Current Assignments

- Homework 3 is due tonight.

  Iteration and basic functions.

- Exam 1 on Monday.

Recursion (Frames and The Stack)

```
foo(0);
```

```
void foo( int x)                    ← x = 0
{
  if ( x < 4
  { // Recur{
    cout <<      if ( x    void foo( int x)              ← x = 2
    foo(x+1)     {         {
    cout <<        cout     if             void foo( int x)          ← x = 3
  }              foo(        {             {
 return; //       cout        if             i   void foo( int x)          ← x = 4
}                }          c            { {
                 return;    f                    if ( x < 4 )
}                }          c                    {
                   retu       }                    cout << "Hello " << x <<endl;
                 }         re                     foo(x+1);
                 }         }                      cout << "Goodbye" << x << endl;
                                                }
                                              return;
                                            }
```
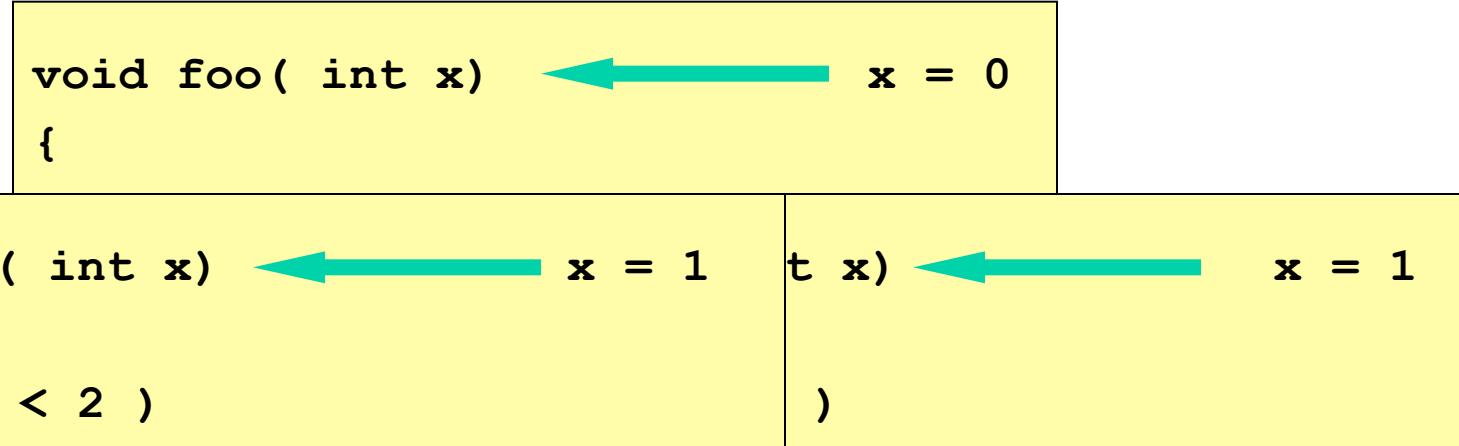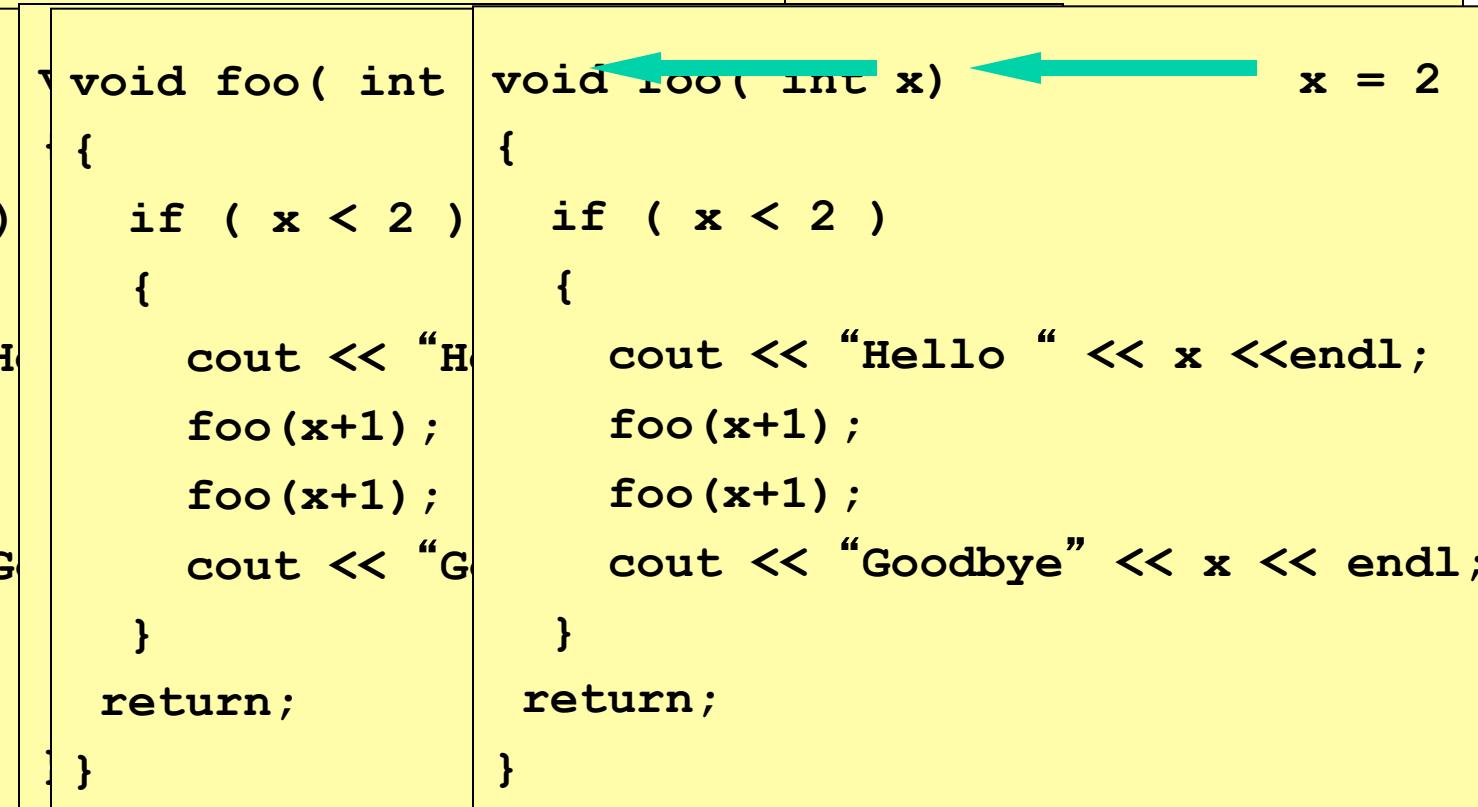
```
void foo( int x)              ← x = 1
```

