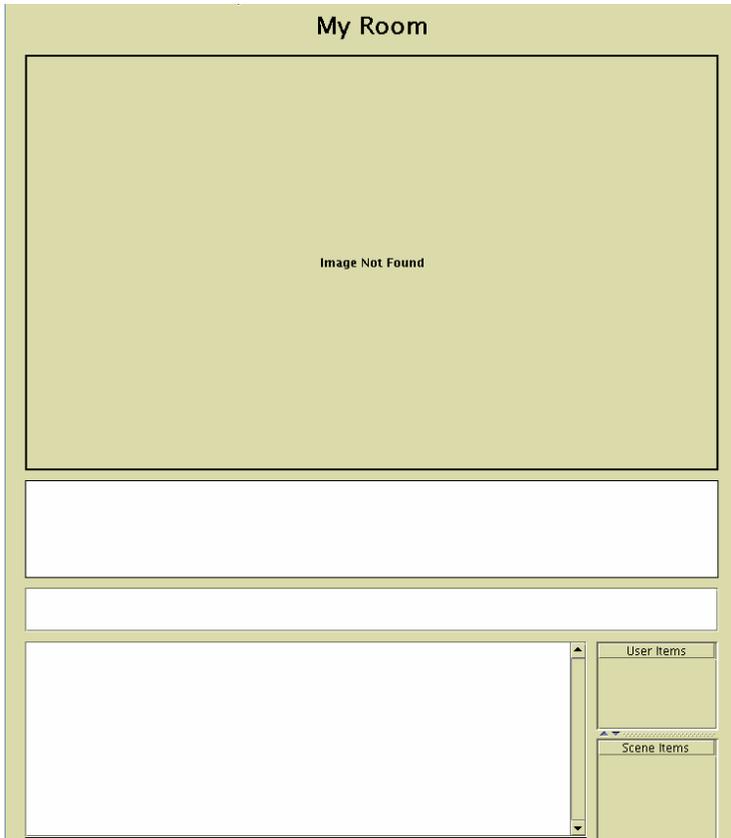
:note: declaration section
scene room
room name "My Room"

:note: action loop section
goto room

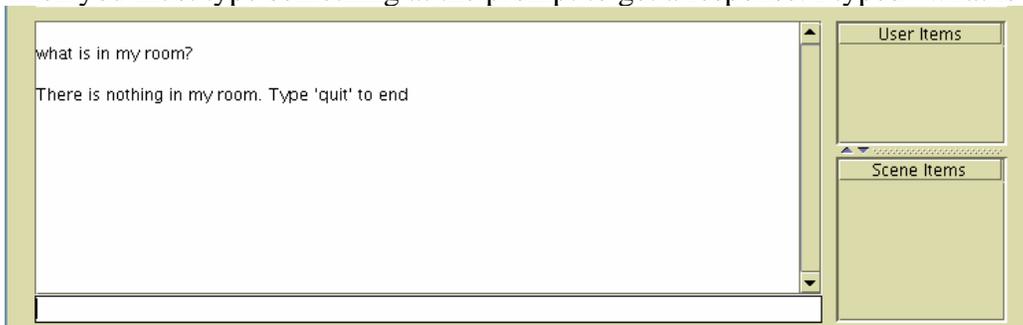
read user input
while not user says "quit"
    say "There is nothing in my room. Type 'quit' to end"
    read user input
endwhile
```

Then follow the compilation instructions below.

The Game Frame shows:



Then you must type something at the prompt to get a response. I typed “what is in my room?”



2.1.3 Successful Program Images

Castle Path



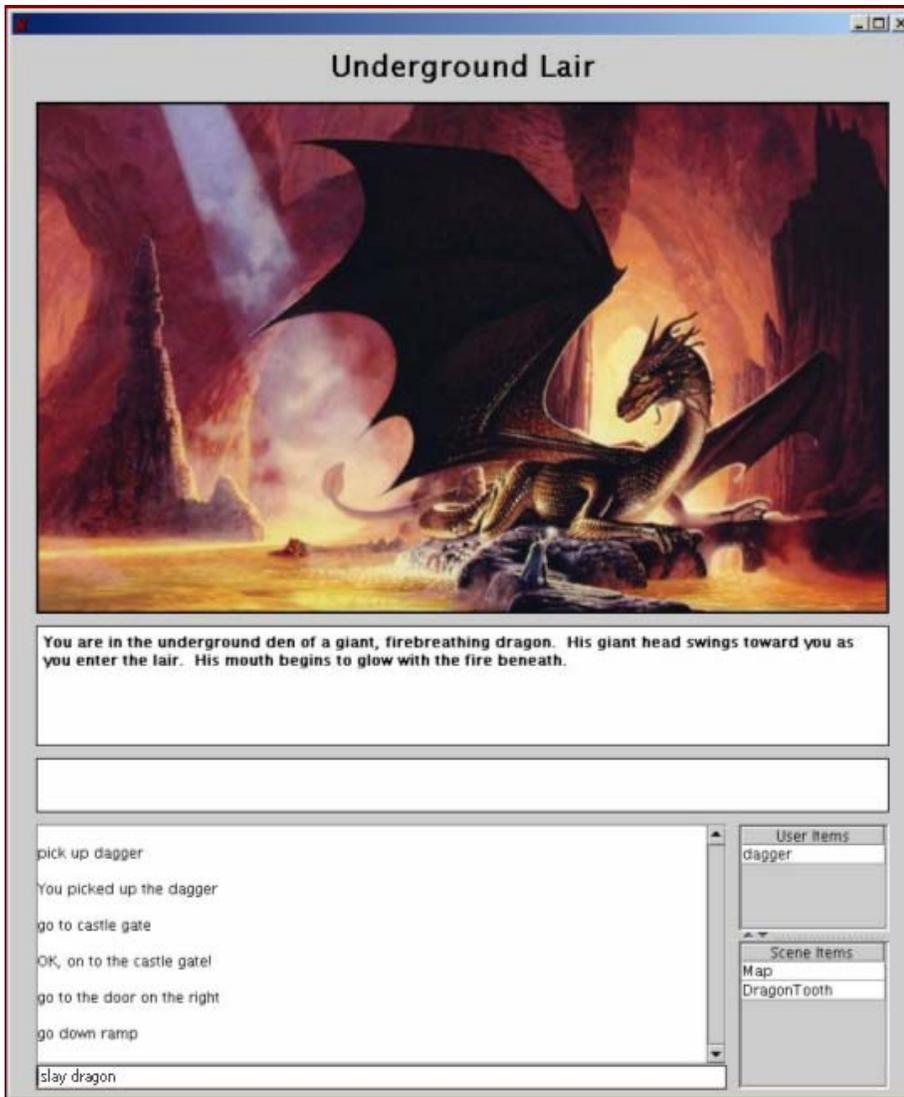
You are standing on a dirt path. Ahead of you in the distance you see the Castle of the North Kingdom. You think you here something that sounds like trumpets blaring way off in the distance. To your left is a small dagger.

There is an exit to North Castle Gate

pick up dagger
You picked up the dagger

User Items
dagger

Scene Items



2.2 Compiling the program

Your GRIMM files must be saved in the grimm folder with the compiler. Open a terminal and move into your grimm folder.

Then at the terminal prompt type:

```
$ make <example_name>
```

The name of your example is the filename with no extension. For example if your file is called:

```
simple.gmm
```

Then type:

```
$ make simple
```

at the prompt.

If the program compiles correctly you will see :

```
java antlr.Tool grimm.g
ANTLR Parser Generator  Version 2.7.4   1989-2004 jGuru.com
java antlr.Tool GRIMMTranslator.g
ANTLR Parser Generator  Version 2.7.4   1989-2004 jGuru.com
javac GRIMM.java
javac Character.java Scene.java GRIMM.java SymbolTable.java GRIMMLexer.java
Thing.java User.java GRIMMParser.java GRIMMTokenTypes.java gameFrame.java
GRIMMWalker.java GRIMMtranslator.java GRIMMtranslatorTokenTypes.java
outputFrame.java Item.java CustomAST.java
Note: GRIMMParser.java uses or overrides a deprecated API.
Note: Recompile with -deprecation for details.
java GRIMM hello.gmm
javac hello.java
java hello
```

If you have typed in errors you will see error messages:

```
java antlr.Tool grimm.g
ANTLR Parser Generator  Version 2.7.4   1989-2004 jGuru.com
java antlr.Tool GRIMMTranslator.g
ANTLR Parser Generator  Version 2.7.4   1989-2004 jGuru.com
javac GRIMM.java
javac Character.java Scene.java GRIMM.java SymbolTable.java GRIMMLexer.java
Thing.java User.java GRIMMParser.java GRIMMTokenTypes.java gameFrame.java
GRIMMWalker.java GRIMMtranslator.java GRIMMtranslatorTokenTypes.java
outputFrame.java Item.java CustomAST.java
Note: GRIMMParser.java uses or overrides a deprecated API.
Note: Recompile with -deprecation for details.
java GRIMM hello.gmm
ERROR MESSAGES HERE
```

3. Language Manual

3.1 Lexical Conventions

3.1.1 Tokens

There are three classes of tokens: identifiers, keywords, and string constants. Newlines signify the end of a statement or end of part of a statement. Comments and whitespace are ignored as they only separate tokens.

3.1.2 Comments

These items are ignored, but are used by the programmer to leave notes about what a piece of code does. Therefore, comments are appropriately indicated by the character sequence: “:note:” and end when a new line character is reached, therefore comments may only be one line long.

```
:note: this is a comment
```

3.1.3 Identifiers

An identifier can be any alpha numeric combination beginning with an alphabet character. Upper and lowercase letters are considered to be different. An identifier may not have the same spelling as a keyword. All identifiers must be unique.

3.1.4 Keywords

The following words are keywords in the GRIMM language and may not be used as identifiers.

and	gameover	item	read
character	goto	name	say
contains	has	not	says
description	hidden	or	scene
drops	holds	otherwise	then
endif	if	otherwiseif	user
endwhile	input	pickup	while

User keyword

The user keyword is a special variable that represents the application user. It contains the state of the user throughout the life of the program. For example, the last input given by the user, the item the user holds, and the scene the user is currently in. It has other keywords that are associated with it in order to retrieve or change these states.

3.1.5 Newline

This token signifies the end of a line and is used to terminate program statements. It is defined as a carriage return at the end of a line (hitting the enter key on a keyboard). Even though newlines are ignored in actual program execution they are very important to the structure of the program. A statement may appear only on a line by itself, with the exception of while loops and if statements where newlines identify the different segments of the construct.

3.1.6 Whitespace

Blanks, tabs, newlines, comments, etc are considered white space. Newlines serve the purposes described above, but all others are ignored as they only separate tokens.

3.1.7 String Constants

A series of characters surrounded by double quotes.

3.2 Declarations

3.2.1 Scenes

Scenes represent states the user can occupy usually named after locations such as “hallway” or “school”. A scene is declared using the keyword `scene` followed by the variable name of the scene. These are all declared at the very beginning of the file, and indicate all different locations available to the story. For example, if a story contained the possibility of movement from the bathroom, bedroom, and backyard the scenes would be declared as follows:

```
scene bathroom
scene bedroom
scene hallway
```

3.2.2 Characters

The programmer may choose to put characters in all or some scenes. Characters represent people that the user may interact with to gain information or items in the story. Characters can move between scenes if the programmer wishes. Characters are declared using the keyword `character` and then the variable name.

```
character steven
```

3.2.3 Items

Items represent objects that can be held or traded by the user. Items do not make sense if they cannot be picked up by a user, for example “house” is not a good choice for an item. At some points the user may need an item to be able to use an exit. The programmer may choose to put items in all or some of their scenes. These items are declared using the keyword `item` and then the variable name. They are either associated with a scene or a character and may be hidden.

```
hallway contains item key
steven holds item book is hidden
```

Items contained by a scene cannot have the same name as items held by characters. If a character is in a scene and a character holds the item, this item is not considered to be in the scene. The user must interact with the character to obtain the item.

3.3 Statements

All statements must be followed by a newline character including the last statement in the file.

3.3.1 Assignments

Following the declarations section each scene, character, and item is assigned certain attributes.

Scenes

Each scene is defined by specifying its name, a description, its associated image, its exits, and what items it contains. The name and description will be displayed as text in the runtime environment. Beneath the name, the image will be displayed and then the description. These items give the user information or clues to the layout of a scene. The Programmer must define the name of the scene or they will get a compile error.

The programmer must define exits; they will be displayed at the bottom of the console. Additionally, any items contained in the room will be displayed. As a user may need an item to use an exit, for example they may need a key to open a door, and therefore some exits can be hidden. These will not immediately be displayed at the bottom of the console.

An example scene definition is shown below.

```
hallway name "Hallway"  
hallway description "You're in the hallway now."  
hallway picture "hallway.jpg"  
hallway exit bathroom is hidden  
hallway exit bedroom  
hallway contains item knife
```

Characters

The interaction between a character and user is determined by the programmer. However, each character has the capacity to hold items. To define these items the programmer must say that a character holds the item. For example:

```
steven holds item dragonBook  
steven holds item gradedproject is hidden
```

3.3.2 Boolean Expressions

There are 3 conditional statements using the keywords says, inside, and holds.

user says “quote”

The user says expression is used to evaluate whether the last input by the user includes the quoted text.

```
user says "hello world"
```

For example, if the user says the following expressions it will match.

```
“hello world Puppy”  
“Zippy says hello world lalala”
```

The following example will not work.

```
“hello Zippy world”
```

user inside scenename

This expression is used to determine if a user is in a specific scene.

```
user inside kitchen
```

user has item or charactername has item

This determines if a user or a character holds an item. This can be used to activate hidden exits.

```
steven has key  
user has key
```

3.3.3 Actions

These statements describe a change in the state of the user or interactions with the user.

Goto

A jump statement allows the user to move from one scene to another. This is indicated by using the goto keyword followed by a scene name. If the programmer specifies a scene that is not an exit of the current scene, this will cause a runtime error and the program will exit.

```
goto hallway
```

Say

A say statement allows the programmer to speak to convey information to the user by way of the terminal. These messages can be merely instructions or quotes from a character. The action is indicated by the keyword say followed by a quote.

```
say “hello”
```

Pick up

The user or characters may pick up items in the scene. This allows users to get items or swap items with a character. This is indicated by the pickup keyword followed by the name of the item to be picked up. The programmer must specify the user or the character name before the pickup keyword. If the programmer specifies an item that is not in the current scene, this causes a runtime error and the program will exit.

```
user pickup key  
steven pickup book
```

Drop

The programmer may allow for a user or a character to drop an item, therefore no longer possessing it. The user or a character name precedes the drops command to specify whether the user or a character is executing the drop action. If the

programmer specifies an item that the user or character does not currently possess, this causes a runtime error and the program will exit.

```
user drops book
steven drops book
```

User input

The programmer may read user input from the console at any time. As described above the programmer may check for specific input using the user says “quote” statement. These actions are executed by the statement:

```
read user input
```

GameOver

The game over action is used to define when the story is over. The programmer may put this at the end of the program or somewhere in a scene. It is indicated by using the keyword `gameover`.

```
gameover
```

3.3.4 Selection

If statements allow the programmer to check the state of the user and then do specified actions. The first line must always be `if` and must be followed by a boolean expression terminated by the keyword `then` and a newline character. On successive lines there can be a series of statements. The end of an if-statement must be indicated on a new line using the keyword `endif`.

```
if user says "pickup key" then
    pickup key
endif
```

The programmer may compound if-statements with other option by using `otherwise`. There are two types of compound if-statements: `otherwiseif` and `otherwise`.

The `otherwiseif` are constructed by an `otherwiseif`, followed by a boolean expression, terminated by a `then` and a newline character followed by a series of statements. There can be as many `otherwiseif`'s as needed.

```
if user says "pickup key" then
    user pickup key
otherwiseif user has key and user says "goto bathroom" then
    goto bathroom
endif
```

Finally there may be a default choice specified by `otherwise`, a newline character and a series of statements.

```
if user says "pickup key" then
    user pickup key
otherwise
```

```
        gameover
    endif
```

All if-statements, compound or not, must be terminated by the endif keyword.

```
    if user says "pickup key" then
        user pickup key
    elseif user has key and user says "goto bathroom" then
        goto bathroom
    otherwise
        gameover
    endif
```

3.3.5 Iteration

While statements allow the programmer to have a set of statements occur as long as a certain state is occurring. While loops evaluate the validity of a boolean expression and then execute a sequence of statements. If the boolean expression is true the statements in the body of the loop will be executed. Otherwise the loop will be terminated. The while statements are indicated by the keyword while followed by a boolean expression followed by a newline character. On succeeding lines there can be any number of statements. The end of a while loop is indicated by the keyword endwhile.

```
while user says "hello"
    read user input
endwhile
```

A while loop with an if-statement in the body:

```
while user inside kitchen
    read user input

    if user says "pickup key" then
        user pickup key
    elseif user has key and user says "goto bathroom" then
        goto bathroom
    otherwise
        gameover
    endif

endwhile
gameover
```

NOTE: Tabs and blank lines are not necessary, but can help the readability of the program.

3.4 Scope and Namespace

There is one global scope in GRIMM. All variables are declared in the declarations section and then are used in the action loop below. GRIMM has only one namespace and therefore all identifiers must be unique.

3.5 Program Structure

A GRIMM script has two main parts: declarations & assignments and the action loop. A program must contain a statement section (although it does not necessarily have to be a loop) but does not have to contain the declarations or assignments section. The declarations & assignments section is optional. An empty file is not a valid GRIMM script, the simplest GRIMM script may be one statement.

3.5.1 Declarations & Assignments

The programmer must define all scenes, characters, and items before they may be used. Therefore, we force the programmer to do all declarations and assignments at the top of the program before the action loop.

```
:note: all my scenes
scene hallway
scene bathroom
scene kitchen

:note: attributes of the hallway
hallway name "Hallway"
hallway description "You're in the hallway now."
hallway picture "hallway.jpg"
hallway exit bathroom is hidden
hallway exit kitchen
hallway contains item key

:note: my character
character mariya
mariya holds item dragonbook
```

3.5.2 Action Loop

The action loop is where all actions specified by the programmer are executed. All scenes, character, and items used here must have been declared in the above section. This section can be any sequence of valid statements; we only suggest the action loop structure because of the intuition in the story: if the story is not over, do these actions.

For example:

```
while user inside hallway
  read user input
  if user says "pickup key" then
    user pickup key
  otherwiseif user has key and user says "goto bathroom" then
    goto bathroom
  otherwiseif user says "talk mariya" then
    mariya says "hello, do you want a key?"
  otherwiseif user says "how old are you mariya?" then
    mariya says "24"
  otherwise
    say "I do not understand what you said"
  endif
endwhile
```

4. Project Plan

In order to complete this project in an organized manner we assembled as a group early on in the semester and then set up weekly meetings. After the white paper we each had our own tasks, but we met to bring the group up to speed and to voice any concerns. In addition to our group meetings, we also met at the TA office hours so that we could ask him questions we had. This system worked out well for us until the final weeks of the project when we needed to meet more often to tie things together. Below you will find descriptions of the, milestones of the project and organizational details.

4.1 Team Responsibilities

At first we were all unsure about the details of the project and therefore were timid to split up tasks. In the beginning we worked a lot as a group, while doing individual research. We would come up with questions about a piece of the compiler and discuss them. After implementing the first stages of the lexer and parser we started to become more comfortable and eventually each person volunteered to implement part of the project and in some cases two people decided to work together. You may see below the partitioning is a little different than that suggested in class.

Mike Lenner	AST Walker/Runtime Environment
Bill Liu	AST Walker/Runtime Environment/Testing
Mariya Nomanbhoy	Translator/Runtime Environment
Becky Plummer	Lexer/Parser/Documentation

Even though Professor Edwards suggested that each team pick a leader, we thought that we could work as a democracy, however we eventually chose Mariya as our leader. We did end up having a few arguments, but they were settled through much discussion. We made sure that everyone was satisfied or at least in agreement before proceeding. Our group was easy to work in, because no one neglected their responsibilities.

4.2 Project Timeline

The following chart shows the major milestones in the course of our project. You may find a more detailed progression in the “Project Logs” section 4.5. There was no road map to this project other than the due dates of the papers. We found that completing the lexer and parser before the LRM was very helpful.

Language Details Defined	Sept 23
Whitepaper	Sept 28
Lexer & Parser Completed	Oct 19
Language Reference Manual	Oct. 21
AST Generation Completed	Nov. 11
Translator Completed	Dec. 9
AST Walker Completed	Dec 14
Runtime Library Completed	Dec. 14
Final Testing Completed	Dec. 19
Final Report & Presentation	Dec. 20

4.3 Software Development Environments

The compiler and runtime environment code was written in Java, the testing suites were written using python, and the entire project was version controlled with CVS. The lexer and parser portions were created using ANTLR. The AST Walker and translator walked the AST using ANTLR, but specific operations were implemented in nested Java instructions.

4.4 Style Guide

Below you may find the formatting guide for our project. Professor Edwards mentioned the value of using CVS in the project overview lecture. We think that a mention should be made about the use of a style guide. Style guides are very important to the readability and cohesiveness of a large implementation.

4.4.1 Spacing Conventions

All *indents* are 8 spaces, not 4.

All *lines* must be less than 80 characters wide.

Curly braces are aligned K&R style. For example:

Function

```
public int FunctionName(void) {  
}
```

If-statement

```
if (foo) {  
} else {  
}
```

While loop

```
while (1) {  
}
```

For loop

```
for (;;) {  
}
```

Try-catch block

```
try {  
} catch {  
}
```

NOTE: Use whitespace appropriately to improve readability.

4.4.2 Commenting Conventions

Important Comments

At the top of each file please add a comment block naming the author(s).

```

/*
 * File: Foo.java
 *
 * Author(s): Mike Lenner, Billy Liu
 */

```

Each class should have a block comment before it describing its purpose.

Each method should have a block comment before it describing its purpose and return values.

Comment Style

A *block* comment should be formatted:

```

/*
 * Here is a block comment.
 */

```

Single line comments should be very short and use `/* */`. Align them in the same column as other single line comments:

```

if(true) {
    x = 1;           /* comment aligned */
} else {
    x = 2;           /* comment2 aligned also */
}

```

Use `//` only for commenting out code.

4.4.3 Declaration Conventions

Declare all variables at the beginning of blocks. The only exception is the for loop index it may be declared in the for loop structure.

```

for(int i = 0; ...

```

4.4.4 Naming Conventions

Name all identifiers appropriately to the usage or contents.

```

public scene getUserScene() {
    ...
}

```

Classes & Functions

Class names are mixed case with the first letter capitalized.

```

class FooBar {
    int Zoo;
}

```

Class method names are mixed case with the first letter uncapitalized.

