Introduction to Programming

Lecture Five

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A while loop

```
i=1;
while(i<20)
{
printf(" %d",i);
}
```

while loop with counter

```
i=1;
while(i<20)
{
// Code
// More code
// Even more code
i=i+1;
}
```

for loop

```
for (i=1;i<20;i=i+1)
{
//Code
}
```

for loop

```
for (Stmts1; Condition; Stmts2)
{
 Code
}
```

```
Stmts1
while (Condition)
{
 Code
 Stmts2
}
```

Lab schedule

Next Mon lab ⇒ 23 Oct (NOT 16 Oct)

Topics in this lecture

- Review
- Functions
- makefile
- Hints for assignment
- Pointers
- Recursion

Review: Lab3

Taylor Series example

```
double x, expx, term;
scanf("%lf",&x);
expx=term=1;
i=1;
while (i<=20)
{
  term=term*x/i;
  expx=expx+term;
  i=i+1;
}
```

Review: Lab4

Bit at given position

```
int checkbit(int num,int position)
{
  int i=1,bit,numcopy=num;
  while (i<position)
  {
     numcopy=numcopy>>1;
     i=i+1;
  }
  bit=numcopy%2;
  return bit;
}
```

Printing subsets of a string

```
for (i=1;i<N;i=i+1)
{
  printf(”\n”);
  for (j=1;j<=length;j=j+1)
  {

     if (checkbit(i,j)==1) {
     printf(”%c”,text[j]); }
  }
}
```

Functions

Compiling and linking

- gcc helloWorld.c -o helloWorld
- Compilation + Linking
- Compilation produces object code
- Linking produces executable from object code(s)
- gcc -c helloWorld.c -o helloWorld.o
- gcc helloWorld.o -o helloWorld

Compiling and linking

- gcc helloWorld.c mymath.c -o helloWorld
- Shouldn't recompile mymath.c
- gcc -c mymath.c -o mymath.o
- gcc helloWorld.c mymath.o -o helloWorld

Hints for Assignment

Problem 1: Find day of the week

Method 1: Use reference date and offset for month

```
    int days[12]=
{0,31,59,80,110,141,171,202,233,263,294,324};
```

Method 2: Doomsday algorithm

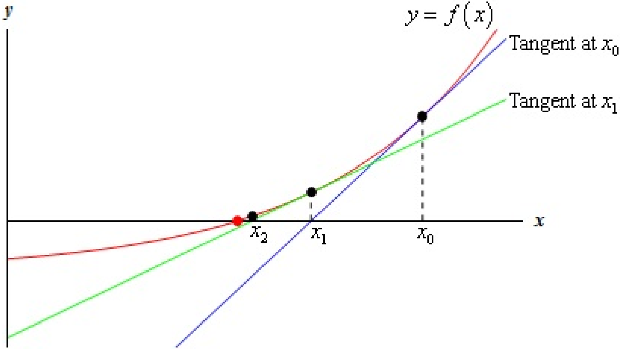
Jan	3
Feb	28
Mar	7
Apr	4
May	9
Jun	6
Jul	11
Aug	8
Sep	5
Oct	10
Nov	7
Dec	12

Problem 2: Histogram

Step 1: Count the vowels.
Step 2: Histogram; find number of lines to print.

Probem 3: Find roots of polynomials

Newton-Raphson Method



$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}. \quad x_{i+1} = x_{old} - \frac{f(x_i)}{f'(x_i)}.$$

Image: http://tutorial.math.lamar.edu/

Addresses and pointers

Printing Addresses

```
int a;
char b;
float c;

 printf(”Address of a is %p”,&a);
 printf(”Address of b is %p”,&b);
 printf(”Address of c is %p”,&c);
```

Array Addressing

int num[20];

Variable	Address	Value
num[0]	68400	
num[1]	68404	
num[2]	68408	
num[3]	68412	
num[18]	68472	
num[19]	68476	

Array Addressing

```
int num[3][5];
```

Variable	Address	Value
num[0][0]	68400	287
num[0][1]	68404	
num[0][2]	68408	841
num[0][3]	68412	-50
num[0][4]	68416	
num[1][0]	68420	

Pointer variables

```
int a;
char b;
float c;

int *x;
char *y;
float *z;
x=&a;
y=&b;
z=&c;
 printf(”Address of a is %p”,x);
 printf(”Address of b is %p”,y);
 printf(”Address of c is %p”,z);
```

Recursion: The Fibonacci sequence

1, 1, 2, 3, 5, 8, 13, 21, 34, 55,. . .

F(1)$=$1, F(2)$=$1, F(n)$=$F(n-1)$+$F(n-2)