COMS 1003: Introduction to Computer Programming in C

Recursion

October 4th 2005

Announcements

- Use the blog
- HW3 and 4 released
- mid-semster reviews
  - me, the class, TAs

Outline

- Review
- Recursion

Recursion

- Doing the same work on smaller instances of a problem
- Circular Definitions

Recursive Procedure

- Base cases
  - condition specifying when to stop recursion
- Recursive Step
  - do some small part of the problem
  - invoke same function on reduced problem

Self-Calling Functions

- Entirely legal, but must handle with care

```
//what do I do?
int a(int x)
{
  return a(x);
}
```

Self-Calling Functions

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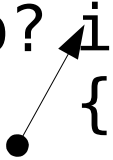
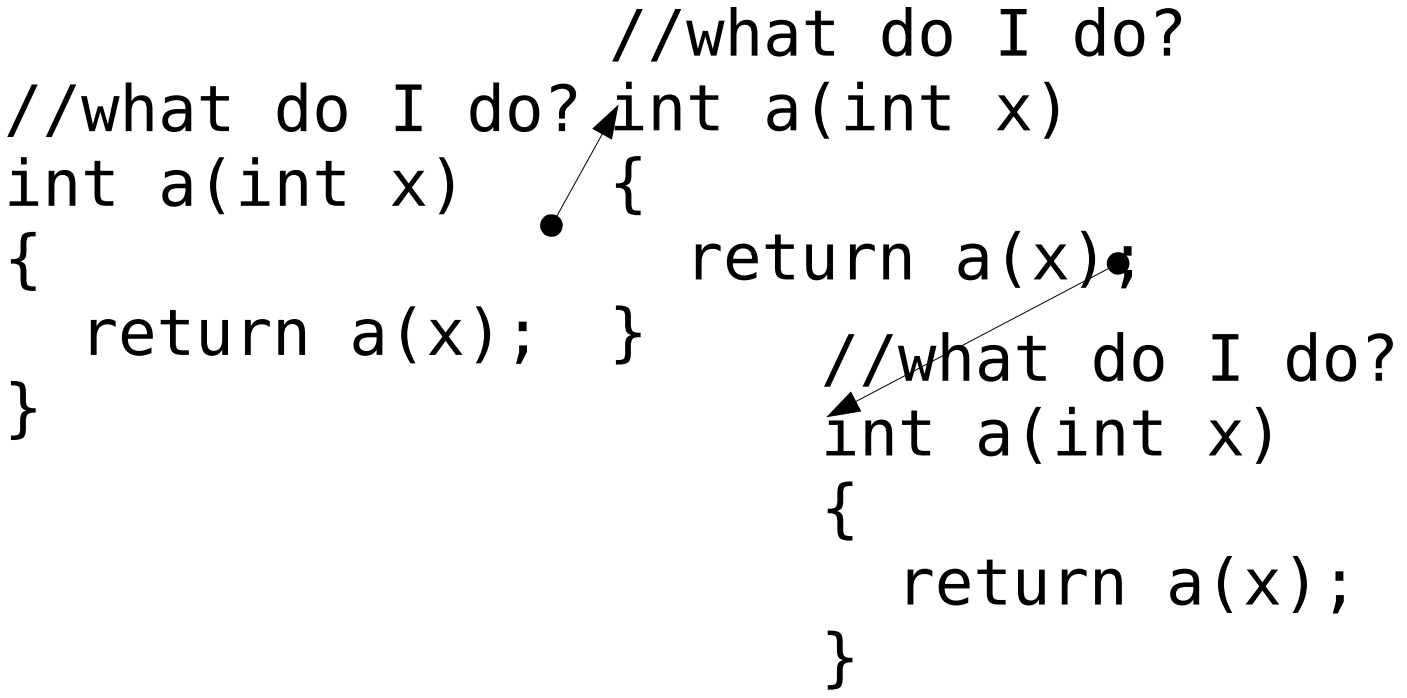
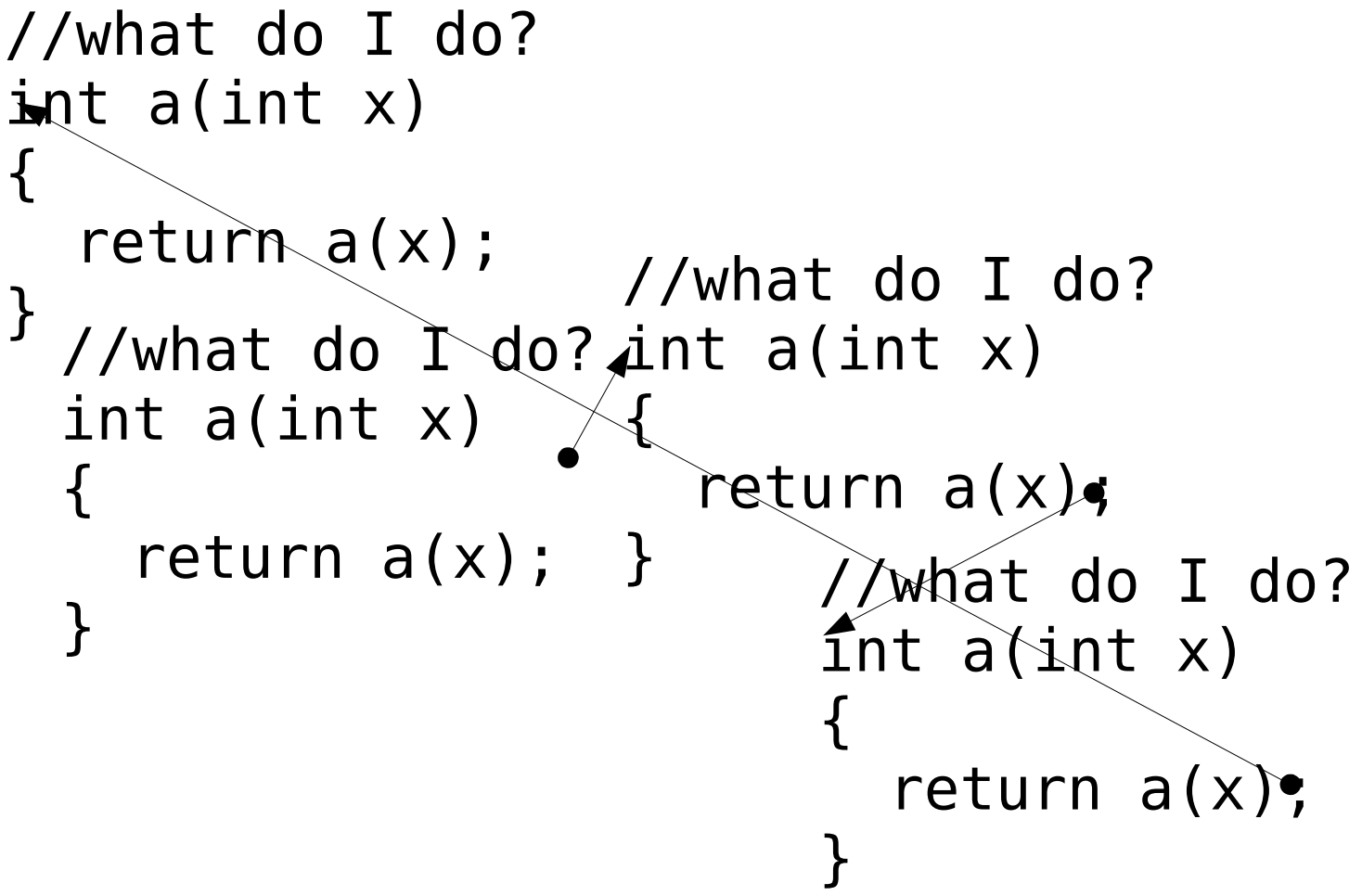