```

class FooBar {
    public int theStyleGuide(int char) {
        int x = 1;
        ...
    }
}

```

Variables

Class member variables are mixed case with underscores, the first letter capitalized.

```
class FooBar {
    int Member_Name;
    ...
}
```

Method variables are lower case with underscores between words.

```
public int FooBar() {
    int my_variable_name;
    ...
}
```

Constants are upper case with underscores between words.

```
public int FooBar() {
    const type_t THE_TYPE = "character";
    ...
}
```

Global variables start with a lowercase “g”, words are capitalized with underscores between them.

```
int gMy_Global_Variable;
```

4.5 Project Logs

4.5.1 Makefile

Working file: Makefile

head: 1.10

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 10; selected revisions: 10

description:

revision 1.10

date: 2004/12/20 01:11:15; author: mhn2102; state: Exp; lines: +5 -3

Updated makefile to remove old java file before compiling.

revision 1.9

date: 2004/12/15 01:09:07; author: wl2139; state: Exp; lines: +3 -0

Added module for test (running all the test scripts)

revision 1.8

date: 2004/12/15 00:42:31; author: wl2139; state: Exp; lines: +4 -1

Added testclean module to clean up test scripts

revision 1.7

date: 2004/12/14 22:59:32; author: wl2139; state: Exp; lines: +5 -4

Added rule for CustomAST.java and added a rule for Make clean

revision 1.6

date: 2004/12/14 19:43:32; author: mhn2102; state: Exp; lines: +11 -0
Okay! Makefile doing good now. Now we can just type make example where the folder has a file example.g file in it and then it will build everything and un the program if it compiles. woo woo

revision 1.5
date: 2004/12/14 19:16:54; author: mhn2102; state: Exp; lines: +3 -4
Updated makefile again

revision 1.4
date: 2004/12/14 18:28:12; author: mhn2102; state: Exp; lines: +1 -1
Removed more unnecessary java files... why isnt it producing tokentype files for anyone else?

revision 1.3
date: 2004/12/14 18:24:25; author: mhn2102; state: Exp; lines: +1 -1
Changed Makefile to take out the extra java files being compiled. Dont really understand why I have these files and no one else does...

revision 1.2
date: 2004/12/14 06:10:35; author: mhn2102; state: Exp; lines: +5 -3
I fixed rthe makefile up and also adding better debugging to GRIMM.java. Everything still compiles and runs as it was before.

revision 1.1
date: 2004/12/09 21:03:26; author: mhn2102; state: Exp;
The translator is pretty much completely working. I need to fix the user inside boolean and other than that everything has been minimally tested and is ready for the real test phase. I added a Makefile so now we can just type make and have everything go.

4.5.2 GRIMM.java

Working file: GRIMM.java

head: 1.8

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 8; selected revisions: 8

description:

revision 1.8
date: 2004/12/18 21:35:06; author: mml2108; state: Exp; lines: +1 -1
changed name of global walker vairbale

revision 1.7
date: 2004/12/15 00:48:48; author: wl2139; state: Exp; lines: +1 -1
Checking command line argument length correctly now

revision 1.6
date: 2004/12/14 18:50:50; author: mhn2102; state: Exp; lines: +0 -3
Updated GRIMM.java so that it doesnt print out some of the debug statements

revision 1.5
date: 2004/12/14 06:10:34; author: mhn2102; state: Exp; lines: +13 -4

I fixed rthe makefile up and also adding better debugging to GRIMM.java.
Everything still compiles and runs as it was before.

revision 1.4
date: 2004/12/09 22:57:12; author: mhn2102; state: Exp; lines: +8 -2
Fixed character node problem. Changed show scene so it now calls user as a
parameter. Things are looking good...

revision 1.3
date: 2004/11/23 23:14:59; author: mml2108; state: Exp; lines: +30 -0
Added error checking and calls to tree walker

revision 1.2
date: 2004/10/15 16:55:48; author: rp2176; state: Exp; lines: +20 -8
added program name as a command line arg. Also does checking for missing
program name

revision 1.1
date: 2004/10/14 23:52:13; author: rp2176; state: Exp;
initial Intepreter

4.5.3 grimm.g

Working file: grimm.g

head: 1.29

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 29; selected revisions: 29

description:

revision 1.29
date: 2004/12/20 03:15:29; author: mml2108; state: Exp; lines: +17 -14
enforced < 80 character line limit per style guidelines

revision 1.28
date: 2004/12/20 02:57:18; author: rp2176; state: Exp; lines: +1 -1
no more mac \r

revision 1.27
date: 2004/12/20 00:21:14; author: rp2176; state: Exp; lines: +15 -18
newlines fixed FOREVER

revision 1.26
date: 2004/12/19 22:48:47; author: mml2108; state: Exp; lines: +7 -0
check for adding same exit to a scene twice

revision 1.25
date: 2004/12/18 22:48:51; author: mml2108; state: Exp; lines: +9 -7
more walker error message correction

revision 1.24
date: 2004/12/18 22:27:28; author: wl2139; state: Exp; lines: +1 -1
Added underscore character to the language

```

revision 1.23
date: 2004/12/18 21:53:08; author: mml2108; state: Exp; lines: +20 -20
fixed bugs and standardized wordings in walker error statements
-----
revision 1.22
date: 2004/12/18 21:34:33; author: mml2108; state: Exp; lines: +157 -107
improved error checking in walker
-----
revision 1.21
date: 2004/12/15 23:47:39; author: wl2139; state: Exp; lines: +2 -1
Fixed typo for error msg
-----
revision 1.20
date: 2004/12/15 23:41:16; author: mml2108; state: Exp; lines: +1 -1
corrected typo
-----
revision 1.19
date: 2004/12/15 23:38:36; author: mml2108; state: Exp; lines: +13 -4
added more error reporting to walker
-----
revision 1.18
date: 2004/12/15 22:15:15; author: mml2108; state: Exp; lines: +10 -4
check for type conflicts on item assignments
-----
revision 1.17
date: 2004/12/15 21:21:24; author: mml2108; state: Exp; lines: +15 -2
added error messages for used identifier
-----
revision 1.16
date: 2004/12/15 21:09:18; author: mml2108; state: Exp; lines: +1 -1
fixed exit assign error message (for real this time)
-----
revision 1.15
date: 2004/12/15 21:08:17; author: mml2108; state: Exp; lines: +2 -2
fixed exit assign error message
-----
revision 1.14
date: 2004/12/14 22:46:27; author: mml2108; state: Exp; lines: +27 -19
Improved error output in Walker
-----
revision 1.13
date: 2004/12/14 21:42:34; author: wl2139; state: Exp; lines: +4 -0
Added authors comment
-----
revision 1.12
date: 2004/12/14 21:34:19; author: mml2108; state: Exp; lines: +65 -53
Changed to match new SymbolTable class and fixed newline issue
-----
revision 1.11
date: 2004/12/14 18:40:29; author: mhn2102; state: Exp; lines: +1 -1
Changed grimm.g so that the newline counts the correct number of newlines
-----
revision 1.10
date: 2004/12/09 21:03:26; author: mhn2102; state: Exp; lines: +0 -5
The translator is pretty much completely working. I need to fix the user
inside boolean and other than that everything has been minimally tested and

```

is ready for the real test phase. I added a Makefile so now we can just type make and have everything go.

revision 1.9

date: 2004/11/23 23:12:36; author: mml2108; state: Exp; lines: +253 -20
Added GRIMMWalker class

revision 1.8

date: 2004/11/11 23:39:41; author: rp2176; state: Exp; lines: +172 -154
grammar file with beginning of the Tree Walker

revision 1.7

date: 2004/11/03 20:41:52; author: rp2176; state: Exp; lines: +52 -26
partially fixed tree. Still some funny things with decls and if statements.

revision 1.6

date: 2004/10/26 19:33:01; author: rp2176; state: Exp; lines: +36 -28
beginning work on implementing building ASTs
CVs: -----

revision 1.5

date: 2004/10/19 22:45:24; author: rp2176; state: Exp; lines: +138 -126
updated grammar with characters, pickup and drop for users and characters.
Characters can begin the story holding items and the scene can begin
containing an item

revision 1.4

date: 2004/10/19 19:42:43; author: rp2176; state: Exp; lines: +5 -10
updated grammar file, removed the instance of the character and added more
interesting boolean expression definition

revision 1.3

date: 2004/10/15 21:27:05; author: rp2176; state: Exp; lines: +88 -33
grammar including while and if constructs

revision 1.2

date: 2004/10/15 16:57:36; author: mml2108; state: Exp; lines: +1 -1
support multiple actions in exit assignment

revision 1.1

date: 2004/10/14 23:51:52; author: rp2176; state: Exp;
initial grammar file

4.5.4 SymbolTable.java

Working file: SymbolTable.java

head: 1.7

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 7; selected revisions: 7

description:

revision 1.7

date: 2004/12/19 22:48:47; author: mml2108; state: Exp; lines: +48 -15

check for adding same exit to a scene twice

revision 1.6

date: 2004/12/19 22:34:19; author: wl2139; state: Exp; lines: +2 -0
style update

revision 1.5

date: 2004/12/18 20:01:51; author: wl2139; state: Exp; lines: +111 -82
Stylized according to style sheet

revision 1.4

date: 2004/12/15 22:15:45; author: mml2108; state: Exp; lines: +10 -1
add overloaded function isDeclared to except a type argument

revision 1.3

date: 2004/12/14 22:51:17; author: mml2108; state: Exp; lines: +1 -1
improved error reporting

revision 1.2

date: 2004/12/14 21:25:07; author: mml2108; state: Exp; lines: +61 -83
Redesigned the symbol table

revision 1.1

date: 2004/11/23 23:06:50; author: mml2108; state: Exp;
Initial version

4.5.5 CustomAST.java

Working file: CustomAST.java

head: 1.3

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 3; selected revisions: 3

description:

revision 1.3

date: 2004/12/19 22:32:03; author: wl2139; state: Exp; lines: +2 -0
style update

revision 1.2

date: 2004/12/19 22:25:08; author: wl2139; state: Exp; lines: +44 -25
Updated according to style guide

revision 1.1

date: 2004/12/14 22:45:22; author: mml2108; state: Exp;
New class such that walker has access to tree node's line numbers

4.5.6 GRIMMTranslator.g

Working file: GRIMMTranslator.g

head: 1.11

branch:

locks: strict

access list:

symbolic names:
keyword substitution: kv
total revisions: 11; selected revisions: 11
description:

revision 1.11
date: 2004/12/20 00:45:54; author: mml2108; state: Exp; lines: +2 -2
changed exact string matching to substring matching for user says statements

revision 1.10
date: 2004/12/20 00:35:12; author: mhn2102; state: Exp; lines: +1 -1
Updated translator to fix pickup statement

revision 1.9
date: 2004/12/19 23:53:17; author: mml2108; state: Exp; lines: +4 -2
improved gameover functionality and corrected string matching

revision 1.8
date: 2004/12/19 23:20:32; author: mhn2102; state: Exp; lines: +1 -1
Fixed say problem in translator.

revision 1.7
date: 2004/12/19 21:22:03; author: mhn2102; state: Exp; lines: +414 -490
I updated the trnslator to mangle variable names oand to fit styl guide.

revision 1.6
date: 2004/12/15 22:43:56; author: mml2108; state: Exp; lines: +1 -1
used compareToIgnoreCase instead of equals

revision 1.5
date: 2004/12/15 22:33:45; author: mml2108; state: Exp; lines: +1 -1
used equals function for testing string equality

revision 1.4
date: 2004/12/15 21:47:11; author: mhn2102; state: Exp; lines: +12 -3
Added error checking functions to user and character so that they can only
pickup and drop items that are in the scene or that they have.

revision 1.3
date: 2004/12/09 22:57:12; author: mhn2102; state: Exp; lines: +18 -13
Fixed character node problem. Changed show scene so it now calls user as a
parameter. Things are looking good...

revision 1.2
date: 2004/12/09 21:37:45; author: mhn2102; state: Exp; lines: +3 -2
Updated translator so pickup and inside now work. Next step is to update the
GRIMM file and fix the unexpected node warning

revision 1.1
date: 2004/12/09 21:03:26; author: mhn2102; state: Exp;
The translator is pretty much completely working. I need to fix the user
inside boolean and other than that everything has been minimally tested and
is ready for the real test phase. I added a Makefile so now we can just type
make and have everything go.

4.5.7 gameGame.java

Working file: gameFrame.java

head: 1.12

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 12; selected revisions: 12

description:

revision 1.12

date: 2004/12/20 00:55:18; author: mml2108; state: Exp; lines: +2 -2
changed JSplit pane init (seriously)

revision 1.11

date: 2004/12/20 00:46:59; author: mml2108; state: Exp; lines: +1 -1
changed JSplit pane init

revision 1.10

date: 2004/12/19 23:19:23; author: mml2108; state: Exp; lines: +22 -13
don't show scene if given a null scene

revision 1.9

date: 2004/12/18 22:00:58; author: mml2108; state: Exp; lines: +486 -378
updated per style sheet guidelines

revision 1.8

date: 2004/12/17 00:00:40; author: mml2108; state: Exp; lines: +132 -88
cleaned up layout, fixed two bugs

revision 1.7

date: 2004/12/15 22:34:06; author: mml2108; state: Exp; lines: +8 -1
fixed bug when no image is given

revision 1.6

date: 2004/12/15 21:47:11; author: mhn2102; state: Exp; lines: +2 -2
Added error checking functions to user and character so that they can only
pickup and drop items that are in the scene or that they have.

revision 1.5

date: 2004/12/15 04:42:17; author: mml2108; state: Exp; lines: +54 -15
cleaned up default case and correct scene and user item issues

revision 1.4

date: 2004/12/09 22:29:09; author: mml2108; state: Exp; lines: +5 -14
added second parameter (User u) to showScene method

revision 1.3

date: 2004/11/11 02:14:56; author: mml2108; state: Exp; lines: +87 -48
Looks good except for the layout sizes. I don't think this is a big deal
though

revision 1.2

date: 2004/11/04 04:35:34; author: mml2108; state: Exp; lines: +81 -29
added more methods, cleaned up look and feel

```
-----  
revision 1.1  
date: 2004/10/29 02:31:51; author: mml2108; state: Exp;  
rough initial version - still needs work
```

4.5.8 Thing.java

```
Working file: Thing.java  
head: 1.4  
branch:  
locks: strict  
access list:  
symbolic names:  
keyword substitution: kv  
total revisions: 4; selected revisions: 4  
description:
```

```
-----  
revision 1.4  
date: 2004/12/19 22:31:29; author: wl2139; state: Exp; lines: +2 -0  
style update
```

```
-----  
revision 1.3  
date: 2004/12/18 20:02:13; author: wl2139; state: Exp; lines: +17 -3  
Stylized according to style sheet
```

```
-----  
revision 1.2  
date: 2004/11/20 02:49:42; author: wl2139; state: Exp; lines: +5 -1  
Fixed constructor inheritance problem
```

```
-----  
revision 1.1  
date: 2004/11/20 02:33:09; author: wl2139; state: Exp;  
New base Thing class for Character, Item, Scene
```

4.5.9 Scene.java

```
Working file: Scene.java  
head: 1.10  
branch:  
locks: strict  
access list:  
symbolic names:  
keyword substitution: kv  
total revisions: 10; selected revisions: 10  
description:
```

```
-----  
revision 1.10  
date: 2004/12/19 22:30:45; author: wl2139; state: Exp; lines: +2 -0  
style update
```

```
-----  
revision 1.9  
date: 2004/12/19 22:19:31; author: wl2139; state: Exp; lines: +36 -36  
Style guide fixes
```

```
-----  
revision 1.8  
date: 2004/12/18 20:23:26; author: wl2139; state: Exp; lines: +4 -0  
Stylized according to style guide
```

```
-----  
revision 1.7
```

date: 2004/12/18 20:16:43; author: wl2139; state: Exp; lines: +86 -41
Stylized according to style guide

revision 1.6

date: 2004/12/15 21:47:11; author: mhn2102; state: Exp; lines: +12 -3
Added error checking functions to user and character so that they can only
pickup and drop items that are in the scene or that they have.

revision 1.5

date: 2004/12/09 21:03:26; author: mhn2102; state: Exp; lines: +5 -0
The translator is pretty much completely working. I need to fix the user
inside boolean and other than that everything has been minimally tested and
is ready for the real test phase. I added a Makefile so now we can just type
make and have everything go.

revision 1.4

date: 2004/11/23 23:13:59; author: mml2108; state: Exp; lines: +12 -1
further corrected constructor errors

revision 1.3

date: 2004/11/20 02:49:41; author: wl2139; state: Exp; lines: +1 -1
Fixed constructor inheritance problem

revision 1.2

date: 2004/11/20 02:32:39; author: wl2139; state: Exp; lines: +1 -7
Made class extend the base Thing class

revision 1.1

date: 2004/10/26 05:44:46; author: wl2139; state: Exp;
Initial checkin

4.5.10 Item.java

Working file: Item.java

head: 1.7

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 7; selected revisions: 7

description:

revision 1.7

date: 2004/12/19 22:31:09; author: wl2139; state: Exp; lines: +2 -0
style update

revision 1.6

date: 2004/12/18 20:23:26; author: wl2139; state: Exp; lines: +4 -0
Stylized according to style guide

revision 1.5

date: 2004/12/18 20:18:58; author: wl2139; state: Exp; lines: +12 -6
Stylized according to style sheet

revision 1.4

date: 2004/12/09 21:03:26; author: mhn2102; state: Exp; lines: +7 -1

The translator is pretty much completely working. I need to fix the user inside boolean and other than that everything has been minimally tested and is ready for the real test phase. I added a Makefile so now we can just type make and have everything go.

```
-----  
revision 1.3  
date: 2004/11/20 02:49:41; author: wl2139; state: Exp; lines: +1 -1  
Fixed constructor inheritance problem  
-----
```

```
revision 1.2  
date: 2004/11/20 02:32:39; author: wl2139; state: Exp; lines: +1 -13  
Made class extend the base Thing class  
-----
```

```
revision 1.1  
date: 2004/10/26 05:44:46; author: wl2139; state: Exp;  
Initial checkin
```

4.5.11 Character.java

Working file: Character.java

head: 1.5

branch:

locks: strict

access list:

symbolic names:

keyword substitution: kv

total revisions: 5; selected revisions: 5

description:

```
-----  
revision 1.5  
date: 2004/12/19 21:15:24; author: mhn2102; state: Exp; lines: +80 -42  
I updated User and Character xclasses to print errors if they call  
invalid actions. Also made them fit style guide.  
-----
```

```
revision 1.4  
date: 2004/12/15 21:47:10; author: mhn2102; state: Exp; lines: +20 -3  
Added error checking functions to user and character so that they can only  
pickup and drop items that are in the scene or that they have.  
-----
```

```
revision 1.3  
date: 2004/11/20 02:49:41; author: wl2139; state: Exp; lines: +2 -2  
Fixed constructor inheritance problem  
-----
```

```
revision 1.2  
date: 2004/11/20 02:32:39; author: wl2139; state: Exp; lines: +1 -25  
Made class extend the base Thing class  
-----
```

```
revision 1.1  
date: 2004/10/28 18:54:59; author: mhn2102; state: Exp;
```

Here are the User and Character class files. They compile and should run correctly. -mariyaCVr: -----

4.5.12 User.java

Working file: User.java

head: 1.5

branch:

```

locks: strict
access list:
symbolic names:
keyword substitution: kv
total revisions: 5;    selected revisions: 5
description:
-----
revision 1.5
date: 2004/12/19 23:53:53; author: mml2108; state: Exp; lines: +4 -4
slightly cleaned up User class runtime error functions
-----
revision 1.4
date: 2004/12/19 22:59:13; author: mhn2102; state: Exp; lines: +1 -1
I fixed the User class so it makes sure the scene is initialized before
testing if the exits exist.
-----
revision 1.3
date: 2004/12/19 21:15:24; author: mhn2102; state: Exp; lines: +108 -62
    I updated User and Character xclasses to print errors if they call
invalid actions. Also made them fit style guide.
-----
revision 1.2
date: 2004/12/15 21:47:11; author: mhn2102; state: Exp; lines: +15 -2
Added error checking functions to user and character so that they can only
pickup and drop items that are in the scene or that they have.
-----
revision 1.1
date: 2004/10/28 18:54:59; author: mhn2102; state: Exp;

Here are the User and Character class files. They compile and should run
correctly. -mariyaCvr: -----

```

4.5.13 grimmtest.py