Goodbye 3

Goodbye 2

Goodbye 1

Goodbye 0

Hello 0

Hello 1

Hello 2

Hello 3

Recursion (Frames and The Stack)

```
foo(0)
```

Hello 0
Hello 1
Goodbye 1
Hel
Goo
Goo

```
void foo( int x)                 x = 0
{
```

```
void foo( int x)          x = 1      t x)            x = 1
{
   if ( x < 2 )                          )
```

```
void foo( int    void foo( int   void foo( int x)              x = 2
{                {                {
   if ( x < 2 )     if ( x < 2 )     if ( x < 2 )
   {                {                {
     cout << "H      cout << "H        cout << "Hello " << x <<endl;
     foo(x+1);       foo(x+1);         foo(x+1);
     foo(x+1);       foo(x+1);         foo(x+1);
     cout << "G      cout << "G        cout << "Goodbye" << x << endl;
   }                }                }
  return;          return;          return;
}                }                }
```

Recursion

- Program Trace

- Fib

- Fact

- Visualization of Recursion with Java

  http://www.iol.ie/~jmchugh/csc302/

Exam 1

- Anatomy of a Computer
- Types and Variables
- Operators
  - Mathematical
  - Boolean
- Control Structures
  - Selection (if…else, switch)
  - Iteration (while, for)

Exam 1

- Input and Output
  - cin, cout, >>, <<
- Functions
  - Calling Functions
  - Function Prototypes
  - Function Definitions
  - Function overloading

Sample Problem

- Find the bug in this code:

```cpp
#include <iostream>
using namespace std
int main( )
{
cout << "hello world!" << endl;
return 0;
}
```

Sample Problem

- Find the bug in this code:

```cpp
#include <iostream>
using namespace std;
int main( )
{
double width, area;
cout<<"Enter the width of the square: ";
cin >> width;
Area = width * width;
cout << "The area of the square with the width = "
     << width << " is " << Area << endl;
return 0;
}
```

Sample Problem

- Find the bug in this code:

```cpp
#include <iostream>

int main()
{
    int i = 30;
    while( i != 100 )
    {
        i++
        if ( i == 100 )
        {
            i = i – 1;
        }
        cout << i << " " << endl;
    }
}
```

Sample Problem

- Find the bug in this code:

```cpp
#include <iostream>
int test( int n );

int main()
{
        int n = 5;
        cout << test( n );
return 0;
}
int test( int )
{
   return (n+1);
}
```

