

Midterm Solution

COMS W1003 Introduction to Computer Science and Programming in C
Fall 2009

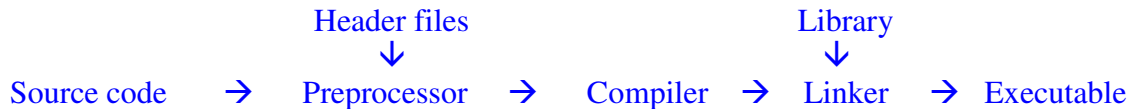
1. (4 points) Convert the following decimal numbers into 8-bit 2's complement numbers and hexadecimal numbers.

a) 15 00001111 0F
b) -9 11110111 F7

2. (5 points) What is an overflow? Give an example of an overflow assuming that numbers are represented in 3 bits.

Overflow is an error in calculation due to the limited number of bits that represents a number in a computer. An example using 3 bit representation is $2 + 3 = -3$ since $010 + 011 = 101$.

3. (5 points) Describe the process of compiling a C program from the source code to the final executable file. You may draw a diagram to describe it.



4. (6 points) Place parenthesis in the following expressions to explicitly show the order of evaluation. For example,

$a + b * c \rightarrow (a + (b * c))$

- a) $d > 10 \ \&\& \ d < 100 \ \parallel \ d == 500 \rightarrow (((d > 10) \ \&\& \ (d < 100)) \parallel (d == 500))$
b) $(\text{double}) \ d / 3 + 4 \rightarrow (((\text{double}) \ d) / 3) + 4$
c) $3 + * \ p ++ \rightarrow (3 + (* \ (p ++)))$

5. (10 points) Convert the following switch-case code to an if-else code.

```
1 switch ( i )
2 {
3     case 0:
4     case 1:
5         n = 10;
6         break;
7
8     case 2:
9         n = 500;
10        break;
11
12    default:
13        n = 0;
14        break;
15 }
```

```
1 if ( i == 0 || i == 1)
2     n = 10;
3 else if ( i == 2)
4     n = 500;
5 else
6     n = 0;
```

Or any variant of the above with the correct logic.

6. (10 points) Convert the following for loop into a while loop.

Midterm Solution

COMS W1003 Introduction to Computer Science and Programming in C
Fall 2009

```
1 for ( i = 0; i < 100; i++ )           1 i = 0;
2 {                                     2 while ( i < 100 )
3     if ( i % 10 == 0 )               3 {
4         printf("\n");                 4     if ( i % 10 == 0 )
5                                         5         printf("\n");
6     n += array[i];                   6
7     printf("%d ", n);                 7     n += array[i];
8 }                                     8     printf("%d ", n);
                                         9     i++;
                                         10 }
```

7. (20 points) The following program finds the common elements in two different integer arrays (fibArray and primeArray) and stores them in another array called commonArray. At the end of the program, it prints out how many common elements there are. There are five bugs in the code. Identify them and then fix them.

```
1 int main()
2 {
3     int fibArray[] = { 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 };
4     int primeArray[] = { 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 };
5     int commonArray[];
6     int i, j;
7
8     for ( i = 0; i < 10; ++i )
9     {
10         for ( j = 0; j < 10; ++j )
11         {
12             if (fibArray[i] = primeArray[j])
13             {
14                 commonArray[j] = primeArray[j];
15                 ++n;
16             }
17         }
18     }
19
20     printf("The total number of common elements is %n\n", n);
21     return 0;
22 }
```

Line 5: commonArray has no size. Fix: `int commonArray[10];`

Line 6: n is not declared. Fix: add declaration `int n;`

Line 12: assignment operator used instead of equality operator. Fix: change `=` to `==`.

Line 14: logic bug. Index to commonArray should be n, not j. Fix: change j to n.

Line 20: type field error. Fix: change `%n` to `%d`.

8. (20 points) The following program defines a function called `sin_degree` which receives a degree in integer and returns the sine value of that degree. It uses the `sin` function from the math library which receives radians as input and returns the sine value of that input. The main function prints the value of and the value of degree and its sine value. The formula to convert from degree to radian is $radians = \pi \times \frac{degree}{180}$. Fill in the

blanks with appropriate code.

```
1 #include <stdio.h>
2 #include <math.h>
3 #define PI 3.1415
```

Midterm Solution

COMS W1003 Introduction to Computer Science and Programming in C
Fall 2009

```
4
5 double sin_degree(int degree);
6
7 int main()
8 {
9     int degree = 180;
10
11     printf("pi = %f\n", PI);
12
13     printf("sin(%d) = %f\n", degree, sin_degree(degree));
14
15     return 0;
16 }
17
18 double sin_degree(int degree)
19 {
20     return sin(PI * degree / 180);
21 }
```

9. (20 points)

a) Describe what the following function is doing. Assume that the arguments to myfunction have the same array size.

The function copies all characters from s to t in reverse order.

b) If the argument to the function is “hello”, then what is the output? olleh

```
1 void myfunction(char *s, char *t)
2 {
3     int i = 0, n = 0;
4     char p;
5
6     n = strlen(s);
7
8     while ( (p = *s++) != '\0' )
9     {
10         t[n-i-1] = p;
11         i++;
12     }
13
14     return;
15 }
```