```

Working file: grimmtest.py
head: 1.5
branch:
locks: strict
access list:
symbolic names:
keyword substitution: kv
total revisions: 5;    selected revisions: 5
description:
-----
revision 1.5
date: 2004/12/15 23:23:48; author: wl2139; state: Exp; lines: +1 -1
Reading stdout and stderr to compare test outputs to now because the parser
uses stderr for some of its error msgs
-----
revision 1.4
date: 2004/12/15 00:41:11; author: wl2139; state: Exp; lines: +8 -0
Add a check to make sure the GRIMM translator has been built
-----
revision 1.3
date: 2004/12/15 00:02:42; author: wl2139; state: Exp; lines: +15 -10

```

Added ability to run the script from a path other than the current path.
Use os.path library for better directory handling
Now only compares stdout to test output. Before, it was comparing stdout and
stderr to the test output.

revision 1.2
date: 2004/12/14 19:27:07; author: wl2139; state: Exp; lines: +7 -11
Made it more efficient by only needing to specify outputs for tests that
fail.

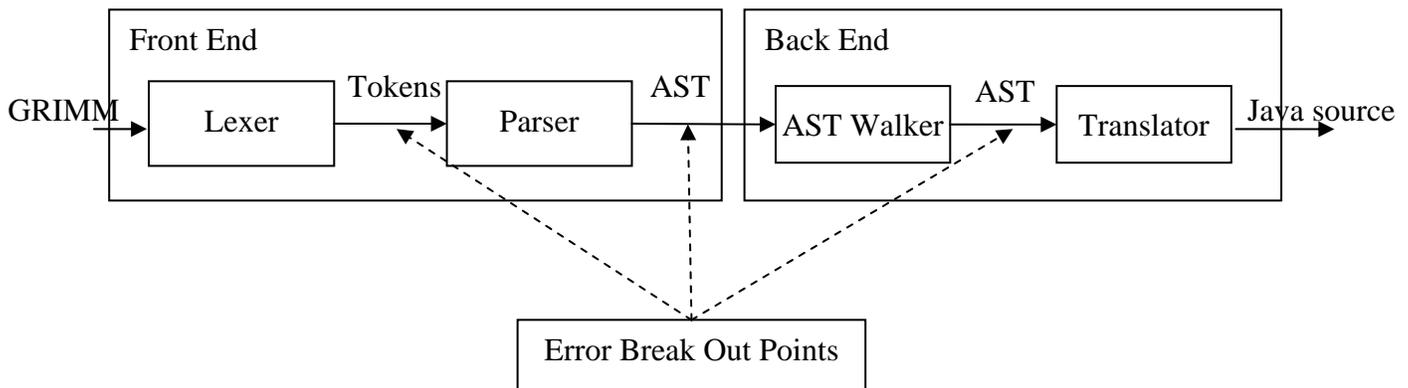
revision 1.1
date: 2004/12/14 17:59:44; author: wl2139; state: Exp;
Initial checkin for test script engine

5. Architectural Design

Considering that GRIMM is a storybook creation language designed for ease of parents and teachers, not only does our project have all the aspects needed in a compiler, it also has a runtime environment. Thus you will find two parts to the architecture of our project. As described above, Becky implemented the lexer, parser, and AST generation; Mike and Billy created the AST Walker; Mariya wrote the translator; and Mike, Billy, and Mariya created the runtime environment.

5.1 GRIMM Compiler

The compiler contains a lexer, parser, AST walker, and translator as shown in the diagram below. In addition to these components we have also identified critical error points. These points define a stop in compilation if errors are found, there are three such points. The first point is after the parser, we decided if errors were found during parsing then compilation should not continue to check the static semantics. Similarly, we decided if errors were found while checking the static semantics then translation should not be launched.



GRIMM

The engine to the compiler is a java file that takes in the name of the GRIMM source file and then takes it through every step of its journey into Java code. It passes the filestream object into the lexer, the lexer splits the file up into a stream of tokens removing whitespace and comments, checks for errors if none the tokens generated by the lexer are passed into the parser, checks for errors if none passes the AST generated by the parser into the AST Walker, checks for errors if none it finally passes the AST generated by the parser into the Translator. Each of these components will be discussed in detail within their respective sections.

Lexer

The lexer, developed in ANTLR by Becky Plummer, defines a simple set of tokens for the language. These tokens are described in detail in the language reference section above. The lexer takes a Java FileReader stream as input and outputs the GRIMM file as tokens. The lexer reads in the sequences of characters separated by white space and checks their spelling against the conventions we defined. An important job for the lexer is to remove whitespace (not including newline characters) and comments from the source.

Parser

From the specific tokens spit out by the lexer, the parser checks the syntax of sets of tokens developed in ANTLR by Becky. The importance of the parser is that it defines the syntax of the language and all other sections of the compiler depend on its accuracy. The parser checks if the tokens appear in the predicted order. For example:

```
user inside NOUN
```

When parsing this statement the parser would check that the token “user” appears first, then “inside”, and lastly a “NOUN” defined by the lexer as a sequence of characters and numbers starting with a character. The parser does not check the semantics of the statement, only that the tokens appear in the expected order.

AST Walker

The GRIMMWalker class verifies the semantic rules within a GRIMM program. The walker was implemented by Mike Lenner and Bill Liu using ANTLR and Java syntax. It works by walking through the Abstract Syntax Tree created by the Parser. The Walker uses the SymbolTable class, which implements most of the semantic checking functions the Walker uses.

The Walker's initial task is to build the symbol table. That is, the walker first goes through the declaration section of the GRIMM program, adding symbols with their correct type to the symbol table. The walker verifies that no two symbols are given the same identifier, because GRIMM has only one namespace. The walker also verifies that all Scene variables are assigned a name property as this is a rule of the GRIMM language. Finally, the walker also checks for type compatibility, as in making sure items are assigned to rooms or assigned to characters with the correct syntax. The Parser only checks that a noun has an item, but there is separate syntax for scene and character containing an item, both scenes and characters are nouns.

Once the walker has passed through the declaration nodes, it goes through the control flow of the program. Passing through these nodes, it verifies all referenced variables have been declared.

The walker implements a custom AST node class that allows access to the line number of each node. The walker's printError function takes advantage of this fact, printing out line numbers with each error message it displays.

Translator

The input into the translator is the Abstract Syntax Tree built by the GRIMM Parser and verified by the Walker. The translator was created by Mariya Nomanbhoy using ANTLR and Java instructions. The GRIMM Translator class walks the AST node by node to create the final Java source output, which will be the executable program once run through the Java compiler. The output Java source file is named the same name as the input GRIMM file.

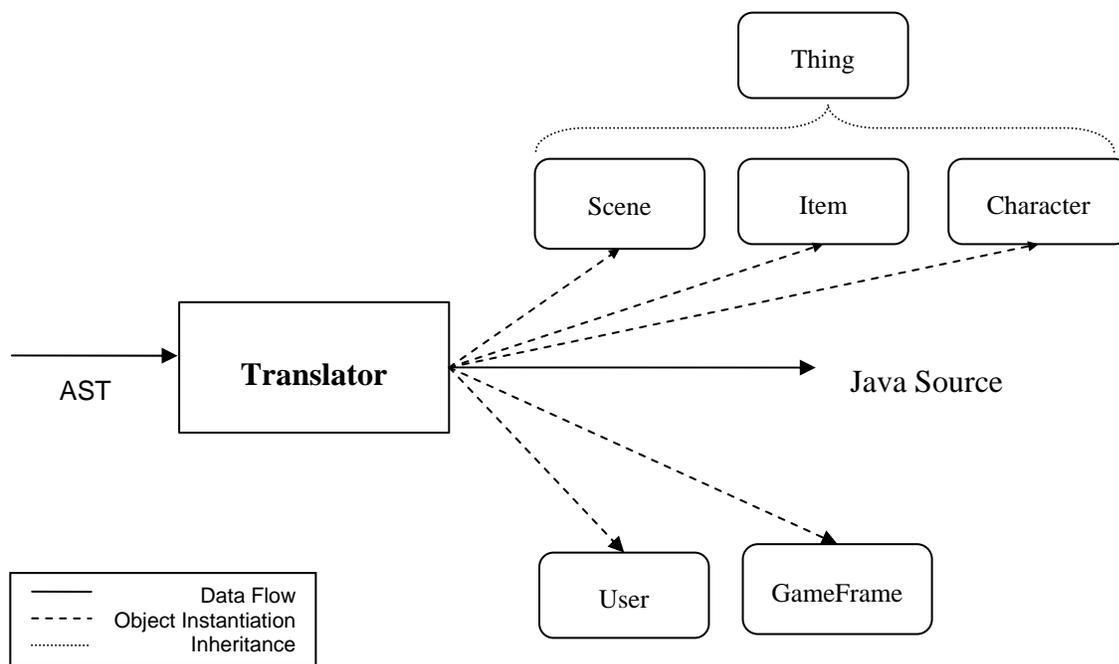
Each GRIMM program has two sections, as described above, the declarations & Assignments and the Action Loop. Once all declarations and assignments are complete, the Translator will move to the statements section of the GRIMM code. All control flow nodes map directly to Java statements with the same function. The *while*, *if*, and *otherwise* nodes cause the Translator to generate the correct java blocks, using the *endwhile*, and *endif* to end the block appropriately.

The GRIMM specific objects are the User, Scene, Character, and Item, described in the Runtime Environment section below. These were developed as classes by Mike, Bill, and Mariya. Methods within each object provide for conditional testing of an objects' state as well as for manipulating the data inside each object. For example:

```
steven drops dragonBook
```

would be translated into a method call that would move the item “dragonBook” between the character class and the current scene class.

5.2 GRIMM Runtime Environment



5.2.1 Object Descriptions

The Java classes that make up the runtime library are divided into three parts. The first grouping includes the Thing class, along with its three derived classes, Scene, Character, and Item. These classes make up the basic building blocks of the runtime library.

Scene, Character, and Item

The Scene class contains all data associated with a scene (image, description, title) as well as methods to retrieve that data. It has the ability to contain Items objects, and of

course methods to manipulate those items. The Character class has less data associated with it as compared to the Scene class, yet it does also provide the ability to own Item objects. The Item class is very lightweight as its primary use is to determine its ownership. Both the Scene and the Character class may own Items, and the Item object is used so as to allow the Scene or the Character to report the existence of that Item.

User

The User class is used to maintain the state of the first person role player during the game. As with character, it has the ability to hold items. However, the User class also contains certain game-play information, such as the current scene, along with methods to change that data. It also maintains records of the game player's input statements.

GameFrame

The final piece of the runtime library is the GameFrame class. This is the class that implements the graphical interface used to display the game play. All text and images are displayed via this class. Additionally, user input is controlled and recorded by this class, passing the data to the User class when appropriate. The user is only allowed to input instructions when the GRIMM program asks for it. At all other times the user is blocked from entering instructions.

5.2.2 Translator Interaction

As the translator encounters nodes of type Scene, Item, and Character, it generates code to instantiate an object from the class of that same name. All three of these classes inherit from the base Thing class. Each declaration of these variables in the GRIMM code corresponds directly to an object instantiation. As the translator encounters nodes representing property assignments of each of these GRIMM data types, it adds method calls from these objects. These method calls assign the passed in data to its owner object (e.g.: a scene object's name or the items it contains).

The control flow nodes also contain direction for the way in which the translator causes the generated code to interact with the user. That is, nodes such as *goto* and *read* cause the translator to invoke methods from the GameFrame class. These calls determine at which point a user may enter input as well as what images and text are displayed to the screen.

6. Test Plan

6.1 Testing Description

GRIMM testing is somewhat difficult, because much of it relies on the user interaction portion of the language. Therefore there are many different kinds of program testing: automated and human interaction. At the heart of the GRIMM testing environment is the testing engine written in Python by Bill Liu. The testing engine, `grimmtest.py`, takes GRIMM file(s) as input, compiles `.gmm` files using the GRIMM compiler, and checks for error messages generated. If error messages were encountered, the testing engine compares the generated output file against the ideal output for the input file. Any differences are outputted as a “diff” to the terminal.

6.1.1 Categories of Tests

The GRIMM testing files are broken into four categories to test each phase of the compilation process:

Lexer Tests – testing the errors in tokens

Parser Tests – testing the language syntax

Static Semantics Tests - testing the tree walker and symbol table.

Runtime Tests – these are unautomated tests done by playing the game, checking for logic errors.

6.1.2 Automation

The testing engine has an option to automatically scan the testing directories and run each test file. This makes it simple to run all the tests quickly after a modification has been made to the language and to ensure there were no side effects.

6.1.3 Testing Choices

Each of the test scripts has a “:note:” in the first line of the program describing what is being tested. All of the examples are included in the Test Suites section below. We chose examples based on their importance to the language. For example, there are some simple examples such as spelling of identifiers and more complicated ones such as while loop structure. Each category listed above has various example tests that are pertinent to that area.

6.1.4 Test Format

Each test consist of a GRIMM `.gmm` file which contains the GRIMM code we are testing. And, it also consists of a `.tst` file, which contains the expected output of the associated GRIMM code.

6.2 Generated Source Code Samples

We each generated one complicated example with at least two rooms, characters, and items. The object of these examples is to test the logic of the runtime environment and how it reacts to the user’s actions.

6.2.1 Dangerous Aho

This is an example using the grimm language. The purpose of the game is to get from Butler library to Prof. Edwards office. In order to do this they must first get a key from the library. They pick up money or a book to exchange with the librarian. Doing this will give the user clues that they need the key. They can then move to Butler lawn, where they talk to a child or teacher. The child can give them a balloon to help them fly over construction to get into Mudd. Once in Mudd the user has a choice to talk to Prof. Aho and answer the question "What is the best language?" to which the proper response is AWK. However, if they get it right and ask him to explain the language he takes forever and the user loses. Otherwise, they can stay out of Aho's dangerous office and answer what is the best class ever, to which the proper response is obviously PLT. If they answer these questions correctly and have the key they can get to Edwards office. If they do not have the key they are returned to Butler.

```
:note: declaring scenes
scene butler
scene mudd
scene lawn
scene ahosOffice
scene edwardsOffice

character librarian
character child
character aho

child holds item balloon

butler name "Butler Library"
butler description "You are currently in Butler Library. There is a librarian
in the library. To pick up an item in the scene type pickup item_name. To
give something to a character type give item_name to character_name. To move
to another scene type move to scene_name."
butler picture "butler.jpg"
butler contains item key
butler contains item money
butler contains item book
butler exit lawn

mudd name "Mudd"
mudd description "You are currently in Mudd. To pick up an item in the scene
type pickup item_name. To give something to a character type give item_name
to character_name. To move to another scene type go to scene_name."
mudd picture "mudd.jpeg"
mudd exit ahosOffice is hidden
mudd exit edwardsOffice is hidden

lawn name "Lawn"
lawn description "You are currently in Butler Lawn. To pick up an item in the
scene type pickup item_name. To give something to a character type give
item_name to character_name. To move to another scene type go to
scene_name."
lawn picture "lawn.jpeg"
lawn exit mudd
lawn exit butler
```

```

ahosOffice name "Al Aho's Office"
ahosOffice description "You are currently in Al Aho's Office. To pick up an
item in the scene type pick up item_name. To give something to a character
type give item_name to character_name. To move to another scene type go to
scene_name."
ahosOffice picture "aa.jpg"
ahosOffice exit mudd
ahosOffice exit butler is hidden
ahosOffice exit edwardsOffice is hidden

edwardsOffice name "Stephen Edwards Office"
edwardsOffice description "You are currently in Stephen Edwards Office."
edwardsOffice picture "se.jpg"

goto butler

while not user inside edwardsOffice
say "You need to make your way from Butler to Prof. Edwards office in order
to demo the hard work you put into your term project."
say "The librarian has accused you of stealing a book."
say "Choose to pay fine by typing pay."
say "Otherwise choose to argue by typing argue"
while user inside butler
    read user input
    if user says "pay" then
        if user has money then
            user drops money
            librarian pickup money
            say "They now think you stole another book. Hint: Try
picking up book..."
        otherwise
            say "You have to make some money first!"
        endif
    otherwiseif user says "argue" then
        goto lawn
        say "You have been ejected from Butler!"
        say "At least you didnt pay."
    otherwiseif user says "pick up book" and not user has book then
        user pickup book
    otherwiseif user says "give book to librarian" and user has book then
        user drops book
        librarian pickup book
        say "Librarian: Thank you! You should pick up the key."
    otherwiseif user says "pick up key" and not user has key then
        user pickup key
    otherwiseif user says "pick up money" and not user has money then
        user pickup money
    otherwiseif user says "go to Lawn" then
        goto lawn
    otherwise
        say "cannot understand what you are saying."
    endif
endwhile

while user inside lawn
    say "Would you like to talk to the child or the teacher?"
    say "Type child or teacher"

```

```

read user input
if user says "child" then
    say "Child: Do you want a balloon or a pony?"
    say "Type balloon or pony."
    read user input
    if user says "balloon" and not user has balloon then
        child drops balloon
        user pickup balloon
        say "Child: Good choice. This will help you fly."
    otherwiseif user says "pony" then
        say "Child: You really think I will give you a pony?"
    otherwise
        say "i dont understand you."
    endif
otherwiseif user says "teacher" then
    say "Teacher: To get to mudd you must fly over construction."
    say "Now you must learn how to fly."
otherwiseif user says "go to Butler Library" then
    goto butler
otherwiseif user says "go to Mudd" then
    if user has balloon then
        goto mudd
    otherwise
        say "You need something to help you fly."
    endif
otherwise
    say "I dont understand what you are saying."
endif
endwhile

while user inside mudd
    say "You got into mudd! Now you need to find Edwards office."
    say "Would you like to ask a professor? Type yes or no."
    read user input
    if user says "yes" then
        goto ahosOffice
    otherwiseif user says "no" then
        say "Okay, then you must answer a question."
        say "What is the best class ever?"
        read user input
        if user says "PLT" then
            if user has key then
                goto edwardsOffice
            otherwise
                say "You got that right."
                say "Too bad you dont have the key!"
                goto butler
            endif
        otherwise
            say "NO NO NO!"
        endif
    otherwise
        say "I dont understand you."
    endif
endwhile

while user inside ahosOffice

```

```

say "Aho: Hi! To get directions you need to answer a question."
say "Aho: What is the best language ever?"
read user input
if user says "AWK" then
    say "Aho: Correct! Would you like me to tell you about it?"
    say "Type yes or no."
    read user input
    if user says "yes" then
        say "You got him started talking!"
        say "You missed your appointment!"
        gameover
    otherwiseif user says "no" then
        say "Good choice. You know enough about it already!"
        say "Aho: Alright then. Just type 'please let me pass
PLT' and you will get to Edward's office."
        read user input
        if user says "please let me pass PLT" then
            goto edwardsOffice
        otherwise
            say "Wrong choice."
        endif
    otherwise
        say "I dont understand what you are trying to say."
    endif
otherwiseif user says "go to Mudd" then
    goto mudd
otherwise
    say "Wrong, try again."
endif
endwhile

while user inside edwardsOffice
    say "You've found your way to see Prof. Edwards! He gives you an A+!
You win!"
    gameover
endwhile
endwhile

```

dangerousAho.java

```

/*
 * File: GRIMM.java
 *
 * Authors: Mike Lenner, Billy Liu, Mariya Nomanbhoy, Becky Plummer
 */

import java.io.*;
import antlr.CommonAST;
import antlr.collections.AST;
import antlr.debug.misc.ASTFrame;

/*
 * This class runs the lexer, parser, walker, and translator on
 * a .gmm file, outputting any compiler errors to the console.
 */
class GRIMM {
    public static void main(String[] args){

```

```

if(args.length > 0){
    try {
        /*get input stream to a file*/
        File fin = new File(args[0]);
        FileReader in = new FileReader(fin);

        /*create lexer and parser objects*/
        GRIMMLexer lexer = new GRIMMLexer(in);
        GRIMMParser parser = new GRIMMParser(lexer);
        GRIMMWalker walker = new GRIMMWalker();

        /*run lexer and parser on the input file*/
        parser.program();

        if (lexer.num_errors > 0) {
            System.out.println("Scanner Errors!");
            return;
        }

        if (parser.num_errors > 0) {
            System.out.println("Parser Errors!");
            return;
        }

        /*Get the AST from the parser*/
        CommonAST parseTree =
        (CommonAST)parser.getAST();

        /*Open a window in which the AST is*/
        /*displayed graphically*/
        //ASTFrame frame =
        //new ASTFrame("AST from the Simp parser",
        //parseTree);

        walker.program(parseTree);

        if (walker.gRet < 0) {
            System.out.println ("Walker Errors!");
            return;
        }

        //frame.setVisible(true);

        GRIMMtranslator gt =
        new GRIMMtranslator(args[0]);
        gt.program( parseTree );
    }catch(IOException e) {
        System.out.println(
        "Error occured while reading your broom
file.");

        e.printStackTrace();
        System.out.println("exception: "+e);
    } catch(antlr.RecognitionException re) {
        System.out.println(
        "Recognition Exception occured while reading"
+ " your grimm file.");
    }
}

```

```

        re.printStackTrace();
        System.out.println("exception: "+re);
    } catch(antlr.TokenStreamException re) {
        System.out.println("Token Stream Exception"
+ " occured while reading your grimm file");
        re.printStackTrace();
        System.out.println("exception: "+re);
    }
}
else{
    System.out.println("ERROR 6111: No program name found"
+ " at the command prompt");
}
return;
}
}
}

```

6.2.2 Steal the Crown

This example shows a story with multiple scenes where the user must go to another scene and get money that will allow the user to open a secret door in the first room. Then inside the secret room there is a crown that the user must pickup to win the game. The user must talk to a character to get the key to the crown room.

:note: scene declarations

```

scene castleLobby
scene throneRoom
scene jewelRoom

```

:note: character declatations

```

character queen
character maid
maid holds item key

```

:note: castle lobby

```

castleLobby name "Entrance Hallway"
castleLobby picture "castle_lobby.jpg"
castleLobby description "The castle has many hidden rooms and talking to
strangers may help you discover passage. Can you find the crown? The maid
'Jessica' is cleanning in the lobby. Say hello to her for her to respond"
castleLobby exit throneRoom
castleLobby exit jewelRoom is hidden

```

:note: throne room

```

throneRoom name "Throne Room"
throneRoom picture "throne_room.jpg"
throneRoom description "The throne room is where the queen has audiences with
members of the public. The queen is expecting you. Say Your Majesty to talk
to her."
throneRoom exit castleLobby
throneRoom contains item money

```

:note: jewel room

```

jewelRoom name "Hidden Jewel Vault"
jewelRoom picture "crown.jpg"

```

```

jewelRoom description "You have found the secret Jewel Room. Look at the
crown jewels aren't they beautiful?"
jewelRoom exit castleLobby
jewelRoom contains item crown

goto castleLobby

while not user inside castleLobby or not user has crown

    :note: castleLobby
    if user inside castleLobby then
        read user input

        if user has key and user says "Jewel Room" then
            goto jewelRoom
        otherwiseif user says "hello Jessica" then
            say "no stranger has ever spoken to me. I have keys to
every room!!"
            say "Do you have any money? I can point you to palace
secrets."
        otherwiseif user says "where do I get money?" then
            say "Well you could ask the queen of course, but don't
tell her I sent you!"
        otherwiseif user has money and user says "I have money" then
            user drops money
            maid pickup money
            maid drops key
            user pickup key
            say "You now have a key. There is a hidden Room door.
To open it type 'Jewel Room'"
        otherwiseif user says "throne room" then
            goto throneRoom
        otherwise
            say "I don't understand you. Did you use punctuation?"
        endif
    endif

    if user inside throneRoom then
        read user input

        if user says "Your Majesty" then
            say "Greetings peasant, what is your distress?"
        otherwiseif user says "i need money" then
            say "Of course!"
            user pickup money
            say "You may exit using the command Lobby"
        otherwiseif user says "Lobby" then
            goto castleLobby
        otherwise
            say "I don't understand you"
        endif
    endif

    if user inside jewelRoom then
        read user input
        if user says "take the crown" then
            user pickup crown

```

```

        otherwiseif user says "Lobby" then
            goto castleLobby
        otherwise
            say "I didn't undersertand you"
        endif
    endif

endif

endwhile

say "good bye!"

```

becky_castle.java

```

/*
 * File: GRIMM.java
 *
 * Authors: Mike Lenner, Billy Liu, Mariya Nomanbhoy, Becky Plummer
 */

import java.io.*;
import antlr.CommonAST;
import antlr.collections.AST;
import antlr.debug.misc.ASTFrame;

/*
 * This class runs the lexer, parser, walker, and translator on
 * a .gmm file, outputting any compiler errors to the console.
 */
class GRIMM {
    public static void main(String[] args){

        if(args.length > 0){
            try {
                /*get input stream to a file*/
                File fin = new File(args[0]);
                FileReader in = new FileReader(fin);