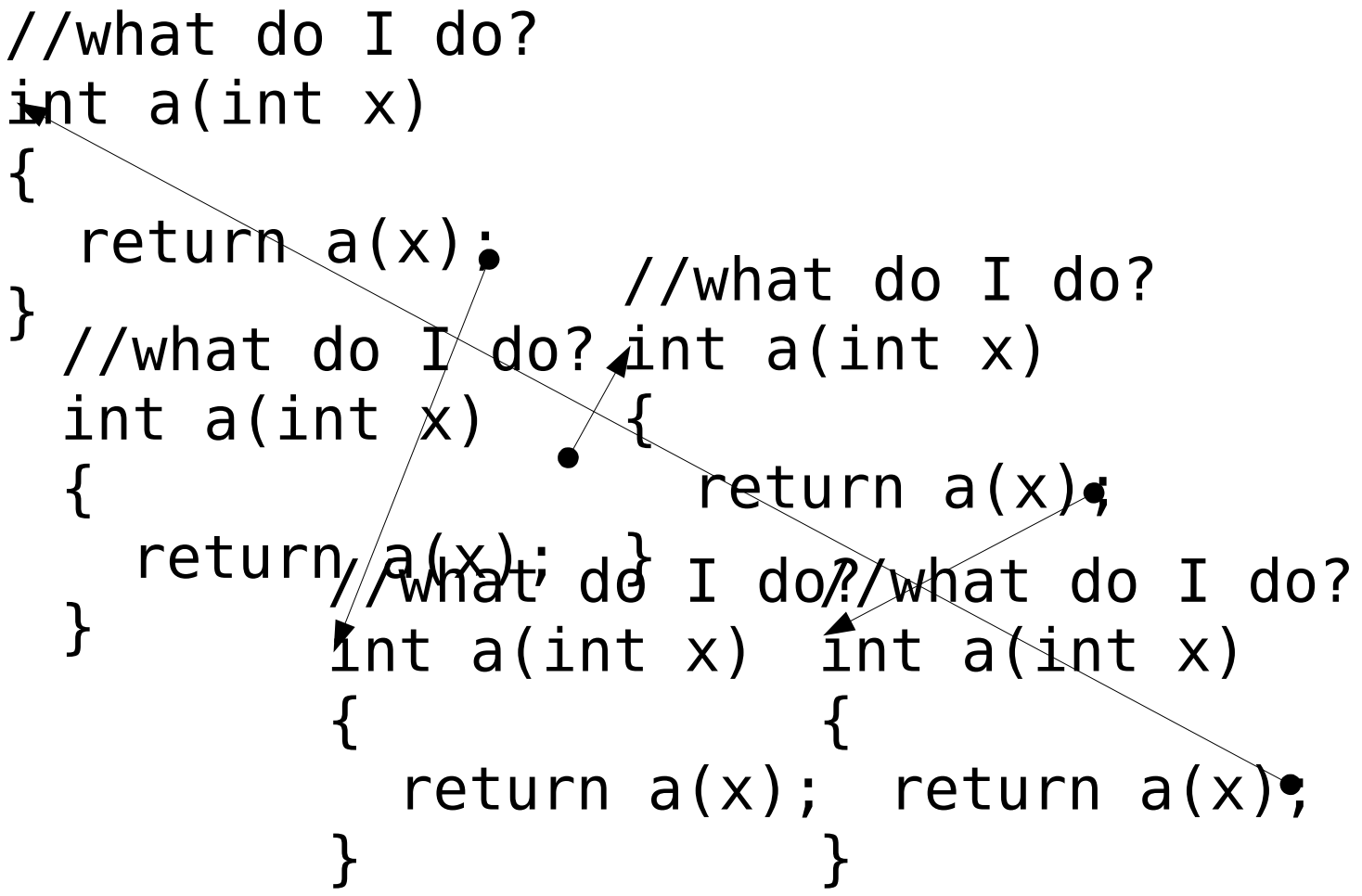
Self-Calling Functions



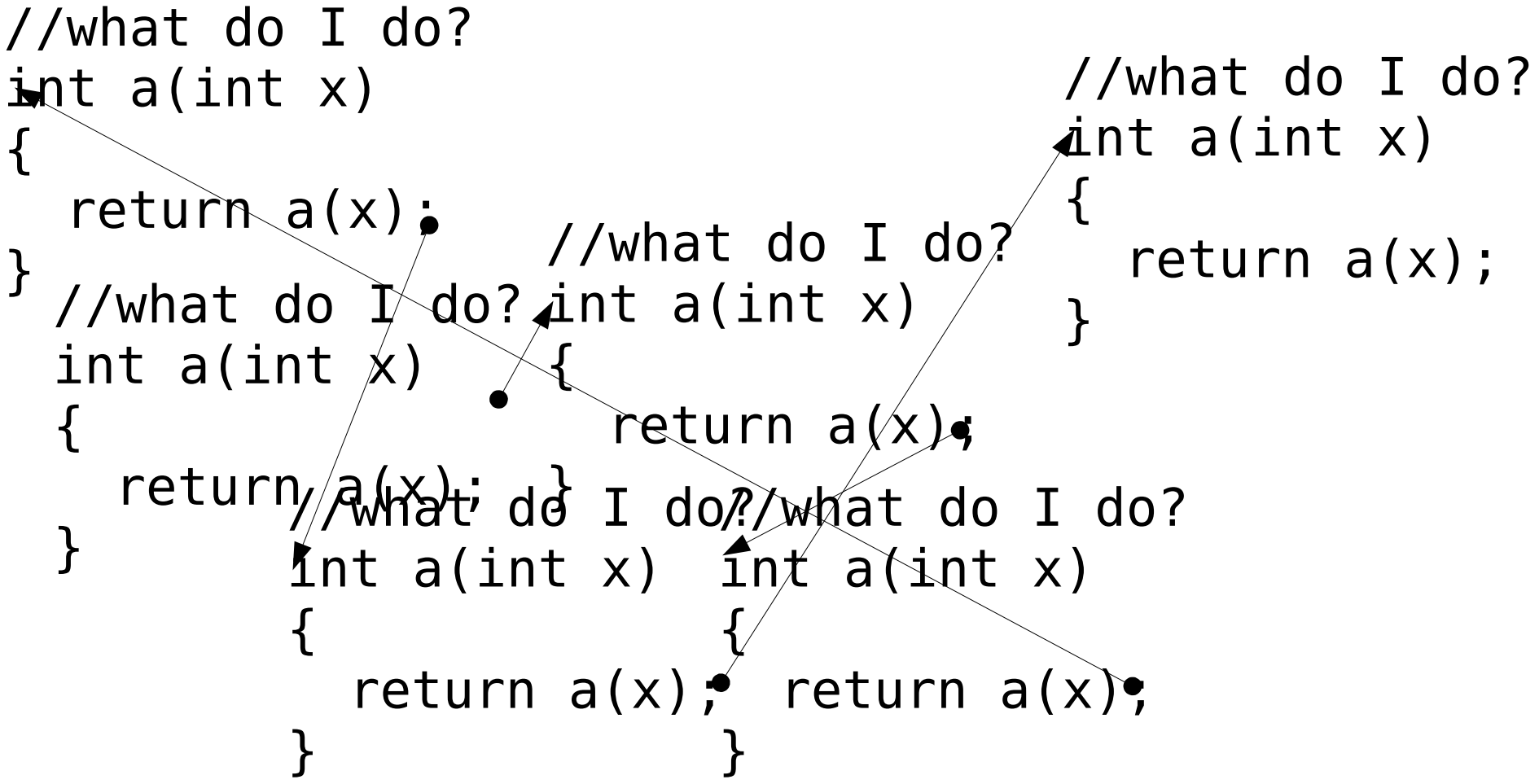
Self-Calling Functions



Self-Calling Functions

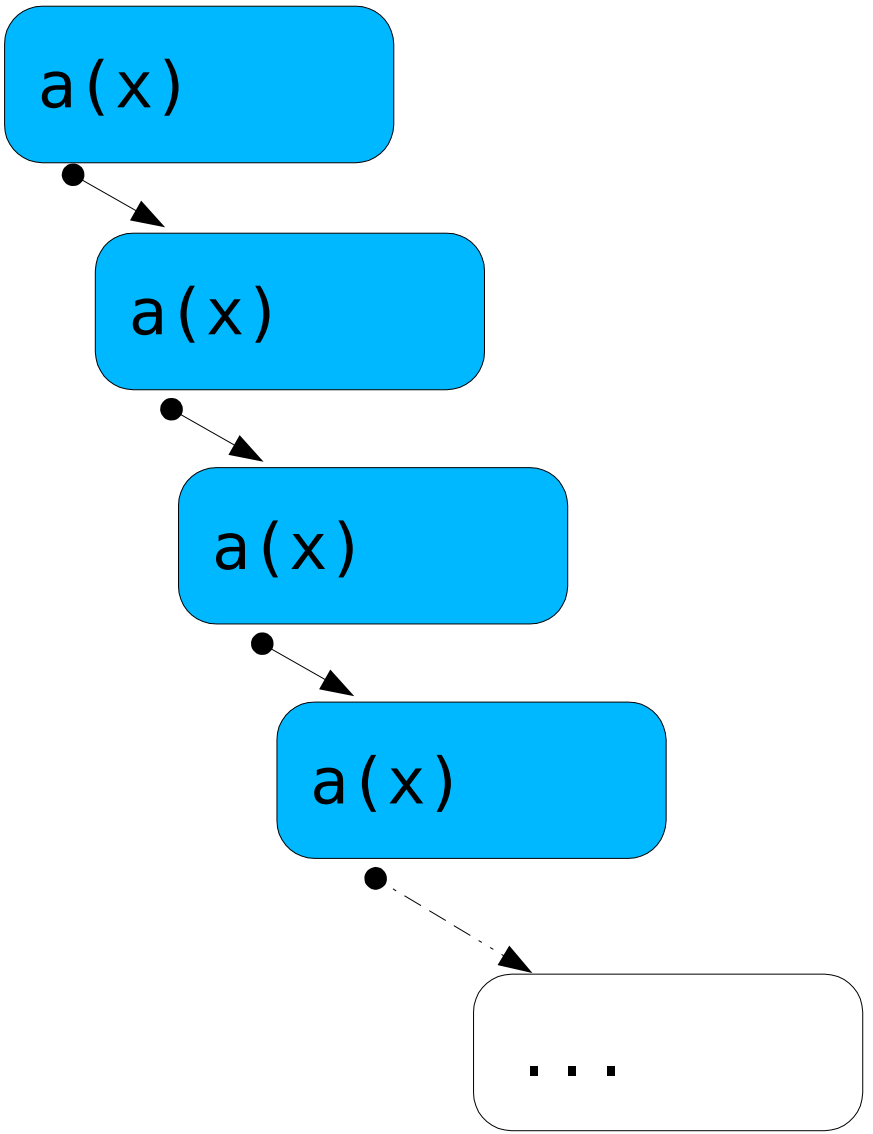


Self-Calling Functions



Call Graph

```
int a(int x)
{
  return a(x);
}
```



Recursive Example: Factorial

- N! = N * (N-1)!
- What if N<=0?
- E.g.,

  4! = 4*3!

  3! = 3*2!

  2! = 2*1!

  1! = 1*0!

  0! = 1

Recursive Example: Factorial

```
/* Function prototype */
long fact(long);
```

Recursive Example: Factorial

```
/* Function prototype */
long fact(long);

/* Function definition */
long fact(long n)
{
  //calculate factorial
  //return answer
}
```

Recursive Example: Factorial

```
/* Function prototype */
long fact(long);

/* Function definition */
long fact(long n)
{
  /* recursive step */
  return n*fact(n-1);
}
```

Recursive Example: Factorial

```
/* Function prototype */
long fact(long);

/* Function definition */
long fact(long n)
{
  /* base cases */
  if(0==n || n==1)
    return 1;
  else
    /* recursive step */
    return n*fact(n-1);
}
```