Sample Problem

- Find the bug in this code:

```
#include (iostream)

int main()
{
    int i = 30;
    while( i < 100 )
    {
        i++
        if ( i == 100 )
        {
            i = i + 1;
        }
        cout << i << " " << endl;
    }
}
```

Sample Problem

- Calculate the value of n:

int a = 3.3, b = 2.7, p = 8.7 , q = 5.4;

double n = p/b + q/a %;

Sample Problem

- Calculate the value of n:

int a = 3.3, b = 2.7, p = 8.7 , q = 5.4;

double n = (p/b + q/a) % 3;

Ans: 2

Sample Problem

- Give the value of n after this code:

```
int n = 3, a = 2, b = 7, c = 4;
if (b>6 && c<4 || a==0)
{
  n = n + 5;
}
if (a>3 && b>5 || c<=9)
{
  n = n + 20;
}
if (c>2 || a<8 && b==7)
{
  n = n - 5;
}
```

Ans: 18

Sample Problem

- Give the value of n after this code:

```
int n = 3, a = 2, b = 7, c = 4;
if (b>6 && c<4 || a==0)
{
  n = n + 5;
}
if (a>3 && b>5 || c<=9)
{
  n = n + 20;
}
if (c>2 || a<8 && b==7)
{
  n = n - 5;
}
```

Ans: 18

Sample Problem

- What does this program print?

```
for ( int i = 0; i < 5; i++  )
{
    for ( int j = 0; j < i; j++ )
    {
        cout << j << " ";
    }
    cout << endl;
}
```

Ans: 0
    0 1
    0 1 2
    0 1 2 3

Sample Problem

- What does this code print?

```cpp
#include <iostream>

using namespace std;

int main()
{
  int n = 1;
  for ( int i = 1; i < 6; i++  )
    {
      n *= i;
      cout << n << " ";
    }
}
```

Ans: 1 2 6 24 120

Sample Problem

- What does this code print?

```cpp
#include <iostream>

using namespace std;

int main()
{
  int n = 1;
  for ( int i = 0; i < 6; i++  )
    {
     n *= i;
     cout << n << " ";
    }
}
```

Ans: 0 0 0 0 0 0

Sample Problem

- What does this code print?

```
int n = 1;

while ( n < 5 )
  {
    for ( int i = 1; i < 5; i++  )
    {
     cout << n++ << " ";
     cout << ++n << " ";
    }
  }
```

Ans: 1 3 3 5 5 7 7 9

Sample Problem

- Write a program that sums the even numbers between 1 and 100 inclusive.

Ans:

```cpp
#include <iostream>
int main()
{
    int sum = 0;
    for ( int i = 1; i <= 100; i++ )
    {
        if ( i % 2 == 0)
        {
            sum = sum + i;
        }
    }
}
```

- What does the following code print:

```
char foo = 'b', bar = 'a';
n = 4;
while ( n < 20 )
{
    if ( n % 4 == 0)
    {
        cout << foo;
    }
    if ( n % 2 == 0)
    {
        cout << bar;
    }
    n = n + 2;
}
cout << 'c';
```

Ans: baabaabaabaac

- What does the following code print:

```
char foo = 'b', bar = 'a';
n = 4;
while ( n < 20 )
{
    if ( n % 4 == 0)
    {
        cout << foo;
    }
    else if ( n % 2 == 0)
    {
        cout << bar;
    }
    n = n + 2;
}
cout << 'c';
```

Ans: babababac

Sample Problem

- What does the following code print:

```cpp
#include <iostream>

using namespace std;

int cow( int );
int sheep( int );

int main()
{
  int n = 1;
  for ( int i = 1; i < 3; i++  )
    {
     cout << "quack " << endl;
     cow( i + 1);
    }
}
```

Ans: quack
moo moo baa moo baa baa quack
moo moo baa moo baa baa

```cpp
int cow( int x )
{
  for ( int i = 0; i < 3; i++ )
    {
      cout << "moo ";
      sheep( i );
    }

  return 0;
}

int sheep( int x )
{
  for ( int i = 0; i < x; i++  )
    {
     cout << "baa ";
    }
  return x;
}
```

Sample Problem

- What does the following code print:

```cpp
#include <iostream>
using namespace std;
int test( int x, int y );
int main()
{
  int j = 1;
  while( test( j, j ) < 8*j )
    {
      cout << j << " ";
      j = j * 2;
    }
return 0;
}
int test( int x, int y )
{
  return (x * y);
}
```

Ans: 1 2 4