                /*create lexer and parser objects*/
                GRIMMLexer lexer = new GRIMMLexer(in);
                GRIMMParser parser = new GRIMMParser(lexer);
                GRIMMWalker walker = new GRIMMWalker();

                /*run lexer and parser on the input file*/
                parser.program();

                if (lexer.num_errors > 0) {
                    System.out.println("Scanner Errors!");
                    return;
                }

                if (parser.num_errors > 0) {
                    System.out.println("Parser Errors!");
                    return;
                }

                /*Get the AST from the parser*/

```

```

CommonAST parseTree =
(CommonAST)parser.getAST();

/*Open a window in which the AST is*/
/*displayed graphically*/
//ASTFrame frame =
//new ASTFrame("AST from the Simp parser",
//parseTree);

walker.program(parseTree);

if (walker.gRet < 0) {
    System.out.println ("Walker Errors!");
    return;
}

//frame.setVisible(true);

GRIMMtranslator gt =
new GRIMMtranslator(args[0]);
gt.program( parseTree );
}catch(IOException e) {
    System.out.println(
    "Error occured while reading your broom file.");
    e.printStackTrace();
    System.out.println("exception: "+e);
} catch(antlr.RecognitionException re) {
    System.out.println(
    "Recognition Exception occured while reading"
    + " your grimm file.");
    re.printStackTrace();
    System.out.println("exception: "+re);
} catch(antlr.TokenStreamException re) {
    System.out.println("Token Stream Exception"
    + " occured while reading your grimm file");
    re.printStackTrace();
    System.out.println("exception: "+re);
}
}
else{
    System.out.println("ERROR 6111: No program name found"
    + " at the command prompt");
}
return;
}
}

```

6.2.3 Castle Quest

The story is a GRIMM program that takes the user to a castle and then to a choice of three doors. Only one door is the correct choice, while the other two will lead to the user's doom

```

:note: my scene declarations
scene road
scene gate
scene dead

```

scene door1
scene door2
scene bigdoor
scene doorlopen
scene treasurerroom
scene lair

:note: build road scene
road name "Castle Path"
road description "You are standing on a dirt path. Ahead of you in the distance you see the Castle of the North Kingdom. You think you here something that sounds like trumpets blaring way off in the distance. To your left is a small dagger."
road picture "images/castle.jpg"
road exit gate
road contains item dagger

:note: build gate scene
gate name "North Castle Gate"
gate description "The castle gate looms before you. The archway appears to be some 30 feet high. It appears deserted which seems strange. To the left and right of the gate are two smaller doors."
gate picture "images/gate.jpg"
gate exit road
gate exit door1
gate exit door2

:note: build end scene
dead name "You Have Perished!"
dead description "You quest is over and I am afraid you have failed. Let us only pray that you were not the last hope. Please try again."
dead picture "images/tombstone.jpg"

:note: the door on the left
door1 name "Left Castle Entrance"
door1 description "You are standing in front of a locked door. Below you here voices yelling but you can't make out if the yelling is out of joy or out of pain. You notice that the hinges seem to be somewhat loose, as if someone need only pry the door open with a metal object to open it."
door1 exit treasurerroom
door1 exit gate
door1 exit doorlopen is hidden
door1 picture "images/Castle_gate2.jpg"

:note: the door on the right
door2 name "Right Casle Entrance"
door2 description "A ramp leads down this entrance. You feel a cool wind coming up from beneath. Bursts of air come out, in almost a slow, rythmic manner."
door2 exit lair
door2 exit gate
door2 picture "images/door2.jpg"

:note: the door in the middle. This will scene only be declared to use as an
:note: exit for the gate scene. If the user goes here, they're dead.
bigdoor name "Main Gate"

```

:note: build dungeon scene
treasureroom name "The King's Treasure Room"
treasureroom description "You have entered a room filled with gold and silver
as far as they eye can see. There are jewels and other priceless items all
over the place."
treasureroom exit doorlopen
treasureroom contains item TreasureChest
treasureroom picture "images/treasure.jpg"

```

```

:note: dragon's lair
lair name "Underground Lair"
lair description "You are in the underground den of a giant, firebreathing
dragon. His giant head swings toward you as you enter the lair. His mouth
begins to glow with the fire beneath."
lair picture "images/dragon.jpg"
lair contains item Map
lair contains item DragonTooth
lair exit dead is hidden

```

```

:note: this scene is identical to door1, except that it has an added exit to
:note: the treasure room. This scene is used so that I can check whether or
:note: not the user has opened the locked door
doorlopen name "Left Castle Entrance"
doorlopen description "The door has been pried open. It is no longer locked!
You see a dark hallway ahead of you which leads to what looks like a treasure
room!!"
doorlopen exit treasureroom
doorlopen exit gate
doorlopen picture "images/Castle_gate.jpg"

```

```
goto road
```

```
while not user inside treasureroom
```

```

    while user inside road
        while not user has dagger
            read user          input
            if user says "take dagger" then
                say "You picked up the dagger"
                user pickup dagger
            otherwise
                say "You are going to need some protection!"
            endif
        endwhile

```

```

    while not user says "castle gate" and not user says
"castlegate"

```

```

        read user input
        say "OK, on to the castle gate!"
    endwhile
    goto gate

```

```
endwhile
```

```

while user inside gate
    read user input
    if user says "go to castle path" then

```

```

        goto road
    otherwiseif user says "go to left castle entrance" then
        :note: forcing user to drop dagger allows this
        if user has dagger then
            goto door1
        otherwise
            goto doorlopen
        endif
    otherwiseif user says "go to right castle entrance" then
        goto door2
    otherwiseif user says "go to the main gain" then
        goto bigdoor
    otherwise
        say "You have to choose a door."
    endif
endwhile

while user inside door1
    read user input
    if user says "go to castle gate" then
        goto gate
    otherwiseif user says "pry open door with dagger" then
        say "You stick the dagger into the door and pull. The
door comes off! The dagger breaks and you must leave it behind."
        user drops dagger
        goto doorlopen
    otherwiseif user says "open door" then
        say "The door is locked"
    otherwise
        say "Are you going to try to get in there or what?"
    endif
endwhile

while user inside doorlopen
    read user input
    if user says "go to gate" then
        goto gate
    otherwiseif user says "go to treasure room" then
        goto treasurerroom
    otherwise
        say "Go and get that treasure!"
    endif
endwhile

while user inside treasurerroom
    read user input
    if user says "go to left castle entrance" then
        goto doorlopen
    otherwiseif user says "take treasure" then
        say "You have recovered the treasure. You are rich
beyond your wildest dreams. You win!"
        user pickup TreasureChest
        gameover
    otherwise
        say "All that treasure and no one guarding it. Hmmm."
    endif
endwhile

```

```

while user inside door2
    read user input
    if user says "go to castle gate" then
        goto gate
    otherwiseif user says "go down ramp" then
        goto lair
    otherwise
        say "Go down the ramp or retreat."
    endif
endif
endwhile

while user inside lair
    read user input
    if user says "kill dragon with dagger" then
        say "The giant dragon uses your dagger as a toothpick.
He then laughs at you and then eats you."
        goto dead
    otherwise
        say "The giant dragon has used his powerful dragon
breath. You are burnt to a crisp."
        goto dead
    endif
endif
endwhile

if user inside dead then
    gameover
endif

if user inside bigdoor then
    say "You are jumped by 20 guards hiding in the main entrance
way. How could you make such an obvious move??? The guards beat you to
death."
    goto dead
endif

endwhile

```

mike_example.java

```

//This is your grimm file translated into java
public class becky_castle {    public static void main( String args[] )
    {
        User player = new User();
        Scene curScene = new Scene(null, null, null);
        //initializing game frame
        gameFrame window = new gameFrame();
        Scene _castleLobby = new Scene(null, null, null);
        Scene _throneRoom = new Scene(null, null, null);
        Scene _jewelRoom = new Scene(null, null, null);
        Character _queen = new Character(null);
        Character _maid = new Character(null);
        Item _key = new Item( "key");
        _maid.pickUp( _key );
        _castleLobby.setName( "Entrance Hallway");
        _castleLobby.setPicture( "castle_lobby.jpg" );
    }
}

```

```

        _castleLobby.setDescr( "The castle has many hidden rooms and
talking to strangers may help you discover passage. Can you find the crown?
The maid 'Jessica' is cleaning in the lobby. Say hello to her for her to
respond" );

        _castleLobby.addExit( _throneRoom, false);
        _castleLobby.addExit( _jewelRoom, true );
        _throneRoom.setName( "Throne Room");
        _throneRoom.setPicture( "throne_room.jpg" );
        _throneRoom.setDescr( "The throne room is where the queen has
audiences with members of the public. The queen is expecting you. Say Your
Majesty to talk to her." );
        _throneRoom.addExit( _castleLobby, false);
        Item _money = new Item( "money");
        _throneRoom.addItem( _money , false );
        _jewelRoom.setName( "Hidden Jewel Vault");
        _jewelRoom.setPicture( "crown.jpg" );
        _jewelRoom.setDescr( "You have found the secret Jewel Room.
Look at the crown jewels aren't they beautiful?" );
        _jewelRoom.addExit( _castleLobby, false);
        Item _crown = new Item( "crown");
        _jewelRoom.addItem( _crown , false );
        player.moveTo( _castleLobby );
        curScene = _castleLobby;
        window.showScene( player.getCurScene(), player);
        while( !(player.getCurScene() == _castleLobby ) ||
!player.hasItem( _crown ) )
        {
            if( (player.getCurScene() == _castleLobby ) )
            {
                player.setSaid( window.getInput() );
                if( player.hasItem( _key ) &&
(player.getSaid().matches("(?i).*Jewel Room.*") ) )
                {
                    player.moveTo( _jewelRoom );
                    curScene = _jewelRoom;
                    window.showScene( player.getCurScene(),
player);
                }
                else if( (player.getSaid().matches("(?i).*hello
Jessica.*") ) )
                {
                    window.setOutput( "no stranger has ever
spoken to me. I have keys to every room!!" );
                    window.showScene(player.getCurScene(),
player);
                }
                else if( (player.getSaid().matches("(?i).*where
do I get money?.*") ) )
                {
                    window.setOutput( "Well you could ask
the queen of course, but don't tell her I sent you!" );
                    window.showScene(player.getCurScene(),
player);
                }
            }
        }
    }
}

```

```

        }
        else if( player.hasItem( _money ) &&
(player.getSaid().matches("(?i).*I have money.*") ) )
        {
            player.drop( _money );
            window.showScene(player.getCurScene(),
player);

            _maid.pickUp( _money, curScene );
            window.showScene(player.getCurScene(),
player);

            _maid.drop( _key, curScene );
            window.showScene(player.getCurScene(),
player);

            player.pickUp( _key );
            window.showScene(player.getCurScene(),
player);

            window.setOutput( "You now have a key.
There is a hidden Room door. To open it type 'Jewel Room'" );
            window.showScene(player.getCurScene(),
player);
        }
        else if(
(player.getSaid().matches("(?i).*throne room.*") ) )
        {
            player.moveTo( _throneRoom );
            curScene = _throneRoom;
            window.showScene( player.getCurScene(),
player);
        }
        else
        {
            window.setOutput( "I don't understand
you. Did you use punctuation?" );
            window.showScene(player.getCurScene(),
player);
        }
    }
    if( (player.getCurScene() == _throneRoom ) )
    {
        player.setSaid( window.getInput() );
        if( (player.getSaid().matches("(?i).*Your
Majesty.*") ) )
        {
            window.setOutput( "Greetings peasant,
what is your distress?" );
            window.showScene(player.getCurScene(),
player);
        }
        else if( (player.getSaid().matches("(?i).*i
need money.*") ) )
        {
            window.setOutput( "Of course!" );
            window.showScene(player.getCurScene(),
player);

            player.pickUp( _money );
            window.showScene(player.getCurScene(),
player);
        }
    }

```

```

        window.setOutput( "You may exit using
the command Lobby" );
        window.showScene(player.getCurScene(),
player);
    }
    else if(
(player.getSaid().matches("(?i).*Lobby.*") ) )
    {
        player.moveTo( _castleLobby );
        curScene = _castleLobby;
        window.showScene( player.getCurScene(),
player);
    }
    else
    {
        window.setOutput( "I don't understand
you" );
        window.showScene(player.getCurScene(),
player);
    }
}
if( (player.getCurScene() == _jewelRoom ) )
{
    player.setSaid( window.getInput() );
    if( (player.getSaid().matches("(?i).*take the
crown.*") ) )
    {
        player.pickUp( _crown );
        window.showScene(player.getCurScene(),
player);
    }
    else if(
(player.getSaid().matches("(?i).*Lobby.*") ) )
    {
        player.moveTo( _castleLobby );
        curScene = _castleLobby;
        window.showScene( player.getCurScene(),
player);
    }
    else
    {
        window.setOutput( "I didn't undersertand
you" );
        window.showScene(player.getCurScene(),
player);
    }
}
}
window.setOutput( "good bye!" );
window.showScene(player.getCurScene(), player);
}
}

```

6.2.4 Pleasing your kid

:note: Make your kid happy before it's too late!

:note: This storyboard revolves around you trying to make your kid happy.
There
:note: are two ways to do this as you'll discover, as well as a few pitfalls.

scene start
scene error
scene finished
scene dead
scene editor
scene statements
scene mcdonalds
scene table
scene home
scene grimm

character teenager
teenager holds item BigMac
teenager holds item Chicken_Nuggets
teenager holds item Toy

start name "In front of the computer"
start description "You're at the computer monitor trying to write a GRIMM
story board for your kid. He is sitting impatiently next to you. You need
to decide on what kind of story to write, what editor to use, and other
important things like that.\n\nWhat editor do you want to use?"
start picture "computer.gif"
start contains item One_Dollar
start contains item Fifty_Cents
start exit dead is hidden
start exit editor is hidden

error name "Error encountered!"
error description "You've come across and error in your program"

finished name "Your kid is happy!"
finished description "You give your kid the toy and he is now happy. In
fact, he's so happy that he forgot about the GRIMM storyboard and you're off
the hook! Congradulations!"
finished picture "finished.jpg"

grimm name "Program Written!"
grimm picture "grimm.jpg"
grimm description "You've successfully written, compiled and run your GRIMM
program! Your kid spent all night playing it and is happy.
Congradulations!"

dead name "Poor Choice!"
dead description "Because of your choice, it takes you forever to properly
write your GRIMM program. By the time you finish, your child is sad and has
gotten tired of waiting for you to write a story. What kind of parent are
you?"
dead picture "sad.jpg"

editor name "Using Vi as your editor"
editor description "You've fired up vim for your editor and now you're ready
to start writing your GRIMM program. The first thing you need to do is
declare some scenes, characters and items. Once you're finished declaring

```

them all, make sure to make a :note: to comment the end of your declarations
so you can start writing your statements."
editor picture "vim.jpg"
editor exit start is hidden
editor exit statements is hidden

statements name "Hungry!"
statements description "You spend a while making all those declarations. You
need to declare some statements. But before that, you've gotten hungry and
need to get food. You start thinking of where to go to get food..."
statements picture "food.gif"
statements exit mcdonalds is hidden

mcdonalds name "McDonalds"
mcdonalds picture "mcdonalds.jpg"
mcdonalds description "You drive to your favorite McDonalds restaurant. It
is a familiar sight: plastic counters, plastic chairs, pictures on the menu,
poor high school students behind the cash registers. Maybe you should order
quickly before your conscience gets to you."
mcdonalds exit home
mcdonalds exit table
mcdonalds exit dead is hidden

home name "Back at Home"
home description "You're drive back home, realizing you spent so much time at
McDonalds while your kid is waiting for your GRIMM storyboard. He's still
sitting here, waiting patiently for your to write the game."
home picture "home.gif"
home exit grimm is hidden
home exit finished is hidden

table name "Table at McDonalds"

:note: program starts here

goto start
user pickup One_Dollar
user pickup Fifty_Cents

while not user inside finished
    while user inside start
        read user input
        if user says "vim" or user says "vi" or user says "gvim" then
            goto editor
        otherwiseif user says "emacs" or user says "xemacs" then
            goto dead
        otherwise
            say "Unfortunately, that editor is not installed on
your machine. Maybe you should choose a more popular editor?"
        endif
    endwhile

    while user inside editor
        read user input
        if user says "character" then
            say "you've declared a character"
        otherwiseif user says "scene" then

```

```

        say "you've declared a scene"
    otherwiseif user says "contains" or user says "item" then
        say "you've declared an item"
    otherwiseif user says ":note:" then
        goto statements
    otherwise
        say "you should declare characters, scenes and items
first"
        endif
    endwhile

    while user inside statements
        read user input
        if user says "mcdonalds" then
            goto mcdonalds
        otherwise
            say "no, you don't feel like going there. maybe you
should go to your favorite fast food restaurant?"
        endif
    endwhile

    while user inside mcdonalds
        say "the teenager says: Welcome to McDonalds, how can I help
you?"
        read user input
        if user says "big mac" and user has One_Dollar then
            say "the teenager says: Thank you for your order."
            say "you give the teenager $1 for the big mac"
            teenager drops BigMac
            user drops One_Dollar
            teenager pickup One_Dollar
            user pickup BigMac
        otherwiseif user says "big mac" and not user has One_Dollar
            then
                say "you don't have enough money to buy a big mac"
        otherwiseif user says "nuggets" and user has Fifty_Cents then
            say "the teenager says: Thank you for your order."
            say "you give the teenager .50 for your chicken
nuggets"
            teenager drops Chicken_Nuggets
            user drops Fifty_Cents
            teenager pickup Fifty_Cents
            user pickup Chicken_Nuggets
        otherwiseif user says "nuggets" and not user has Fifty_Cents
            then
                say "you don't have enough money to buy the nuggets"
        otherwiseif user says "toy" then
            if user has Fifty_Cents then
                say "the teenager says: Thank you for your
order"
                say "you give the teenager .50 for your toy."
                teenager drops Toy
                user drops Fifty_Cents
                teenager pickup Fifty_Cents
                user pickup Toy
            otherwise
                say "you dont have enough money to buy the toy"

```

```

                endif
            otherwise
                say "maybe you should order a big mac, chicken nuggets,
or a kids toy?"
            endif

            if user says "home" then
                goto home
            endif

            if user says "table" then
                goto dead
            endif
        endwhile

        while user inside home
            read user input
            if user has Toy and user says "toy" then
                goto finished
            otherwiseif user says "story" or user says "write" or user
says "program" or user says "grimm" then
                goto grimm
            otherwise
                say "you need to do something quick to satisfy your
kid"
            endif
        endwhile

        if user inside dead then
            gameover
        endif

    endwhile

```

kid.java

```

//This is your grimm file translated into java
public class kid {      public static void main( String args[] )
    {
        User player = new User();
        Scene curScene = new Scene(null, null, null);
        //initializing game frame
        gameFrame window = new gameFrame();
        Scene _start = new Scene(null, null, null);
        Scene _error = new Scene(null, null, null);
        Scene _finished = new Scene(null, null, null);
        Scene _dead = new Scene(null, null, null);
        Scene _editor = new Scene(null, null, null);
        Scene _statements = new Scene(null, null, null);
        Scene _mcdonalds = new Scene(null, null, null);
        Scene _table = new Scene(null, null, null);
        Scene _home = new Scene(null, null, null);
        Scene _grimm = new Scene(null, null, null);
        Character _teenager = new Character(null);
        Item _BigMac = new Item( "BigMac");
        _teenager.pickUp( _BigMac );
        Item _Chicken_Nuggets = new Item( "Chicken_Nuggets");
    }
}

```

```

    _teenager.pickUp( _Chicken_Nuggets );
    Item _Toy = new Item( "Toy");
    _teenager.pickUp( _Toy );
    _start.setName( "In front of the computer");
    _start.setDescr( "You're at the computer monitor trying to write
a GRIMM story board for your kid. He is sitting impatiently next to you.
You need to decide on what kind of story to write, what editor to use, and
other important things like that.\n\nWhat editor do you want to use?" );
    _start.setPicture( "computer.gif" );
    Item _One_Dollar = new Item( "One_Dollar");
    _start.addItem( _One_Dollar , false );
    Item _Fifty_Cents = new Item( "Fifty_Cents");
    _start.addItem( _Fifty_Cents , false );
    _start.addExit( _dead, true );
    _start.addExit( _editor, true );
    _error.setName( "Error encountered!");
    _error.setDescr( "You've come across and error in your program"
);

    _finished.setName( "Your kid is happy!");
    _finished.setDescr( "You give your kid the toy and he is now
happy. In fact, he's so happy that he forgot about the GRIMM storyboard and
you're off the hook! Congradulations!" );
    _finished.setPicture( "finished.jpg" );
    _grimm.setName( "Program Written!");
    _grimm.setPicture( "grimm.jpg" );
    _grimm.setDescr( "You've successfully written, compiled and run
your GRIMM program! Your kid spent all night playing it and is happy.
Congradulations!" );
    _dead.setName( "Poor Choice!");
    _dead.setDescr( "Because of your choice, it takes you forever to
properly write your GRIMM program. By the time you finish, your child is sad
and has gotten tired of waiting for you to write a story. What kind of
parent are you?" );
    _dead.setPicture( "sad.jpg" );
    _editor.setName( "Using Vi as your editor");
    _editor.setDescr( "You've fired up vim for your editor and now
you're ready to start writing your GRIMM program. The first thing you need
to do is declare some scenes, characters and items. Once you're finished
declaring them all, make sure to make a :note: to comment the end of your
declarations so you can start writing your statements." );
    _editor.setPicture( "vim.jpg" );
    _editor.addExit( _start, true );
    _editor.addExit( _statements, true );
    _statements.setName( "Hungry!");
    _statements.setDescr( "You spend a while making all those
declarations. You need to declare some statements. But before that, you've
gotten hungry and need to get food. You start thinking of where to go to get
food..." );
    _statements.setPicture( "food.gif" );
    _statements.addExit( _mcdonalds, true );
    _mcdonalds.setName( "McDonalds");
    _mcdonalds.setPicture( "mcdonalds.jpg" );
    _mcdonalds.setDescr( "You drive to your favorite McDonalds
restaurant. It is a familiar sight: plastic counters, plastic chairs,
pictures on the menu, poor high school students behind the cash registers.
Maybe you should order quickly before your conscience gets to you." );
    _mcdonalds.addExit( _home, false);

```

```

    _mcdonalds.addExit( _table, false);
    _mcdonalds.addExit( _dead, true );
    _home.setName( "Back at Home");
    _home.setDescr( "You're drive back home, realizing you spent so
much time at McDonalds while your kid is waiting for your GRIMM storyboard.
He's still sitting here, waiting patiently for your to write the game." );
    _home.setPicture( "home.gif" );
    _home.addExit( _grimm, true );
    _home.addExit( _finished, true );
    _table.setName( "Table at McDonalds");
    player.moveTo( _start );
    curScene = _start;
    window.showScene( player.getCurScene(), player);
    player.pickUp( _One_Dollar );
    window.showScene(player.getCurScene(), player);
    player.pickUp( _Fifty_Cents );
    window.showScene(player.getCurScene(), player);
    while( !(player.getCurScene() == _finished ) )
    {
        while( (player.getCurScene() == _start ) )
        {
            player.setSaid( window.getInput() );
            if( (player.getSaid().matches("(?i).*vim.*") ) ||
(player.getSaid().matches("(?i).*vi.*") ) ||
(player.getSaid().matches("(?i).*gvim.*") ) )
            {
                player.moveTo( _editor );
                curScene = _editor;
                window.showScene( player.getCurScene(),
player);
            }
            else if( (player.getSaid().matches("(?i).*emacs.*") )
|| (player.getSaid().matches("(?i).*xemacs.*") ) )
            {
                player.moveTo( _dead );
                curScene = _dead;
                window.showScene( player.getCurScene(),
player);
            }
            else
            {
                window.setOutput( "Unfortunately, that editor
is not installed on your machine. Maybe you should choose a more popular
editor?" );
                window.showScene(player.getCurScene(), player);
            }
        }
        while( (player.getCurScene() == _editor ) )
        {
            player.setSaid( window.getInput() );
            if( (player.getSaid().matches("(?i).*character.*") )
)
            {
                window.setOutput( "you've declared a character"
);
                window.showScene(player.getCurScene(), player);
            }
        }
    }
}

```

```

else if( (player.getSaid().matches("(?i).*scene.*") )
)
{
    window.setOutput( "you've declared a scene" );
    window.showScene(player.getCurScene(), player);
}
else if(
(player.getSaid().matches("(?i).*contains.*") ) ||
(player.getSaid().matches("(?i).*item.*") ) )
{
    window.setOutput( "you've declared an item" );
    window.showScene(player.getCurScene(), player);
}
else if( (player.getSaid().matches("(?i).*:note:.*")
) )
{
    player.moveTo( _statements );
    curScene = _statements;
    window.showScene( player.getCurScene(),
player);
}
else
{
    window.setOutput( "you should declare
characters, scenes and items first" );
    window.showScene(player.getCurScene(), player);
}
}
while( (player.getCurScene() == _statements ) )
{
    player.setSaid( window.getInput() );
    if( (player.getSaid().matches("(?i).*mcdonalds.*") )
)
    {
        player.moveTo( _mcdonalds );
        curScene = _mcdonalds;
        window.showScene( player.getCurScene(),
player);
    }
    else
    {
        window.setOutput( "no, you don't feel like
going there. maybe you should go to your favorite fast food restaurant?" );
        window.showScene(player.getCurScene(), player);
    }
}
while( (player.getCurScene() == _mcdonalds ) )
{
    window.setOutput( "the teenager says: Welcome to
McDonalds, how can I help you?" );
    window.showScene(player.getCurScene(), player);
    player.setSaid( window.getInput() );
    if( (player.getSaid().matches("(?i).*big mac.*") ) &&
player.hasItem( _One_Dollar ) )
    {
        window.setOutput( "the teenager says: Thank you
for your order." );

```

```

        window.showScene(player.getCurScene(), player);
        window.setOutput( "you give the teenager $1 for
the big mac" );

        window.showScene(player.getCurScene(), player);
        _teenager.drop( _BigMac, curScene );
        window.showScene(player.getCurScene(), player);
        player.drop( _One_Dollar );
        window.showScene(player.getCurScene(), player);
        _teenager.pickUp( _One_Dollar, curScene );
        window.showScene(player.getCurScene(), player);
        player.pickUp( _BigMac );
        window.showScene(player.getCurScene(), player);
    }
    else if( (player.getSaid().matches("(?i).*big mac.*")
) && !player.hasItem( _One_Dollar ) )
    {
        window.setOutput( "you don't have enough money
to buy a big mac" );
        window.showScene(player.getCurScene(), player);
    }
    else if( (player.getSaid().matches("(?i).*nuggets.*")
) && player.hasItem( _Fifty_Cents ) )
    {
        window.setOutput( "the teenager says: Thank you
for your order." );
        window.showScene(player.getCurScene(), player);
        window.setOutput( "you give the teenager .50
for your chicken nuggets" );
        window.showScene(player.getCurScene(), player);
        _teenager.drop( _Chicken_Nuggets, curScene );
        window.showScene(player.getCurScene(), player);
        player.drop( _Fifty_Cents );
        window.showScene(player.getCurScene(), player);
        _teenager.pickUp( _Fifty_Cents, curScene );
        window.showScene(player.getCurScene(), player);
        player.pickUp( _Chicken_Nuggets );
        window.showScene(player.getCurScene(), player);
    }
    else if( (player.getSaid().matches("(?i).*nuggets.*")
) && !player.hasItem( _Fifty_Cents ) )
    {
        window.setOutput( "you don't have enough money
to buy the nuggets" );
        window.showScene(player.getCurScene(), player);
    }
    else if( (player.getSaid().matches("(?i).*toy.*") ) )
    {
        if( player.hasItem( _Fifty_Cents ) )
        {
            window.setOutput( "the teenager says:
Thank you for your order" );
            player);
            window.showScene(player.getCurScene(),
            window.setOutput( "you give the teenager
.50 for your toy." );
            player);
            window.showScene(player.getCurScene(),

```

```

        _teenager.drop( _Toy, curScene );
        window.showScene(player.getCurScene(),
player);

        player.drop( _Fifty_Cents );
        window.showScene(player.getCurScene(),
player);

        _teenager.pickUp( _Fifty_Cents, curScene
);
        window.showScene(player.getCurScene(),
player);

        player.pickUp( _Toy );
        window.showScene(player.getCurScene(),
player);

    }
    else
    {
        window.setOutput( "you dont have enough
money to buy the toy" );
        window.showScene(player.getCurScene(),
player);
    }
}
else
{
    window.setOutput( "maybe you should order a big
mac, chicken nuggets, or a kids toy?" );
    window.showScene(player.getCurScene(), player);
}
if( (player.getSaid().matches("(?i).*home.*") ) )
{
    player.moveTo( _home );
    curScene = _home;
    window.showScene( player.getCurScene(),
player);
}
if( (player.getSaid().matches("(?i).*table.*") ) )
{
    player.moveTo( _dead );
    curScene = _dead;
    window.showScene( player.getCurScene(),
player);
}
}
while( (player.getCurScene() == _home ) )
{
    player.setSaid( window.getInput() );
    if( player.hasItem( _Toy ) &&
(player.getSaid().matches("(?i).*toy.*") ) )
    {
        player.moveTo( _finished );
        curScene = _finished;
        window.showScene( player.getCurScene(),
player);
    }
    else if( (player.getSaid().matches("(?i).*story.*") )
|| (player.getSaid().matches("(?i).*write.*") ) ||

```

```

(player.getSaid().matches("(?i).*program.*") ) ||
(player.getSaid().matches("(?i).*grimm.*") ) )
    {
        player.moveTo( _grimm );
        curScene = _grimm;
        window.showScene( player.getCurScene(),
player);
    }
    else
    {
        window.setOutput( "you need to do something
quick to satisfy your kid" );
        window.showScene(player.getCurScene(), player);
    }
}
if( (player.getCurScene() == _dead ) )
{
    window.setOutput(" GAMEOVER");
    window.showScene(player.getCurScene(), player);
}
while(true) {;}
    }
}
}

```

6.3 Test Suites

We created tests scripts that test each aspect of our language. Each test consists of a .gmm file containing the GRIMM source and a .tst file which contains the expected error output. In the case of successful compilation we expect no error message therefore we have no .tst file. In the case of unsuccessful compilation we get an error message which is checked against the expected output stored in the .tst file. Under each category we have various tests listed in the order .gmm file followed by the .tst file.

6.3.1 Lexer Test Scripts

bad.gmm

```
:note: this should fail because tokens must start with an alpha
```

```
12say
```

bad.tst

```
Token Stream Exception ocured while reading your grimm file
line 3:1: unexpected char: '1'
```

```

    at GRIMMLexer.nextToken(GRIMMLexer.java:155)
    at antlr.TokenBuffer.fill(TokenBuffer.java:69)
    at antlr.TokenBuffer.LA(TokenBuffer.java:80)
    at antlr.LLkParser.LA(LLkParser.java:52)
    at GRIMMParser.decls(GRIMMParser.java:1237)
    at GRIMMParser.program(GRIMMParser.java:1305)
    at GRIMM.main(GRIMM.java:31)

```

```
exception: line 3:1: unexpected char: '1'
```

bad2.gmm

:note: common semicolon check

```
scene foo;
```

```
say "there are no semicolons in GRIMM"
```

bad2.tst

Token Stream Exception occurred while reading your grimm file
line 3:10: unexpected char: ';'

```
    at GRIMMLexer.nextToken(GRIMMLexer.java:155)
    at antlr.TokenBuffer.fill(TokenBuffer.java:69)
    at antlr.TokenBuffer.LA(TokenBuffer.java:80)
    at antlr.LLkParser.LA(LLkParser.java:52)
    at GRIMMParser.scene_decl(GRIMMParser.java:84)
    at GRIMMParser.decls(GRIMMParser.java:1240)
    at GRIMMParser.program(GRIMMParser.java:1305)
    at GRIMM.main(GRIMM.java:31)
```

exception: line 3:10: unexpected char: ';'

good.gmm

:note: this is simply a print statement that should pass the lexer

```
say "test successful"
```

underscore.gmm

:note: this test makes sure the lexer accepts underscores

```
character edwards_teacher
```

```
say "this should pass"
```

6.3.2 Parser Test Scripts

boolean.gmm

:note: boolean expressions

```
if user says "foo" and not user says "bar" or user says "foo2"
then
    gameover
endif
```

character.gmm

:note: this tests that we can declare characters

```
character Edwards
```

```
say "character is declared"
```

gameover_bad.gmm

:note: this tests a common mistake with gameover. it should be
'gameover'

game over

gameover_bad.tst

line 3:1: unexpected token: game
Parser Errors!

gameover.gmm

:note: this tests the gameover statement

gameover

goto.gmm

:note: this tests the goto statement

scene classroom

classroom name "Classroom"

goto classroom

hidden_exit.gmm

:note: this tests that the hidden is parsed correctly

scene classroom

scene office

classroom name "Classroom"

classroom exit office is hidden

office name "Edward's office"

say "office is a hidden exit"

hidden_key.gmm

:note: this script tests that we can hide items

scene classroom

classroom name "Classroom"

classroom contains item key is hidden

say "hidden key in classroom"

holds.gmm

:note: this tests that characters can hold items

character edwards

edwards holds item grades

say "edwards holds the item grades"

if_fail.gmm

:note: this tests a common syntax errors with the if statement

```
if user says "foo" then
    say "you said foo"
```

say "these is missing the 'endif' "

if_fail.tst

```
line 7:1: unexpected token: null
line 7:1: unexpected token: null
Parser Errors!
```

if_fail2.gmm

:note: this test common syntax errors with the if statement

```
if user says "foo" then
    say "you said foo"
otherwise if user says "bar" then
    say "you said bar"
endif
```

say "otherwise if should be one word"

if_fail2.tst

```
line 5:11: unexpected token: if
Parser Errors!
```

if_fail3.gmm

:note: this test common syntax errors with the if statement

```
if user says "foo" then
    say "you said foo"
otherwiseif user says "bar"
    say "you said bar"
endif
```

say "otherwiseif is missing 'then'"

if_fail3.tst

```
line 5:28: expecting "then", found '
'
Parser Errors!
```

if_fail4.gmm

:note: this test common syntax errors with the if statement

```
if user says "foo" then
    say "you said foo"
otherwiseif user says "bar" then
    say "you said bar"
otherwise then
    say "you said nothing"
endif
```

```
say "otherwise should not have 'then'"
```

if_fail4.tst

```
line 7:11: unexpected token: then  
Parser Errors!
```

if_fail5.gmm

```
:note: this test common syntax errors with the if statement
```

```
if user says "foo" then  
    if user says "foo2" then  
        say "you said foo2"  
    otherwiseif user says "bar" then  
        say "you said foo"  
    endif
```

```
say "nested if is missing 'endif'"
```

if_fail5.tst

```
line 11:1: unexpected token: null  
line 11:1: unexpected token: null  
Parser Errors!
```

if_fail6.gmm

```
:note: this test common syntax errors with the if statement
```

```
if user says "foo"  
    say "you said foo"  
endif
```

```
say "these is missing the 'then' "
```

if_fail6.tst

```
line 3:19: expecting "then", found '  
'  
line 5:1: expecting EOF, found 'endif'  
Parser Errors!
```

if.gmm

```
:note: this tests a complex, proper if statement
```

```
if user says "foo1" then  
  
    say "foo1"  
    otherwiseif user says "foo2" then  
        say "foo2"  
    otherwiseif user says "foo bar" then  
        if user says "bar1" then  
            say "bar1"  
        otherwiseif user says "bar2" then  
            say "bar2"  
        otherwise  
            say "bar3"
```

```
        endif
    otherwise
        say "foo3"
    endif

say "this is a proper if statement"
```

item_fail.gmm

:note: parser error on item

```
scene classroom
```

```
classroom name "Classroom"
classroom contains key
```

```
say "it should be: classroom contains item key"
```

item_fail.tst

line 6:20: expecting "item", found 'key'
Parser Errors!

keywords.gmm

:note: this test makes sure keywords cant be used as ids

```
character character
character scene
character holds
character item
character contains
character is
character hidden
character name
character description
character picture
character exit
character user
character says
character has
character inside
character and
character if
character then
character endif
character otherwiseif
character otherwise
character while
character endwhile
character goto
character read
character user
character input
character pickup
character drops
character gameover
```

```
scene character
```

scene scene
scene holds
scene item
scene contains
scene is
scene hidden
scene name
scene description
scene picture
scene exit
scene user
scene says
scene has
scene inside
scene and
scene if
scene then
scene endif
scene otherwiseif
scene otherwise
scene while
scene endwhile
scene goto
scene read
scene user
scene input
scene pickup
scene drops
scene gameover

gameover

keywords.tst

line 3:11: expecting NOUN, found 'character'
line 4:11: expecting NOUN, found 'scene'
line 5:11: expecting NOUN, found 'holds'
line 6:11: expecting NOUN, found 'item'
line 7:11: expecting NOUN, found 'contains'
line 8:11: expecting NOUN, found 'is'
line 9:11: expecting NOUN, found 'hidden'
line 10:11: expecting NOUN, found 'name'
line 11:11: expecting NOUN, found 'description'
line 12:11: expecting NOUN, found 'picture'
line 13:11: expecting NOUN, found 'exit'
line 14:11: expecting NOUN, found 'user'
line 15:11: expecting NOUN, found 'says'
line 16:11: expecting NOUN, found 'has'
line 17:11: expecting NOUN, found 'inside'
line 18:11: expecting NOUN, found 'and'
line 19:11: expecting NOUN, found 'if'
line 20:11: expecting NOUN, found 'then'
line 21:11: expecting NOUN, found 'endif'
line 22:11: expecting NOUN, found 'otherwiseif'
line 23:11: expecting NOUN, found 'otherwise'
line 24:11: expecting NOUN, found 'while'
line 25:11: expecting NOUN, found 'endwhile'

```
line 26:11: expecting NOUN, found 'goto'
line 27:11: expecting NOUN, found 'read'
line 28:11: expecting NOUN, found 'user'
line 29:11: expecting NOUN, found 'input'
line 30:11: expecting NOUN, found 'pickup'
line 31:11: expecting NOUN, found 'drops'
line 32:11: expecting NOUN, found 'gameover'
line 34:7: expecting NOUN, found 'character'
line 35:7: expecting NOUN, found 'scene'
line 36:7: expecting NOUN, found 'holds'
line 37:7: expecting NOUN, found 'item'
line 38:7: expecting NOUN, found 'contains'
line 39:7: expecting NOUN, found 'is'
line 40:7: expecting NOUN, found 'hidden'
line 41:7: expecting NOUN, found 'name'
line 42:7: expecting NOUN, found 'description'
line 43:7: expecting NOUN, found 'picture'
line 44:7: expecting NOUN, found 'exit'
line 45:7: expecting NOUN, found 'user'
line 46:7: expecting NOUN, found 'says'
line 47:7: expecting NOUN, found 'has'
line 48:7: expecting NOUN, found 'inside'
line 49:7: expecting NOUN, found 'and'
line 50:7: expecting NOUN, found 'if'
line 51:7: expecting NOUN, found 'then'
line 52:7: expecting NOUN, found 'endif'
line 53:7: expecting NOUN, found 'otherwiseif'
line 54:7: expecting NOUN, found 'otherwise'
line 55:7: expecting NOUN, found 'while'
line 56:7: expecting NOUN, found 'endwhile'
line 57:7: expecting NOUN, found 'goto'
line 58:7: expecting NOUN, found 'read'
line 59:7: expecting NOUN, found 'user'
line 60:7: expecting NOUN, found 'input'
line 61:7: expecting NOUN, found 'pickup'
line 62:7: expecting NOUN, found 'drops'
line 63:7: expecting NOUN, found 'gameover'
Parser Errors!
```

no_stmt.gmm

:note: this tests that a program needs at least one statement

character Edwards

no_stmt.tst

```
line 4:1: unexpected token: null
Parser Errors!
```

pickup.gmm

:note: this tests pickup

scene classroom

```
classroom name "A classroom"
classroom contains item chalk
```

user pickup chalk

scene_decl.gmm

:note: this simply declares a scene

scene classroom
classroom name "A Classroom"

say "test finished with success"

scene_descr.gmm

:note: declares a scene and sets a description for the scene

scene classroom
classroom name "A classroom"
classroom description "The PLT classroom is on the 5th floor of Mudd"

say "test finished with success"

scene_exit.gmm

:note: declares two scenes and makes one scene an exit for the other

scene classroom
scene office

classroom name "A Classroom"
classroom exit office

office name "An office"

say "test finished with success"

scene_item.gmm

:note: declares a scene and gives it an item

scene classroom

classroom name "Aclassroom"
classroom contains item chalk

say "test finished with success"

scene_name.gmm

:note: declares a scene and sets a name for the scene

scene classroom
classroom name "COMSW4115 Classroom"

say "test finished with success"

scene_pic.gmm

:note: declares a scene and gives it a picture

```
scene classroom

classroom name "A classroom"
classroom picture "classpic.jpg"

say "test finished with success"
```

strconst.gmm

:note: this tests that string constants must be used in certain places

```
scene classroom

classroom name The Classroom
classroom description The Description
classroom picture file
if user says foo then
    gameover
endif
```

strconst.tst

```
line 5:16: expecting STRCONST, found 'The'
line 5:20: unexpected token: Classroom
line 6:1: unexpected token: classroom
line 7:1: unexpected token: classroom
line 8:14: expecting STRCONST, found 'foo'
Parser Errors!
```

while_fail1.gmm

:note: this has some common while parse errors

```
:note: there has to be at least one statement in a while
while user says "foo"
endwhile
```

```
:note: missing an 'endwhile'
while user says "foo"
    read user input
```

while_fail1.tst

```
line 5:1: unexpected token: endwhile
line 10:1: expecting "endwhile", found 'null'
line 10:1: unexpected token: null
Parser Errors!
```

while_fail2.gmm

:note: this makes sure there is a boolean in the while statement

```
character edwards
scene classroom

classroom name "Classroom"
classroom contains item chalk
```

```

while user
  say "foo"
endwhile

while edwards
  say "bar"
endwhile

while classroom
  say "boo"
endwhile

while chalk
  say "zoo"
endwhile

while read user input
  say "poo"
endwhile

while not read user input
  say "doo"
endwhile

```

while_fail2.tst

```

line 9:7: unexpected token: user
line 13:7: unexpected token: edwards
line 17:7: unexpected token: classroom
line 21:7: unexpected token: chalk
line 25:7: unexpected token: read
line 29:11: unexpected token: read
Parser Errors!

```

while.gmm

:note: this tests some proper, complex while statements

```

character edwards

edwards holds item grades

while user has grades
  say "GRIMM gets an A+"
endwhile

while user says "foo"
  read user input

endwhile

while not user says "foo"
  read user input
endwhile

```

6.3.3 Walker Test Scripts

char_item_typechk1.gmm

:note: type checking between character and item

```
scene classroom
character edwards

classroom name "Classroom"
classroom contains item edwards

user pickup edwards
user drops edwards
if user has edwards then
    say "foo"
endif
while user has edwards
    say "foo"
endwhile

say "these fails because edwards is a character, not an item"
```

char_item_typechk1.tst

```
Semantic Error on 7: edwards already declared
Semantic Error on 9: edwards not declared or not of type item
Semantic Error on 10: edwards not declared or not of type item
Semantic Error on 11: edwards not declared or not of type item
Semantic Error on 14: edwards not declared or not of type item
Walker Errors!
```

char_item_typechk2.gmm

:note: type checking between character and item

```
scene classroom
character edwards

classroom name "Classroom"
classroom contains item chalk

chalk holds item edwards
chalk holds item chalk
chalk holds item classroom

say "these fail because chalk is an item type, not a character
type"
```

char_item_typechk2.tst

```
Semantic Error on 9: chalk not declared or is not of type
character
Semantic Error on 10: chalk not declared or is not of type
character
Semantic Error on 11: chalk not declared or is not of type
character
Walker Errors!
```

exit_dup.gmm

:note: foo has the bar exit twice. this is a semantic error.

scene foo
scene bar

bar name "Bar"

foo name "Foo"
foo exit bar
foo exit bar

gameover

exit_dup.tst

Semantic Error on 10: foo already has bar as an exit
Walker Errors!

exit_fail.gmm

:note: this test fails because the exit is not defined before it
is used

scene classroom

classroom name "A classroom"
classroom exit office

say "bad test"

exit_fail.tst

Semantic Error on 6: office not declared or is not of type scene.
Walker Errors!

goto_fail.gmm

:note: the goto statement fails because the scene has not been
declared

scene classroom

goto office

goto_fail.tst

Semantic Error on 5: office not declared or not of type scene
Semantic Error: Scene classroom doesn't have a name defined
Walker Errors!

goto_typechk.gmm

:note: type check for scene, item and character

scene classroom
character edwards

classroom name "Classroom"
classroom contains item chalk

```
goto classroom
goto edwards
goto chalk
```

```
say "goto chalk and goto edwards fails because they are not
scenes"
```

goto_typechk.tst

```
Semantic Error on 10: edwards not declared or not of type scene
Semantic Error on 11: chalk not declared or not of type scene
Walker Errors!
```

hidden_fail.gmm

```
:note: the hidden keyword fails because the scene is not declared
```

```
scene classroom
```

```
classroom name "Classroom"
classroom exit office is hidden
```

```
say "hidden fails because office is not declared"
```

hidden_fail.tst

```
Semantic Error on 6: office not declared or is not of type scene.
Walker Errors!
```

holds_bad.gmm

```
:note: this fails because the character is not defined
```

```
edwards holds item grades
```

```
say "edwards is not defined as a character"
```

holds_bad.tst

```
Semantic Error on 3: edwards not declared or is not of type
character
Walker Errors!
```

id_dup.gmm

```
:note: this test fails because all Things must have unique
identifiers
```

```
scene classroom
```

```
classroom name "Classroom"
character classroom
```

```
say "id problem"
```

id_dup.tst

```
Semantic Error on 6: Identifier classroom already used
Walker Errors!
```

item_assign.gmm

:note: checks the holds keyword

scene foo
character bar

foo name "Foo"
foo holds item zoo

say "it should be foo contains item zoo"

item_assign.tst

Semantic Error on 7: foo not declared or is not of type character
Walker Errors!

item_test1.gmm

:note: this test makes sure we can't have the same id

scene classroom
character edwards

classroom name "Classroom"
classroom contains item chalk

edwards holds item chalk

say "this is bad"

item_test1.tst

Semantic Error on 9: chalk already declared
Walker Errors!

name_bad.gmm

:note: this fails the semantic analysis because all scenes must
declare names

scene classroom

say "test fails"

name_bad.tst

Semantic Error: Scene classroom doesn't have a name defined
Walker Errors!

name_undecl.gmm

:note: the scene is not named

scene classroom

say "classroom needs a name"

name_undecl.tst

Semantic Error: Scene classroom doesn't have a name defined
Walker Errors!

recur_scene.gmm

:note: GRIMM allows for recursive scenes

scene foo

foo name "Foo"
foo exit foo

say "foo has an exit to itself"

scene_char_typechk1.gmm

:note: type checking for scenes and characters

scene foo
character bar

foo name "Foo"
foo exit bar

say "bar is a character, not a scene"

scene_char_typechk1.tst

Semantic Error on 7: bar not declared or is not of type scene.
Walker Errors!

scene_char_typechk3.gmm

:note: type checking between character and scene

character foo
scene bar

bar name "Bar"

foo name "Foo"
foo description "Foo Description"
foo picture "/pic.jpg"
foo contains item bar
foo exit bar

say "these are errors because foo is not a scene"

scene_char_typechk3.tst

Semantic Error on 8: Cannot assign name "Foo" to scene foo
because foo is not declared or is not of type scene.
Semantic Error on 9: foo not declared or is not of type scene.
Semantic Error on 10: foo not declared or is not of type scene.
Semantic Error on 11: foo not declared or is not of type scene
Semantic Error on 12: foo not declared or is not of type scene
Walker Errors!

scene_dup.gmm

:note: this test fails because all Things must have unique
identifiers

scene classroom

classroom name "Classroom"
character classroom

say "id problem"

scene_dup.tst

Semantic Error on 6: Identifier classroom already used
Walker Errors!

scene_full.gmm

:note: full scene declaration with name, description, picture,
exit and items

scene classroom
scene office

classroom name "W4115 Classroom"
classroom description "The classroom is on the 5th floor of Mudd"
classroom picture "classpic.jpg"
classroom exit office
classroom contains item chalk

office name "Steve Edwards Office"
office description "Office is on the 4th floor of CS building"
office picture "mugshot.jpg"
office contains item compiler

say "success"

scene_item_typechk1.gmm

:note: type checking for scenes and items

scene foo
scene bar

foo name "Foo"
foo contains item bar

say "bar is a scene, not an item "

scene_item_typechk1.tst

Semantic Error on 7: bar already declared
Semantic Error: Scene bar doesn't have a name defined
Walker Errors!

scene_item_typechk2.gmm

:note: type check between item and scene

scene foo

foo name "Foo"

user drops foo

say "this should fail because foo is not at item"

scene_item_typechk2.tst

Semantic Error on 7: foo not declared or not of type item
Walker Errors!

6.3.4 Translator Tests

javakeyword.gmm

:note: this tests that the translator is mangling the variables
so it doesn't
:note: conflict with the java compiler

character class

gameover

7. Lessons Learned

7.1 Individual Lessons

7.1.1 Mike

The most important piece of knowledge that I wished I had possessed when beginning this project was the overall, big picture of the compiler design. Knowing beforehand how each component worked and what functionality it needed to implement would have been a huge help. Instead, I found myself trying to build components by feel, adding code in what looked to be right, only to discover afterward what that code should have been doing. If given the chance to repeat this project, I would have first begun with an outline of all code to be written. Having each component's functionality sketched out before beginning development would have been the better way to approach this.

In designing the GUI GameFrame class, I was forced to do an almost complete redesign of the layout towards the end of the project. Unfortunately, when I had begun development, my knowledge of the Java Swing libraries and they manner in which layout is done is not what it is now. In my first iteration of the GameFrame class, my layout was sloppy and subject to unpredictable behavior when resizing occurred. Having now learned proper techniques for making such layout designs, I was able to rewrite a much tighter, predictable GUI window.

One of the best parts of this project was my fellow design team members and the manner in which we worked together. Based on the experiences of others, it seems that having good team chemistry is as important as any other factor. Our team excelled in work delegation, communication, meeting self-imposed deadlines, and work collaboration. This was a major part of our success, more so than I thought it would be.

7.1.2 Bill

When first developing the testing engine, I was only comparing standard out with the ideal test output. However, some parts of ANTLR output things to standard error (like parse error messages). I had to change the testing engine to grab both standard out and standard error and compare that to the test output (which was generated by grabbing both standard out and standard error).

To report the line number of the error during a tree walk, we had to create a custom AST class to store the line number every time a new token was initialized. The custom AST class also had a getLineNumber() method which was called during the tree walk to return that line number. Also, the way we did the walker could have been done easier if we had assumed the parser did its job for us. Also, it's much easier to manage the symbol table if you use a custom symbol table class. We tried to reuse our application classes and it was overly complicated.

We found in some cases, such as “scene class” that the translator needs to mangle

variable names, otherwise it could clash with the output language's keywords. Therefore, we had to change the variable names by adding an “_” to all variables.

Finally, A very important note is to write a style guide before everyone starts coding

7.1.3 Mariya

My advice is to divide up the parts of the compiler early. Look ahead in the lectures or the reading to understand what the specific components of the compiler are and give each person something to work on immediately. I think we tried to do one part at a time, so some people ended up having nothing to do while others were trying to get their part done, and then the workload would switch. I don't think this is the most efficient way to do the project. Also, in the beginning plan out the language, style, and structure specifics before writing lots of code. This will save a lot of time in the end.

7.1.4 Becky

I feel that the hardest part of this project was understanding each component and what it did at the beginning of the course. As a group we spent a lot of time trying to figure out what each piece was and its function in the compiler. I found that we were trying to build a part of the compiler and we did not understand what we were doing, then we would go to class with the intention of asking Professor Edwards, and then the topic of the lesson for that day would be the part of the compiler we were trying to implement. Thus, one lesson I learned was that the lectures are a little behind where the project progression should be.

Secondly, we were a great group, but I think that if we had understood each section better we could have split things up a little earlier and we might have been able to do some more complicated things with our language. We ended up learning a lot together and therefore we did each part one after another. So, there was one or two people coding with others watching and learning. Whereas we could have had everyone working on different aspects while meeting as a group.

There are a few interesting features in working with runtime environments expecting a user. For example, it is impossible to know which scene a user is in at compile time when checking if the exits being used are valid. Or another case is items, it is impossible to know at compile time what items a user has. Thus when the programmer specifies for a user to pickup an item we don't know at compile time if the scene actually has the item or not.

7.2 Group Advice

1. Choose group members that you can work well with, not necessarily your friends. We found our working environment functional as well as pleasurable.
2. Read ahead in the slides/book/past projects (especially the Architecture section) to find out what a compiler is made of so that you understand each part and can split up the project more effectively.

3. Create a style guide as well as set up CVS early as you will need both.
4. Start as early as possible. Do not wait for in class deadlines, set your own.

Appendix

A1. Makefile

```
.DEFAULT:

# makes everything that we have so far (default, just type "make")
all: grammars main extra

% : %.gmm
    java antlr.Tool grimm.g
    java antlr.Tool GRIMMTranslator.g
    javac GRIMM.java
    javac Character.java Scene.java GRIMM.java SymbolTable.java
GRIMMLexer.java Thing.java User.java GRIMMParser.java GRIMMTokenTypes.java
gameFrame.java GRIMMWalker.java GRIMMtranslator.java
GRIMMtranslatorTokenTypes.java outputFrame.java Item.java CustomAST.java
    java GRIMM $*.gmm
    javac $*.java
    java $*

main: GRIMM.java
    javac GRIMM.java

grammars: grimm.g GRIMMTranslator.g
    java antlr.Tool grimm.g
    java antlr.Tool GRIMMTranslator.g

extra: Character.java Scene.java GRIMM.java SymbolTable.java GRIMMLexer.java
Thing.java User.java GRIMMParser.java GRIMMTokenTypes.java gameFrame.java
GRIMMWalker.java GRIMMtranslator.java GRIMMtranslatorTokenTypes.java
outputFrame.java Item.java CustomAST.java
    javac Character.java Scene.java GRIMM.java SymbolTable.java
GRIMMLexer.java Thing.java User.java GRIMMParser.java GRIMMTokenTypes.java
gameFrame.java GRIMMWalker.java GRIMMtranslator.java
GRIMMtranslatorTokenTypes.java outputFrame.java Item.java CustomAST.java

test:
    ./grimmtest.py testscripts/lexer/* testscripts/parser/*
testscripts/walker/* testscripts/translator/* testscripts/app/*

clean: testclean
    rm -f *~ *.class GRIMMLexer.* GRIMMParser.* GRIMMtranslator*
*TokenTypes* GRIMMWalker.java

testclean:
    rm -f testscripts/lexer/*.java testscripts/lexer/*~
testscripts/parser/*.java testscripts/parser/*~ testscripts/walker/*.java
testscripts/walker/*~
```

A2. GRIMM.java

```
/*
 * File: GRIMM.java
 *
 * Authors: Mike Lenner, Billy Liu, Mariya Nomanbhoy, Becky Plummer
 */
```

```

import java.io.*;
import antlr.CommonAST;
import antlr.collections.AST;
import antlr.debug.misc.ASTFrame;

/*
 * This class runs the lexer, parser, walker, and translator on
 * a .gmm file, outputting any compiler errors to the console.
 */
class GRIMM {
    public static void main(String[] args){

        if(args.length > 0){
            try {
                /*get input stream to a file*/
                File fin = new File(args[0]);
                FileReader in = new FileReader(fin);

                /*create lexer and parser objects*/
                GRIMMLexer lexer = new GRIMMLexer(in);
                GRIMMParser parser = new GRIMMParser(lexer);
                GRIMMWalker walker = new GRIMMWalker();

                /*run lexer and parser on the input file*/
                parser.program();

                if (lexer.num_errors > 0) {
                    System.out.println("Scanner Errors!");
                    return;
                }

                if (parser.num_errors > 0) {
                    System.out.println("Parser Errors!");
                    return;
                }

                /*Get the AST from the parser*/
                CommonAST parseTree =
                (CommonAST)parser.getAST();

                /*Open a window in which the AST is*/
                /*displayed graphically*/
                //ASTFrame frame =
                //new ASTFrame("AST from the Simp parser",
                //parseTree);

                walker.program(parseTree);

                if (walker.gRet < 0) {
                    System.out.println ("Walker Errors!");
                    return;
                }

                //frame.setVisible(true);

                GRIMMtranslator gt =

```

```

        new GRIMMtranslator(args[0]);
        gt.program( parseTree );
    }catch(IOException e) {
        System.out.println(
            "Error occured while reading your broom file.");
        e.printStackTrace();
        System.out.println("exception: "+e);
    } catch(antlr.RecognitionException re) {
        System.out.println(
            "Recognition Exception occured while reading"
            + " your grimm file.");
        re.printStackTrace();
        System.out.println("exception: "+re);
    } catch(antlr.TokenStreamException re) {
        System.out.println("Token Stream Exception"
            + " occured while reading your grimm file");
        re.printStackTrace();
        System.out.println("exception: "+re);
    }
    }
    else{
        System.out.println("ERROR 6111: No program name found"
            + " at the command prompt");
    }
    return;
}
}
}

```

A3. grimm.g

```

/*
 * Author(s): Mike Lenner, William Liu, Becky Plummer
 */

class GRIMMLexer extends Lexer;
options {
    k = 2;
    charVocabulary = '\3'..'\'377';
    testLiterals = false;
    exportVocab = GRIMM;
}
{
    int num_errors = 0;
    public void reportError(String s)
    {
        super.reportError(s);
        num_errors++;
    }

    public void reportError(RecognitionException e)
    {
        super.reportError(e);
        num_errors++;
    }
}
}

```

```

protected ALPHA : 'a'..'z' | 'A'..'Z' | '_' ;
protected DIGIT : '0'..'9' ;

WS : ( (' ' | '\t') { $setType(Token.SKIP); } )+;

STRCONST : '"'! ( ~('"' | '\n') | ('"'! '"' ) ) * '"'! ;

NEWLINE : (( '\n' | '\r' '\n' ){ newline(); } )+;

COMMENT : ( " :note:" (~('\n' | '\r')) * NEWLINE )
          { $setType(Token.SKIP); };

NOUN options { testLiterals = true; }
      : ALPHA (ALPHA | DIGIT)*;

//
*****

class GRIMMParser extends Parser;
/*
 * keywords: goto, say, says, user, pickup, has, while, if, then, endif,
 * otherwise, otherwiseif, and, or, endwhile, inside, scene, exit, picture,
 * description, name, item, character, hidden, read, input, gameover,
contains
 */

options {
    k = 2;
    buildAST = true;
    exportVocab = GRIMM;
}

tokens{
    STMTS;
    DECLS;
    PROGRAM;
    BOOLEXP;
}
{
    int num_errors = 0;
    public void reportError( String s ) {
        super.reportError(s);
        num_errors++;
    }

    public void reportError(RecognitionException e) {
        super.reportError(e);
        num_errors++;
    }
}

/* declarations */
scene_decl:
    "scene" ^ NOUN (NEWLINE!)+;

char_decl:

```

```

    "character"^ NOUN (NEWLINE!)+;

/* assginments */
char_item_assign:
    NOUN "holds"^ "item" NOUN (NEWLINE!)+;

item_assign:
    NOUN "contains"^ "item" NOUN ("is"! "hidden")? (NEWLINE!)+;

name_assign:
    NOUN "name"^ STRCONST (NEWLINE!)+;

desc_assign:
    NOUN "description"^ STRCONST (NEWLINE!)+;

picture_assign:
    NOUN "picture"^ STRCONST (NEWLINE!)+;

exit_assign:
    NOUN "exit"^ NOUN ("is"! "hidden")? (NEWLINE!)+;

/* user boolean expressions */
user_says:
    "user"! "says"^ STRCONST;

person_has:
    ("user" | NOUN ) "has"^ NOUN;

user_inside:
    "user"! "inside"^ NOUN;

/* control structures */
conditional:
    ("not"^)? ( user_says | person_has | user_inside );

bool_expr:
    and_expr ( "or"^ and_expr )*
    {#bool_expr = #( [BOOLEXP, "bool_expr"], bool_expr ); }
;

and_expr:
    conditional ( "and"^ conditional )*;

if_stmt:
    "if"^ bool_expr "then"! (NEWLINE!)+ stmts
    (otherwiseif)*
    (otherwise)?
    "endif"!;

otherwiseif:
    "otherwiseif"^ bool_expr "then"! (NEWLINE!)+ stmts
;

otherwise:
    "otherwise"^ (NEWLINE!)+ stmts
;

```

```

while_stmt:
    "while"^ bool_expr (NEWLINE!)+ stmts "endwhile"!!;

/* actions */
action:
    jump
    | say
    | user_input
    | game_over
    | pick_up
    | drop
    ;

jump:
    "goto"^ NOUN;

say:
    "say"^ STRCONST;

user_input:
    "read" "user"! "input"!!;

pick_up:
    ("user" | NOUN ) "pickup"^ NOUN;

drop:
    ("user" | NOUN ) "drops"^ NOUN;

game_over:
    "gameover";

/* putting it together */
stmt:
    if_stmt
    | while_stmt
    | action;

stmts:
    (stmt (NEWLINE!)+
    {#stmts = #( [STMTS, "stmts"], stmts ); }
    ;

decls:
    (
        scene_decl
        | char_decl
        | char_item_assign
        | item_assign
        | name_assign
        | desc_assign
        | picture_assign
        | exit_assign
    )*
    {#decls = #( [DECLS, "decls"], decls ); }
    ;

```

```

program:
/* add custom AST node to make line numbers available in walker */
{ getASTFactory().setASTNodeType("CustomAST"); }
    decls
    stmts
    EOF!
    {#program = #( [PROGRAM, "program"], program ); }
    ;

/*
*****/

class GRIMMWalker extends TreeParser;

options {
    ASTLabelType = "CustomAST"; /* add custom AST node to make line numbers
*/
                                /* available in walker */
}

{
    /* globals */
    SymbolTable gSym_Tab = new SymbolTable();
    int gRet = 0;

    /* print error function */
    public void printError(String msg, int line) {
        System.out.println("Semantic Error on "+line+": "+msg);
    }
}

program:
    #(PROGRAM declaration statement)
    {
        if (!gSym_Tab.checkIntegrity()) {
            gRet = -1;
        }
    };

declaration:
    #(DECLS ( (scene_decl |
              exit_assign |
              char_decl |
              char_item_assign |
              name_assign |
              desc_assign |
              item_assign |
              picture_assign)* ) );

statement:
    #(STMTS (action | if_stmt | while_stmt)+ );

while_stmt:
    #("while" bool_exp statement);

if_stmt:

```

```

        #("if" bool_exp statement (other_expr)*);

other_expr:
    #("otherwiseif"
        {gSym_Tab.printDebug("In otherwiseif");}
        bool_exp statement)
    | #("otherwise"
        {gSym_Tab.printDebug("In otherwise");}
        statement);

bool_exp:
    #(BOOLEXP log_expr )
    {gSym_Tab.printDebug("bool expr");};

log_expr:
    #("and" log_expr log_expr)
    {gSym_Tab.printDebug("and expr");}
    | #("or" log_expr log_expr)
    {gSym_Tab.printDebug("or expr");}
    | #("not" cond_pred)
    | cond_pred;

cond_pred:
    #("says" STRCONST)
    {gSym_Tab.printDebug("says expr");}
    | #("inside" scene_name:NOUN)
    {
        gSym_Tab.printDebug("inside expr");
        if (!gSym_Tab.isDeclared(scene_name.getText(),SymbolTable.SCENE))
        {
            printError (scene_name.getText()+" not declared"+
                " or not of type scene",
                scene_name.getLineNumber());
            gRet = -1;
        }
    }
    | #("has" has_expr);

has_expr:
    ("user" item_user:NOUN)
    {
        gSym_Tab.printDebug("User has");
        if (!gSym_Tab.isDeclared(item_user.getText(),SymbolTable.ITEM))
        {
            printError (item_user.getText()+ " not declared"+
                " or not of type item",
                item_user.getLineNumber());
            gRet = -1;
        }
    }
    | (char_name:NOUN item_char:NOUN)
    {
        gSym_Tab.printDebug("Char has");
        if (!gSym_Tab.isDeclared(item_char.getText(),SymbolTable.ITEM)) {
            printError (item_char.getText()+ " not declared"+
                " or not is not of type item",
                item_char.getLineNumber());

```

```

        gRet = -1;
    }
    if (!gSym_Tab.isDeclared(char_name.getText(),SymbolTable.CHAR))
{
        printError (char_name.getText()+ " not declared"+
                    " or is not of type character",
                    char_name.getLineNumber());
        gRet = -1;
    }
};

action:
    #("goto" scene_name:NOUN)
    {
        gSym_Tab.printDebug ("goto");
        if (!gSym_Tab.isDeclared(scene_name.getText(),SymbolTable.SCENE))
{
            printError (scene_name.getText()+" not declared"+
                        " or not of type scene",
                        scene_name.getLineNumber());
            gRet = -1;
        }
    }
| #("pickup" pickup_stmnt)
| #("drops" drop_stmnt)
| ("gameover")
    {gSym_Tab.printDebug("Game Over");}
| ("read")
    {gSym_Tab.printDebug("Read User input");}
| say;

pickup_stmnt:
    ("user" item_user:NOUN)
    {
        gSym_Tab.printDebug ("user pickup");
        if (!gSym_Tab.isDeclared(item_user.getText(),SymbolTable.ITEM))
{
            printError (item_user.getText()+ " not declared or"+
                        " not of type item",
                        item_user.getLineNumber());
            gRet = -1;
        }
    }
| (char_name:NOUN item_name:NOUN)
    {
        gSym_Tab.printDebug ("char pickup");
        if (!gSym_Tab.isDeclared(item_name.getText(),SymbolTable.ITEM)) {
            printError (item_name.getText()+ " not declared or"+
                        " not of type item",
                        item_name.getLineNumber());
            gRet = -1;
        }
        if (!gSym_Tab.isDeclared(char_name.getText(),SymbolTable.CHAR)) {
            printError (char_name.getText()+ " not declared or "+
                        " not of type character",

```

```

        char_name.getLineNumber());
        gRet = -1;
    }
};

drop_stmt:
    ("user" item_user:NOUN)
    {
        gSym_Tab.printDebug ("user drops");
        if (!gSym_Tab.isDeclared(item_user.getText(),SymbolTable.ITEM))
        {
            printError (item_user.getText()+ " not declared or"+
                " not of type item",
                item_user.getLineNumber());
            gRet = -1;
        }
    }
| (char_name:NOUN item_name:NOUN)
    {
        gSym_Tab.printDebug ("char drop");
        if (!gSym_Tab.isDeclared(item_name.getText(),SymbolTable.ITEM)) {
            printError (item_name.getText()+ " not declared or"+
                " not of type item",
                item_name.getLineNumber());
            gRet = -1;
        }
        if (!gSym_Tab.isDeclared(char_name.getText(),SymbolTable.CHAR)) {
            printError (char_name.getText()+ " not declared or "+
                " declared of type other than character",
                char_name.getLineNumber());
            gRet = -1;
        }
    }
};

say:
    #("say" s:STRCONST) {gSym_Tab.printDebug(s.getText());};

scene_decl:
    #("scene" n:NOUN)
    {
        int temp;
        gSym_Tab.printDebug("Scene Decl");
        temp = gSym_Tab.addSymbol(n.getText(),SymbolTable.SCENE);
        if (temp == -1) {
            printError("Identifier "+n.getText()+" already used",
                n.getLineNumber());
        }
        gRet += temp;
    }
};

char_decl:
    #("character" n:NOUN)
    {
        int temp;
        temp = gSym_Tab.addSymbol(n.getText(),SymbolTable.CHAR);
        if (temp == -1) {

```

```

        printError("Identifier "+n.getText()+" already used",
                    n.getLineNumber());
    }
    gRet += temp;
};

exit_assign:
#("exit" scene_name:NOUN exit_name:NOUN ("hidden"?)
{
    if (!gSym_Tab.isDeclared(exit_name.getText(),SymbolTable.SCENE))
    {
        printError(exit_name.getText()+ " not declared"+
                    " or is not of type scene.",
                    exit_name.getLineNumber());
        gRet = -1;
    }
    if (!gSym_Tab.isDeclared(scene_name.getText(),SymbolTable.SCENE))
    {
        printError(scene_name.getText()+
                    " not declared or is not of type scene",
                    scene_name.getLineNumber());
        gRet = -1;
    }
    if (!gSym_Tab.addExit(scene_name.getText(),
                          exit_name.getText())) {
        printError(scene_name.getText()+" already has "+
                    exit_name.getText()+" as an exit",
                    scene_name.getLineNumber());
        gRet = -1;
    }
};

name_assign:
#("name" scene_name:NOUN name:STRCONST)
{
    if (!gSym_Tab.isDeclared(scene_name.getText(),SymbolTable.SCENE))
    {
        printError ("Cannot assign name \" "+name.getText()+
                    "\" to scene "+scene_name.getText()+
                    " because "+scene_name.getText()+" is not"+
                    " declared or is not of type scene.",
                    scene_name.getLineNumber());
        gRet = -1;
    }

    gSym_Tab.nameDefined(scene_name.getText());
};

picture_assign:
#("picture" scene_name:NOUN STRCONST)
{
    if (!gSym_Tab.isDeclared(scene_name.getText(),SymbolTable.SCENE))
    {
        printError (scene_name.getText()+
                    " not declared or is not of type scene.",

```

```

        scene_name.getLineNumber());
        gRet = -1;
    }
};

desc_assign:
#("description" scene_name:NOUN STRCONST)
{
    if (!gSym_Tab.isDeclared(scene_name.getText(),SymbolTable.SCENE))
{
        printError (scene_name.getText()+
                    " not declared or is not of type scene.",
                    scene_name.getLineNumber());
        gRet = -1;
    }
};

item_assign:
#("contains" scene_name:NOUN "item" item_name:NOUN)
{
    if (!gSym_Tab.isDeclared(scene_name.getText(),
                            SymbolTable.SCENE)) {
        printError(scene_name.getText()+
                    " not declared or is not of type scene",
                    scene_name.getLineNumber());
        gRet = -1;
    } else {
        int temp;
        temp = gSym_Tab.addSymbol(item_name.getText(),
                                SymbolTable.ITEM);

        if (temp == -1) {
            printError(item_name.getText()+
                        " already declared",
                        item_name.getLineNumber());
        }
        gRet += temp;
    }
};

char_item_assign:
#("holds" char_name:NOUN "item" item_name:NOUN)
{
    if (!gSym_Tab.isDeclared(char_name.getText(),SymbolTable.CHAR)) {
        printError (char_name.getText()+
                    " not declared or is not of type character",
                    char_name.getLineNumber());
        gRet = -1;
    } else {
        int temp;
        temp = gSym_Tab.addSymbol(item_name.getText(),
                                SymbolTable.ITEM);

        if (temp == -1) {
            printError(item_name.getText()+
                        " already declared",

```

```

        }
        gRet += temp;
    }
};

```

A4. SymbolTable.java

```

/*
 * File: SymbolTable.java
 *
 * Authors: Mike Lenner, William Liu
 */
import java.util.*;

/*
 * Symbol Table class stores symbols for the walker
 */
public class SymbolTable {
    /* Flag to print debug messages to console */
    public static final boolean DEBUG = false;

    /* Vector of symbols for our symbol table */
    Vector symbols = new Vector();

    /* Types of objects in the symbol table */
    public static final String SCENE = "scene";
    public static final String CHAR = "character";
    public static final String ITEM = "item";

    /*
     * Constructor
     */
    public SymbolTable() {}

    /*
     * Adds a symbol of type to the symbol table using name as the id.
     * Returns 0 on success, -1 on error.
     */
    public int addSymbol(String name, String type) {
        Symbol newSym = new Symbol();

        newSym.Id = name;
        newSym.Type = type;

        if (isDeclared(name)) {
            printDebug("Scene "+name+" already declared");
            return -1;
        }
        symbols.add(newSym);

        return 0;
    }

    /*
     * Tests whether a certain symbol is already in the symbol table.
     * Returns true if it exists, false if it does not.
     */

```

```

    */
    public boolean isDeclared(String name) {
        for (int i=0; i<symbols.size(); i++) {
            Symbol temp = (Symbol) symbols.get(i);
            if (temp.Id.equals(name))
                return true;
        }
        return false;
    }

    /*
    * Tests if symbol is declared and is of correct type.
    * Returns true if declared and of correct type, false otherwise.
    */
    public boolean isDeclared(String name, String type) {
        for (int i=0; i<symbols.size(); i++) {
            Symbol temp = (Symbol) symbols.get(i);
            if (temp.Id.equals(name) && temp.Type.equals(type))
                return true;
        }
        return false;
    }

    /* Sets a flag for a symbol in the symbol table to indicate that a
    * symbol is defined. This is used to make sure that scene types are
    * given names.
    * Returns true on success, false if the symbol does not exist.
    */
    public boolean nameDefined(String name) {
        // check for valid names for each scene symbol
        for (int i=0; i<symbols.size(); i++) {
            Symbol temp = (Symbol) symbols.get(i);
            if (temp.Id.equals(name)) {
                temp.Name_Defined = true;
                return true;
            }
        }
        return false;
    }

    /*
    * Checks the integrity of the symbol table to ensure that all scene
    * types have a name assigned.
    * Returns true if the symbol table is ok, false otherwise.
    */
    public boolean checkIntegrity() {
        for (int i=0; i<symbols.size(); i++) {
            Symbol temp = (Symbol) symbols.get(i);
            if ((temp.Type == SCENE) && (!temp.Name_Defined)) {
                System.out.println("Semantic Error: Scene " +
                    temp.Id+" doesn't have a name defined");
                return false;
            }
        }
        return true;
    }
}

```

```

/*
 * This method is used to add an exit to a scene symbol. It is used
 * when an exit is assigned to a scene. It allows to check later to
 * verify a scene has not been added as exit twice to the same scene
 */
public boolean addExit(String scene, String exit) {
    for (int i=0; i<symbols.size(); i++) {
        Symbol temp = (Symbol) symbols.get(i);
        if (temp.Id.equals(scene)) {
            if (temp.Exits.contains(exit))
                return false;
            else {
                temp.Exits.addElement(exit);
                return true;
            }
        }
    }
    System.out.println("Semantic Error: scene"+
        " has not been declared and was not"+
        " caught in isDeclared(). Something"+
        " is very wrong.");
    return false;
}

/*
 * Outputs a message to the console if DEBUG is true.
 */
public void printDebug(String msg) {
    if (DEBUG)
        System.out.println(msg);
}

}

/*
 * Symbol class for each id
 */
class Symbol
{
    public String Type;          /* symbol type (SCENE, CHAR, ITEM) */
    public String Id;           /* unique id for symbol */
    public boolean Name_Defined; /* flag for SCENE types */
    public Vector Exits;

    /*
     * Constructor
     */
    public Symbol() {
        Type = "";
        Id = "";
        Name_Defined = false;

        /* initialize exit vector */
        Exits = new Vector();
    }
}

```

```
}
```

A5. CustomAST.java

```
/*
 * File: CustomAST.java
 *
 * Author(s): Mike Lenner, Billy Liu
 *
 */

import antlr.*;
import antlr.collections.AST;

/*
 * AST class that will store the line number so our walker can report line
 * numbers when a semantic error occurs
 */
public class CustomAST extends CommonAST {
    private int Line_Number;

    /*
     * Constructor
     */
    public CustomAST() { }

    /*
     * Constructor that initializes with token
     */
    public CustomAST(Token tok) { super(tok); }

    /*
     * Initializes the AST
     */
    public void initialize(AST t) {
        super.initialize(t);
        if (t.getClass().getName().compareTo("CustomAST") == 0) {
            CustomAST t2 = (CustomAST)t;
            Line_Number = t2.Line_Number;
        }
    }

    /*
     * Initializes a token
     */
    public void initialize(Token tok) {
        super.initialize(tok);
        /* store the line number from the token */
        Line_Number = tok.getLine();
    }

    /*
     * Used in tree walker to get the token's line number
     * Returns the line number.
     */
}
```

```

        */
        public int getLineNumber() {
            return Line_Number;
        }
    }
}

```

A6. GRIMMTranslator.g

```

/*
 * File: GRIMMTranslator.g
 *
 * Author: Mariya Nomanbhoy
 */

{import java.io.*;}

/*
 * This is the translator class. A translator object is made in the Main
 * file. It will then translate grimm file into proper java code using
 * the AST. The constructor takes a String parameter which is the name
 * of the java file to be created.
 */
class GRIMMtranslator extends TreeParser;

options {
    importVocab = GRIMM;
    //buildAST = true;
}

{
    /* Class member variables */
    public String Class_Name;
    public String Java_Code;
    int Tabs = 0;

    /*
     * Constructor takes the name of output file as a String and
     * creates a new translator object.
     */
    public GRIMMtranslator( String filename ) {
        super();
        Class_Name = filename;
    }

    /*
     * This function prints the tabs based on how the current indentation
     * of the file.
     */
    public void printTabs() {
        for( int j = 0; j < Tabs; j++ ) {
            Java_Code += "\t";
        }
    }
}

/*
 * This method does the translation of the grimm file into a java

```

```

* file. It takes a parse tree as a parameter and returns void.
* The method will print out the java code to Class_Name.java
*/
program {
    Java_Code = "//This is your grimm file translated into java\n";
    Tabs = 0;
}

:#{
    /*
    * Writing out header to string value.
    * This includes initializing a game frame and user
    */
    PROGRAM {

        /* creating a java class */
        Java_Code += "public class "
+ Class_Name.substring(0, Class_Name.length() - 4)
+ " {";

        printTabs();
        Tabs++;
        printTabs();

        /* starting main function */
        Java_Code += "public static void main( String args[]

";
        Java_Code += ")\n\t{\n";
        Tabs++;

        /* initializing user */
        printTabs();
        Java_Code += "User player = new User();\n";
        printTabs();

        Java_Code
+= "Scene curScene = new Scene(null, null, null);\n";

        /* initializing graphics */
        printTabs();
        Java_Code += "//initializing game frame";
        Java_Code
+= "\n\t\tgameFrame window = new gameFrame();\n";

        /*
        The program is divided up into two main parts.
        The first part has all declarations and assignments.
        There can be 0 or more of these
        */

        }

        declarations

        /*
        The second part of the code is the statements which
        there can be one or more off
        */

```

```

        statements {

        /* closing main and class */
        Java_Code += "\t}\n}";
        try{
            BufferedWriter out = new BufferedWriter(
                new FileWriter(
                    Class_Name.substring(0,Class_Name.length() -3)
                    + "java"));
            out.write(Java_Code);
            out.close();
        } catch(IOException e) {
            System.out.println(e);
        }
    });

/*
 * This will translate all declarations into java.
 */
declarations:

    /* first we check what kind of a declaration we have */
    #(dec:DECLS
        ((sceneDecl |
        exitAssign |
        charDecl |
        charItemAssign |
        nameAssign |
        descAssign |
        itemAssign |
        pictureAssign )*) );

/*
 * Printing a scene declaration.
 */
sceneDecl:
    #("scene" n:NOUN ) {
        printTabs();
        /*printing new scene */
        Java_Code += "Scene _" + n.getText()
            + " = new Scene(null, null, null);\n";
    };

/*
 * Printing a character declaration.
 */
charDecl:
    #("character" n:NOUN ) {
        printTabs();
        /* printing new scene */
        Java_Code += ("Character _" + n.getText()
            + " = new Character(null);\n");
    };

/*
 * Assigning and exit to a scene.

```

```

*/
exitAssign:
    #(dec:"exit" scene_name:NOUN exit_name:NOUN ("hidden")? ) {
        printTabs();
        if( dec.getNumberOfChildren() == 3 ) {
            /* adding hidden exit */
            Java_Code += "_" + scene_name.getText() +
                ".addExit( _" + exit_name.getText() + ", true );\n";
        }
        else {
            /* adding visible exit */
            Java_Code += "_" + scene_name.getText() +
                ".addExit( _" + exit_name.getText() + ", false);\n";
        }
    };

/*
* Assigning a name to an object such as character or scene
*/
nameAssign:
    #("name" var:NOUN name:STRCONST ) {
        printTabs();
        Java_Code += "_" + var.getText() + ".setName( \"\"
            + name.getText() + \"\");\n";
    };

/*
* Assigning a picture to a scene
*/
pictureAssign:
    #("picture" scene_name:NOUN name:STRCONST) {
        printTabs();
        Java_Code += "_" + scene_name.getText() + ".setPicture( \"\"
            + name.getText() + \"\");\n";
    };

/*
* Assigning a descr to a scene
*/
descAssign:
    #("description" scene_name:NOUN descr:STRCONST) {
        printTabs();
        Java_Code += ("_" + scene_name.getText() + ".setDescr( \"\"
            + descr.getText() + "\" );\n");
    };

/*
* Assigning an item to a scene
*/
itemAssign:
    #(dec:"contains" scene_name:NOUN "item" item_name:NOUN) {
        printTabs();
        Java_Code += "Item _" + item_name.getText()
            + " = new Item( \"\" + item_name.getText()
            + \"\");\n";
        printTabs();
    };

```

```

        if( dec.getNumberOfChildren() == 4 ) {
            Java_Code += "_" + scene_name.getText()
                + ".addItem( _" + item_name.getText() + ", true );\n";
        }

        else {
            Java_Code += "_" + scene_name.getText() +
                ".addItem( _" + item_name.getText() + " , false );\n";
        }
    };

/*
 * Assigning an item to a character
 */
charItemAssign:
    #("holds" char_name:NOUN "item" item_name:NOUN) {
        printTabs();
        Java_Code += "Item _" + item_name.getText()
            + " = new Item( \"" + item_name.getText() + "\" );\n";
        printTabs();
        Java_Code += "_" + char_name.getText() + ".pickUp( _"
            + item_name.getText() + " );\n";
    };

/*
 * Going through all statements and calling appropriate function.
 */
statements:
    #(STMTS (action | ifStmt | whileStmt)+ );

/*
 * We have found an action and need to act appropriately
 */
action:
    #("goto" scene_name:NOUN) {
        printTabs();
        Java_Code += "player.moveTo( _" + scene_name.getText()
            + " );\n";

        printTabs();
        Java_Code += "curScene = _" + scene_name.getText() + ";\n";
        printTabs();
        Java_Code +=
            "window.showScene( player.getCurScene(), player);\n";
    }
    | #("pickup" pickUpStmnt)
    | #("drops" dropStmnt)
    | ("gameover") {
        printTabs();
        Java_Code += "window.setOutput(\" GAMEOVER\");\n";
        printTabs();
        Java_Code +=
            "window.showScene(player.getCurScene(), player);\n";
        Java_Code +=
            "while(true) {;\n";
    }
    | ("read") {
        printTabs();
        Java_Code += "player.setSaid( window.getInput() );\n";
    }

```

```

    }
    | #("say" text:STRCONST) {
        printTabs();
        Java_Code += "window.setOutput( \"\" + text.getText()
        + "\" );\n";
        printTabs();
        Java_Code +=
            "window.showScene(player.getCurScene(), player);\n";
    };

/*
 * user or character is picking up an item
 */
pickUpStmnt:
    (var:NOUN item:NOUN) {
        printTabs();
        Java_Code += "_" + var.getText() + ".pickUp( \""
        + item.getText() + "\", curScene );\n";
        printTabs();

        Java_Code +=
            "window.showScene(player.getCurScene(), player);\n";
    }
    | (var_user:"user" item_user:NOUN) {
        printTabs();
        Java_Code += "player.pickUp( \"" + item_user.getText() + "
);\n";

        printTabs();
        Java_Code +=
            "window.showScene(player.getCurScene(), player);\n";
    };

/*
 * User or character is dropping an item
 */
dropStmnt:
    (var:NOUN item:NOUN ) {
        printTabs();
        Java_Code += "_" + var.getText() + ".drop( \"" + item.getText()
        + "\", curScene );\n";
        printTabs();
        Java_Code +=
            "window.showScene(player.getCurScene(), player);\n";
    }
    | (var_user:"user" item_user:NOUN ) {
        printTabs();
        Java_Code += "player.drop( \"" + item_user.getText() + "
");\n";
        printTabs();
        Java_Code +=
            "window.showScene(player.getCurScene(), player);\n";
    };

/*
 * Found a while statement
 */
whileStmnt:
    #("while" {
        printTabs();
        Java_Code += "while( ";

```

```

    }

    boolExp {
        Java_Code += " )\n";
        printTabs();
        Java_Code += "{\n";
        Tabs++;
    }

    statements {
        Tabs--;
        printTabs();
        Java_Code += "}\n";
    });
/*
 * Found an if statement
 */
ifStmt:
    #("if" {
        printTabs();
        Java_Code += "if( ";
    }

    boolExp {
        Java_Code += " )\n";
        printTabs();
        Java_Code += "{\n ";
        Tabs++;
    }

    statements {
        /* ending previous if statement*/
        Tabs--;
        printTabs();
        Java_Code += "}\n";
    }

    (otherExpr)*
);
/*
 * Found an otherwise if or otherwise statement
 */
otherwiseExpr:
    #("otherwiseif" {
        printTabs();
        Java_Code += "else if( ";
    }

    boolExp {
        Java_Code += " )\n";
        printTabs();
        Java_Code += "{\n ";
        Tabs++;
    }

    statements {
        Tabs--;
        printTabs();

```

```

        Java_Code += "}\n ";
    })
    |#("otherwise" {
        printTabs();
        Java_Code += "else\n";
        printTabs();
        Java_Code += "{\n ";
        Tabs++;
    }
statements {
    Tabs--;
    printTabs();
    Java_Code += "}\n ";
});

/*
 * found a boolean expression
 */
boolExp:
    #(BOOLEXP logExpr );

logExpr:
    #("and" logExpr {
        Java_Code += " && ";
    } logExpr)
    |#("or" logExpr {
        Java_Code += " || ";
    } logExpr)
    |#("not" {
        Java_Code += " !";
    } condPred)
    | condPred;

condPred:
    #("says" words:STRCONST) {
        Java_Code += "(player.getSaid().equals(\""
        + words.getText() + "\") )";
    }
    | #("inside" scene_name:NOUN) {
        Java_Code += "(player.getCurScene() == \""
        + scene_name.getText() + " )";
    }
    | #("has" hasExpr);

hasExpr:
    (person:"user" item_user:NOUN) {
        Java_Code += "player.hasItem( \"" + item_user.getText() + " )
";
    }
    | (char_name:NOUN item_char:NOUN) {
        Java_Code += "\"" + char_name.getText() +
        ".hasItem( \"" + item_char.getText() + " ) ";
    };
};

```

A7. gameFrame.java

```
/*
```

```

* File: GameFrame.java
*
* Author(s): Mike Lenner
*/
import javax.swing.*;
import javax.swing.border.*;
import javax.swing.table.AbstractTableModel;
import java.awt.*;
import java.util.Vector;
import java.io.*;

/*
 * The GameFrame class is responsible for displaying the console on which the
 * GRIMM story will be displayed and played.
 */
public class gameFrame extends JFrame {

    /* components */
    static private JTextArea Terminal;
    private JLabel Title;
    private JTextArea Desc;
    private JTextField Input;
    private JTextArea Exits;
    private JLabel Image;
    private JSplitPane Item_Pane;
    private JTable Scene_Items;
    private JTable User_Items;
    private JScrollPane Term_Scroll;
    private JScrollPane Exit_Scroll;

    private static final String NONE = "noimg";

    /* private members of gameFrame */
    private boolean Cmd_Entered = false;
    private String Cmd_Text;

    /*
     * Constructor for GameFrame class
     *
     * Return Value: none
     */
    public gameFrame() {
        initComponents();
        setVisible(true);
    }

    /*
     * This function is responsible for building the various components of
     * the frame and setting their layout correctly. This function also
     * assigns all required listeners.
     *
     * Return Value: none
     */
    private void initComponents() {

        /* build default objects for top panel */
        Title = new JLabel();

```

```

Desc = new JTextArea();
Exits = new JTextArea();
Image = new JLabel();
Terminal = new JTextArea();
Input = new JTextField();

/* set all preferred sizes */
Title.setPreferredSize(new Dimension(700,40));
Desc.setPreferredSize(new Dimension(700,100));
//Exits.setPreferredSize(new Dimension(700,45));
Image.setPreferredSize(new Dimension(700,425));
Input.setPreferredSize(new Dimension(575,20));

/* build default image */
setImg(NONE);

/* create borders */
Border empty_5 = BorderFactory.createEmptyBorder(5,5,5,5);
Border line_black1 =
    BorderFactory.createLineBorder(Color.black, 1);
Border line_black2 =
    BorderFactory.createLineBorder(Color.black, 2);
Border compund1 =
    BorderFactory.createCompoundBorder(line_black1,
                                      empty_5);

/* add borders */
Image.setBorder(line_black2);
Desc.setBorder(compund1);
Exits.setBorder(empty_5);

/* set fonts */
Title.setFont(new Font("",Font.BOLD, 24));
Desc.setFont(new Font("", Font.BOLD, 12));
Exits.setFont(new Font("", Font.BOLD, 12));

/* set properties of text areas */
Desc.setEditable(false);
Desc.setLineWrap(true);
Desc.setWrapStyleWord(true);
Exits.setEditable(false);
Title.setHorizontalAlignment(JLabel.CENTER);
Image.setHorizontalAlignment(JLabel.CENTER);

/* build two tables for user and room items with default */
/* items */
User_Items = new JTable(new CustomTabMod("User Items"));
Scene_Items = new JTable(new CustomTabMod("Scene Items"));

/* create scoll bar panes for two item tables */
JScrollPane user_scroll = new JScrollPane(User_Items);
JScrollPane scene_scroll = new JScrollPane(Scene_Items);

/* split pane for item lists */
Item_Pane = new JSplitPane(JSplitPane.VERTICAL_SPLIT,
                          user_scroll, scene_scroll);
Item_Pane.setOneTouchExpandable(true);

```

```

Item_Pane.setPreferredSize(new Dimension(125,220));
Item_Pane.setDividerLocation(90);

/* set properties of terminal text area and input field */
Terminal.setEditable(false);
Terminal.setLineWrap(true);
Terminal.setWrapStyleWord(true);
Input.setEditable(false);
Input.setBorder(line_black1);
Input.setFocusable(true);
Terminal.setFocusable(false);

/* add terminal into scroll bar pane */
Term_Scroll = new JScrollPane(Terminal,
    JScrollPane.VERTICAL_SCROLLBAR_ALWAYS,
    JScrollPane.HORIZONTAL_SCROLLBAR_NEVER);
Term_Scroll.setPreferredSize(new Dimension(575,200));

/* add exit into scroll bar pane */
Exit_Scroll = new JScrollPane(Exits,
    JScrollPane.VERTICAL_SCROLLBAR_AS_NEEDED,
    JScrollPane.HORIZONTAL_SCROLLBAR_NEVER);
Exit_Scroll.setPreferredSize(new Dimension(700,45));

/* determine layout */
getContentPane().setLayout(new GridBagLayout());
GridBagConstraints gbc = new GridBagConstraints();

gbc.insets = new Insets(5,20,5,20);
gbc.ipadx = 0;
gbc.ipady = 0;
gbc.gridx = 0;
gbc.gridy = 0;
gbc.weighty = 0;
gbc.weightx = 1;
gbc.gridwidth = 3;
gbc.fill = GridBagConstraints.HORIZONTAL;
getContentPane().add(Title,gbc);

gbc.gridx = 0;
gbc.gridy = 1;
gbc.weighty = 0.5;
gbc.weightx = 1;
gbc.gridwidth = 3;
gbc.fill = GridBagConstraints.BOTH;
getContentPane().add(Image,gbc);

gbc.gridx = 0;
gbc.gridy = 2;
gbc.weighty = 0.5;
gbc.weightx = 1;
gbc.gridwidth = 3;
gbc.fill = GridBagConstraints.HORIZONTAL;
getContentPane().add(Desc,gbc);

gbc.gridx = 0;
gbc.gridy = 3;

```

```

gbc.weighty = 0.5;
gbc.weightx = 1;
gbc.gridwidth = 3;
gbc.fill = GridBagConstraints.HORIZONTAL;
getContentPane().add(Exit_Scroll,gbc);

gbc.insets = new Insets(5,20,0,5);
gbc.gridx = 0;
gbc.gridy = 4;
gbc.weighty = 0.5;
gbc.weightx = 0;
gbc.gridwidth = 2;
gbc.fill = GridBagConstraints.BOTH;
getContentPane().add(Term_Scroll,gbc);

gbc.insets = new Insets(5,5,5,20);
gbc.gridx = 2;
gbc.gridy = 4;
gbc.weighty = 0.5;
gbc.weightx = 1;
gbc.gridwidth = 1;
gbc.gridheight = 2;
gbc.fill = GridBagConstraints.BOTH;
getContentPane().add(Item_Pane,gbc);

gbc.insets = new Insets(0,20,5,5);
gbc.gridx = 0;
gbc.gridy = 5;
gbc.weighty = 0;
gbc.weightx = 0;
gbc.gridwidth = 2;
gbc.gridheight = 1;
gbc.fill = GridBagConstraints.BOTH;
getContentPane().add(Input,gbc);

/* Set location of frame */
setLocation(100,10);

pack();

/*
 * set up listeners
 */

/* set up exit event */
addWindowListener(new java.awt.event.WindowAdapter() {
    public void
        windowClosing(java.awt.event.WindowEvent evt) {
            exitForm(evt);
        }
});

/* set up listner for terminal input from user */
Input.addActionListener(new java.awt.event.ActionListener() {
    public void
        actionPerformed(java.awt.event.ActionEvent evt) {
/* record cmd txt */      Cmd_Text = evt.getActionCommand();

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/* record cmd avail */      Cmd_Entered = true;
    }
    });

}

/*
 * This is a wrapper function to allow gracefull closing of the frame.
 *
 * Return Value: none
 */
private void exitForm(java.awt.event.WindowEvent evt) {
    System.exit(0);
}

/*
 * This function assigns the description text.
 *
 * Return Value: none
 */
public void setDescription(String text) {
    Desc.setText(text);
}

/*
 * This function assigns the title text
 *
 * Return Value: none
 */
public void setTitle(String text) {
    Title.setText(text);
}

/*
 * This function takes all exits passed in via the parameter and
 * assigns the text name associated with those exits to the Exits text
 * area.
 *
 * Return Value: none
 */
public void setExits(Vector ext) {
    String list = "";

    for (int i=0; i < ext.size(); i++) {
        Scene temp = (Scene) ext.get(i);
        list += "There is an exit to " + temp.getName() + "\n";
    }
    Exits.setText(list);
}

/*
 * This function takes all items passed in via the parameter and
 * assigns the text name associated with those items to the User_Items
 * table.
 *
 * Return Value: none
 */

```

```

public void setUserItems(Vector items) {
    /* clear all items */
    ((CustomTabMod)User_Items.getModel()).clear();

    for (int i=0; i < items.size(); i++) {
        Item temp = (Item) items.get(i);
        User_Items.setValueAt(temp.getName(), i, 0);
    }
}

/*
 * This function takes all items passed in via the parameter and
 * assigns the text name associated with those items to the Scene_Items
 * table.
 *
 * Return Value: none
 */
public void setSceneItems(Vector items) {
    /* clear all items */
    ((CustomTabMod)Scene_Items.getModel()).clear();

    for (int i=0; i < items.size(); i++) {
        Item temp = (Item) items.get(i);
        Scene_Items.setValueAt(temp.getName(), i, 0);
    }
}

/*
 * This function assigns the image passed in via the parameter to the
 * image label. If the path cannot be resolved, or a null path is
 * passed, the label will display the text "No Image Found." All paths
 * are assumed to be relative.
 *
 * Return Value: none
 */
public void setImg(String name) {
    if (name == null) {
        Image.setText("Image Not Found");
        return;
    }

    java.net.URL imgURL = gameFrame.class.getResource(name);
    if (imgURL != null) {

        ImageIcon newImg = new ImageIcon(imgURL);
        Image.setText(null);
        Image.setIcon(newImg);

    } else {
        Image.setText("Image Not Found");
    }
}

/*
 * This function is the main interface for the GameFrame class. A
 * Scene and a User object are passed in via parameter and all relevant

```

```

* data is extracted. This data is used to correctly display the given
* scene, including the scene's title, picture, description, exits, and
* visible items. This function also allows for display of the user's
* items.
*
* Return Value: none
*/
public void showScene(Scene s, User u) {
    if (s != null) {
        setTitle(s.getName());
        setDescription(s.getDescr());
        setExits(s.getVisibleExits());
        setImg(s.getPicture());
        setSceneItems(s.getVisibleItems());
        setUserItems(u.items());

        /* update GUI */
        repaint();
    }
}

/*
* This function allows the user to enter input into the GameFrame
* class. When this function is called, the input text field is
* unlocked and the function sits in a loop, waiting for input. Once
* the user has typed in a string of characters followed by a character
* return, this function will break from the loop, return the user's
* command, and relock the input field.
*
* Return Value: The user's command (String)
*/
public String getInput()
{
    String cmd;

    /* allow user to enter commands */
    Input.setEditable(true);
    Input.setEnabled(true);

    /* request keyboard focus */
    Input.requestFocusInWindow();

    /* keep control of program here until user enters cmd */
    while (!Cmd_Entered);

    /* save command string */
    cmd = Cmd_Text;

    /* output to the terminal */
    setOutput(cmd);

    /* reset for next command */
    Cmd_Entered = false;
    Cmd_Text = "";

    /* clear text field */

```

```

        Input.setText(null);
        Input.setCaretPosition(0);

        /* disallow user to enter commands until next call */
        Input.setEditable(false);
        Input.setEnabled(false);

        return cmd;
    }

    /*
     * This function will output the passed in String to the terminal text
     * area. A newline is placed before and after the output.
     *
     * Return Value: none
     */
    public static void setOutput(String text) {
        Terminal.append("\n" + text + "\n");
        Terminal.setCaretPosition(Terminal.getDocument().getLength());
    }

    /*
     * This inner class is used to implement custom table model. This
     * allows for the scene items and user items to be easily stored,
     * displayed, and manipulated in the desired fashion.
     */
    class CustomTabMod extends AbstractTableModel {

        private Vector Data = new Vector();
        private String Header;

        /*
         * Constructor. Uses the passed in string as the header title
         * of the column
         *
         * Return Value: none
         */
        public CustomTabMod(String header) {
            this.Header = header;
        }

        /*
         * Returns the size of the Data vector, which will translate
         * into the number of rows in our list.
         *
         * Return Value: number of items in Data vector (int)
         */
        public int getRowCount() {
            return Data.size();
        }

        /*
         * Returns the number of columns for our list, which is always
         * one since our table is only one column wide. This function
         * must be implemented as part of the AbstractTableModel
         * abstract class.
         */
    }

```

```

    * Return Value: 1 (int)
    */
    public int getColumnCount() {
        return 1;
    }

    /*
    * This function will return the header title for our one
    * column table.
    *
    * Return Value: Header class member which store the title of
    * the column
    */
    public String getColumnName(int column) {
        return Header;
    }

    /*
    * This function is necessary as part of the AbstractTableModel
    * abstract class. Since we only have one row, the column
    * parameter is not used.
    *
    * Return Value: Item at position row in Data vector (Item)
    */
    public Object getValueAt(int row, int column) {
        return Data.get(row);
    }

    /*
    * This function allows for adding new Items to the list. The
    * event that is fired alerts the table that there is a new
    * value and it should be displayed.
    *
    * Return Value: none
    */
    public void setValueAt(Object aValue, int rowIndex,
        int columnIndex) {
        Data.addElement(aValue);
        fireTableDataChanged();
    }

    /*
    * This function clears all elements from the list. The event
    * that is fired alerts the table that there is a new value and
    * it should be displayed.
    *
    * Return Value: none
    */
    public void clear() {
        Data.removeAllElements();
        fireTableDataChanged();
    }
}

public static void main(String[] args) {

    /*Scene s1 = new Scene("Scene #1",

```

```

        "This is scene #1",
        "img");*/
    ///User u = new User();

    //s1.addItem(new Item("Key"),false);

    gameFrame gf = new gameFrame();
    //gf.showScene(s1,u);

    while(true)
        gf.getInput();

    }

} // end gameFrame class

A8.Thing.java
/*
 * File: Thing.java
 *
 * Author: William Liu
 */

/*
 * Base class for all objects in GRIMM
 */
public class Thing
{
    private String name;          /* name of the object */

    /*
     * Constructor initializes the name
     */
    public Thing(String n) {
        name = n;
    }

    /*
     * Returns the name
     */
    public String getName() {
        return name;
    }

    /*
     * Sets the name of the Thing
     */
    public void setName(String n) {
        name = n;
    }
}

```

A9. Scene.java

```
/*
 * File: Scene.java
 *
 * Author: William Liu
 */

import java.util.Vector;

/*
 * Scene class for all scenes in GRIMM
 */
public class Scene extends Thing
{
    private String Description;    /* description of scene */
    private String Image;         /*image for the scene */
    private Vector Hidden_Items = new Vector(); /* hidden items */
    private Vector Visible_Items = new Vector(); /* visible items */
    private Vector Hidden_Exits = new Vector(); /* hidden exits */
    private Vector Visible_Exits = new Vector(); /* visible exits */

    /*
     * Constructor takes the name, description, and picture
     */
    public Scene(String n, String descr, String img) {
        super(n);
        Description = descr;
        Image = img;
        return;
    }

    /*
     * Constructor takes just initializes description and image
     */
    public Scene(String n) {
        super(n);
        Description = Image = n;
    }

    /*
     * Returns the description of the scene
     */
    public String getDescr() {
        return Description;
    }

    /*
     * Sets the description for the scene
     */
    public void setDescr(String s) {
        Description = s;
    }

    /*
     * Returns all the hidden items in the scene
     */
}
```

```

    */
public Vector getHiddenItems() {
    return Hidden_Items;
}

/*
 * Returns all the visible items in the scene
 */
public Vector getVisibleItems() {
    return Visible_Items;
}

/*
 * Returns all visible and hidden items in the scene
 */
public Vector getAllItems() {
    Vector all_items = new Vector();
    all_items.addAll(Hidden_Items);
    all_items.addAll(Visible_Items);
    return all_items;
}

/*
 * Deletes an item from the scene
 * Returns true if successfully deleted, otherwise false
 */
public boolean delItem(Item i) {
    if (Visible_Items.contains(i))
        return Visible_Items.remove(i);
    else if (Hidden_Items.contains(i))
        return Hidden_Items.remove(i);
    else
        return false;
}

/*
 * Adds an item to the scene with the option of it being hidden
 */
public boolean addItem(Item i, boolean hidden) {
    if (hidden)
        return Hidden_Items.add(i);
    else
        return Visible_Items.add(i);
}

/*
 * Returns the number of visible items
 */
public int numVisibleItems() {
    return Visible_Items.size();
}

/*
 * Returns the visible exits
 */
public Vector getVisibleExits() {
    return Visible_Exits;
}

```

```

}

/*
 * Returns the hidden exits
 */
public Vector getHiddenExits() {
    return Hidden_Exits;
}

/*
 * Returns all the hidden and visible exits
 */
public Vector getAllExits() {
    Vector all_exits = new Vector();
    all_exits.addAll(Hidden_Exits);
    all_exits.addAll(Visible_Exits);
    return all_exits;
}

/*
 * Adds an exit to the scene with optional hidden flag
 * Returns success if added, otherwise returns false
 */
public boolean addExit(Scene s, boolean hidden) {
    if(hidden)
        return Hidden_Exits.add(s);
    else
        return Visible_Exits.add(s);
}

/*
 * Deletes an exit from the scene.
 * Returns true on success, false otherwise
 */
public boolean delExit(Scene s) {
    if(Hidden_Exits.contains(s))
        return Hidden_Exits.remove(s);
    else if(Visible_Exits.contains(s))
        return Visible_Exits.remove(s);
    else
        return false;
}

/*
 * Gets the filename for the picture for this scene
 */
public String getPicture() {
    return Image;
}

/*
 * Sets the picture image for this scene
 */
public void setPicture(String s) {
    Image = s;
}

```

```

/*
 * Tests whether this scene has a certain exit
 * Returns true if it does, otherwise false
 */
public boolean hasExit(Scene s) {
    return (getAllExits().contains(s));
}

/*
 * Returns true if the scene contains an item, otherwise false.
 */
public boolean hasItem(Item i) {
    if(Hidden_Items.indexOf(i ) == -1
        && Visible_Items.indexOf( i ) == -1)
        return false;
    return true;
}
}

```

A10. Character.java

```

/*
 * File: Character.java
 *
 * Author: Mariya Nomanbhoy
 */

import java.util.Vector;

/*
 * This is a Character class. It holds the information for the
 * characters in the game such as the items they hold and their name.
 * It does not hold their scene as characters can be members of multiple
 * scenes at once.
 */
public class Character extends Thing {

    private Vector Items;          /* items being held */

    /*
     * Constructor takes the name as a String and creates a new
     * character holding 0 items.
     */
    public Character(String n) {
        super(n);
        Items = new Vector();
    }

    /*
     * Pick up an item, therefore add it to the items being held.
     * This takes an item as a parameter and returns void. This
     * method will only be used for declarations, as it is only
     * during declarations that the Character can pick up an item
     * not in the current scene. This usage is guaranteed by
     * translator.
     */
}

```

```

public void pickUp( Item i ) {
    Items.add( i );
}

/*
 * Pick up an item, therefore add it to the items being held.
 * This takes an item and a Scene as parameters and returns
 * void. Will exit game if item is not in the scene passed and
 * therefore cannot be picked up. This method is used at all
 * times except during declarations.
 */
public void pickUp( Item i, Scene s ) {
    if( s.hasItem( i ) ) {
        Items.add( i );
        s.delItem( i );
    }
    else {
        System.out.println( "Runtime Error: Character "
            + "trying to pick up item " + i.getName()
            + " which is not in the scene." );
    }
}

/*
 * Drop an item, therefore remove it from the items being held.
 * This takes an item as a parameter and returns void. Will
 * exit game if item is not being held by the character and
 * therefore cannot be dropped.
 */
public void drop( Item i, Scene s ) {
    if( hasItem(i) ) {
        Items.remove(i);
        s.addItem( i, false );
    }
    else {
        System.out.println( "Runtime Error: Character "
            + "trying to drop an item " + i.getName()
            + " which they do not have." );
    }
}

/*
 * returns number of items held by character as an int.
 */
public int numItems() {
    return Items.size();
}

/*
 * returns the items held by user as a vector of items.
 */
public Vector items() {
    return Items;
}

/*

```

```

        * This method takes an item as a parameter and returns a boolean.
        * returns true if Item i is being held by Character, otherwise
        * returns false.
        */
    public boolean hasItem( Item i ) {
        if( Items.indexOf( i ) == -1 )
            return false;
        return true;
    }
}

```

A11. Item.java

```

/*
 * File: Iteme.java
 *
 * Authors: William Liu
 */

/*
 * Item Class
 */
public class Item extends Thing {

    /*
     * Constructor initializes name of item and hidden flag
     */
    public Item(String n, boolean hid) {
        super(n);
        boolean hidden = hid;
    }

    /*
     * Constructor initializes the item with just the name
     */
    public Item( String n ) {
        super(n);
    }
}

```

A12.User.java

```

/*
 * File: User.java
 *
 * Author: Mariya Nomanbhoy
 */

import java.util.Vector;

/*
 * This is a user class. It holds the information for the person
 * playing the storybook game such as the items and the scene
 * they is in.
 */
public class User {
    private Scene Cur_Scene;        /* the scene the user is currently in */
    private String Said;           /* Last input by the user */
}

```

```

private Vector Items;          /* List of items held by the User */

/*
 * Constructor for user.  This initializes the user to have 0
 * items and sets the scene and the last thing said to NULL
 */
public User() {
    Items = new Vector();
    Said = null;
    Cur_Scene = null;
}

/*
 * Get the last thing said by the user.  Takes no parameters and
 * returns a string.
 */
public String getSaid() {
    return Said;
}

/*
 * Set the last thing said by the user.  Takes a string as a
 * parameter and returns void.
 */
public void setSaid( String s ) {
    Said = s;
}

/*
 * Pick up an item, therefore add it to the items being held.
 * This takes an item as a parameter and returns void.  Will
 * exit game if item is not in current scene and therefore
 * cannot be picked up.
 */
public void pickUp( Item i ) {
    if( Cur_Scene.hasItem( i ) == true ) {
        Items.add( i );
        Cur_Scene.delItem(i);
    }
    else {
        System.out.println("Runtime Error: User picking "
            + "up item " + i.getName() + " that is not in "
            + "the scene.");
        System.exit(0);
    }
}

/*
 * Drop an item, therefore remove it from the items being held.
 * This takes an item as a parameter and returns void.  Will
 * exit game if item is not being held by the user and therefore
 * cannot be dropped.
 */
public void drop( Item i ) {
    if( hasItem( i ) ) {
        Items.remove(i);
        Cur_Scene.addItem( i, false );
    }
}

```

```

    }
    else {
        System.out.println("Runtime Error: User dropping"
            + " item " + i.getName() + " that it does not "
            + "have.");
        System.exit(0);
    }
}

/*
 * returns number of items held by User as an int.
 */
public int numItems() {
    return Items.size();
}

/*
 * returns the items held by user as a vector of items.
 */
public Vector items() {
    return Items;
}

/*
 * This method takes an item as a parameter and returns a boolean.
 * returns true if Item i is being held by user, otherwise returns
 * false.
 */
public boolean hasItem( Item i ) {
    if( Items.indexOf( i ) == -1 )
        return false;
    return true;
}

/*
 * This method returns the current scene of the user. It takes
 * no parameters and returns a Scene object.
 */
public Scene getCurScene() {
    return Cur_Scene;
}

/*
 * This method moves the character to new scene by changing the
 * current scene. It takes a Scene as a paramater and returns
 * void. If the Scene passed is not an exit of the current scene
 * a runtime error is printed and the game is exited.
 */
public void moveTo( Scene s ) {
    if( Cur_Scene == null || Cur_Scene.hasExit( s ) ) {
        Cur_Scene = s;
    }
    else {
        System.out.println( "User trying to move "
            + " to exit " + s.getName() + " which is "
            + "not a valid exit for this scene.");
        System.exit(0);
    }
}

```

```

    }
}
}

```

A13. grimmtest.py

```

#!/usr/bin/python

import sys, os, string
import difflib, pprint
#import fileinput, glob

#extension of test scripts
extt = "gmm"

#extension of test script outputs
exto = "tst"

#GRIMM translator class after build
grimm_class = "GRIMM.class"

#command to execute grimm compiler
cmd = "java GRIMM "

#####
##
#parse command line arguments
if len(sys.argv) < 2:
    print "Usage: " +sys.argv[0]+ " <test_scripts>"
    sys.exit(0)

#Make sure GRIMM translator exists
if not os.path.isfile(os.path.join(os.path.dirname(sys.argv[0]),
grimm_class)):
    print "GRIMM translator does not exist. Make it first."
    sys.exit(0)

files = sys.argv[1:]

for f in files:
    typed_input = f #saved the user inputted path for better output
    f = os.path.abspath(f)

    #split the filename and extension
    try: name, ext = os.path.basename(f).split('.')
    except: continue

    if ext != extt: continue #file is not a grimm test file

    try: os.stat(f) #make sure the input file exists
    except:
        print f + " does not exist"
        continue

    try: #read in the test output file if it exists
        test_output = os.path.join(os.path.dirname(f), name+'.'+exto)
        output_ideal = open(test_output).readlines()

```

```

except: #otherwise, it's a successful test and open the default output
        test_output = os.path.join(os.path.dirname(f), 'success.tst')
        output_ideal = open(test_output).readlines()

working_dir = os.getcwd() #save the current working directory
os.chdir(os.path.dirname(sys.argv[0])) #change into GRIMM directory
#run test and save it's output
cmd_inf, cmd_outf = os.popen4(cmd + f)
os.chdir(working_dir) #go back to the working dir
os.wait()
output_test = cmd_outf.readlines()

#compare the outputs
if output_test == output_ideal:
    print typed_input + ' passed'
    continue
else:
    diff = difflib.Differ() #instantiate a differ object
    #diff the two outputs
    result = list(diff.compare(output_ideal, output_test))
    print '-----

    print f + ' test failed with diff:'
    for l in result:
        if l[0:2] != ' ':
            pprint.pprint(l.rstrip())
    print '-----

```