CENG 230

Introduction to C Programming

Week 7 – Repetition

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Some slides/content are borrowed from Tansel Dokeroglu,
Nihan Kesim Cicekli.

Conditional Expression Operator

Previously on CEng 230!

y= x > 3 ? a+1 : a-1; means

```
İf (x > 3)
        y=a+1;
else
        y=a-1;
```

```
z=(a > b) ? a: b;   (finds maximum)
```

```
Printf(“%d%c”, k, (k%10==9) ? ‘A’ : ‘a’);
```

Previously on CEng 230!

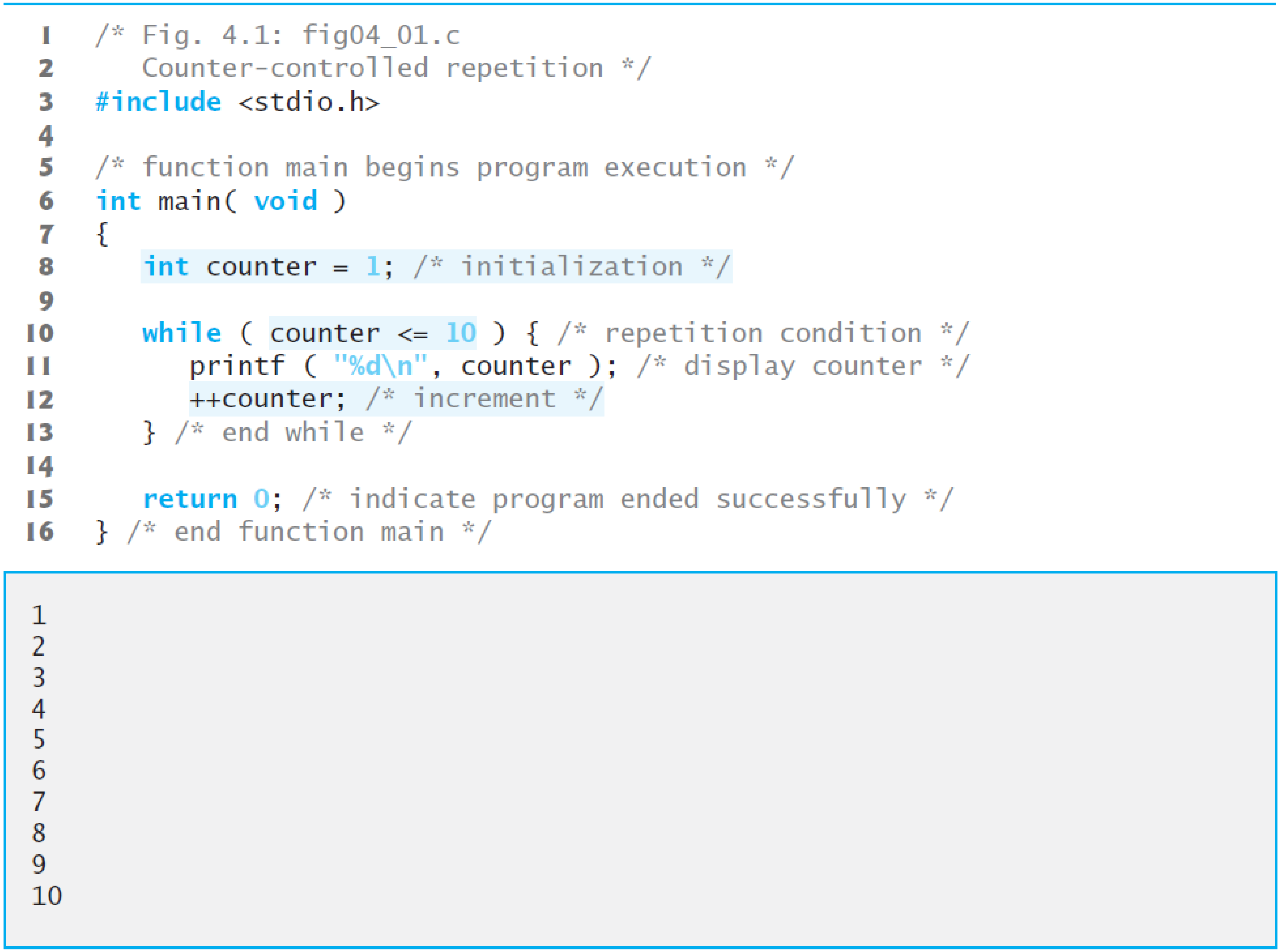
Loops, iterations, repetitions

while, do-while and for statements

Most programs involve repetition or looping.

Previously on CEng230!

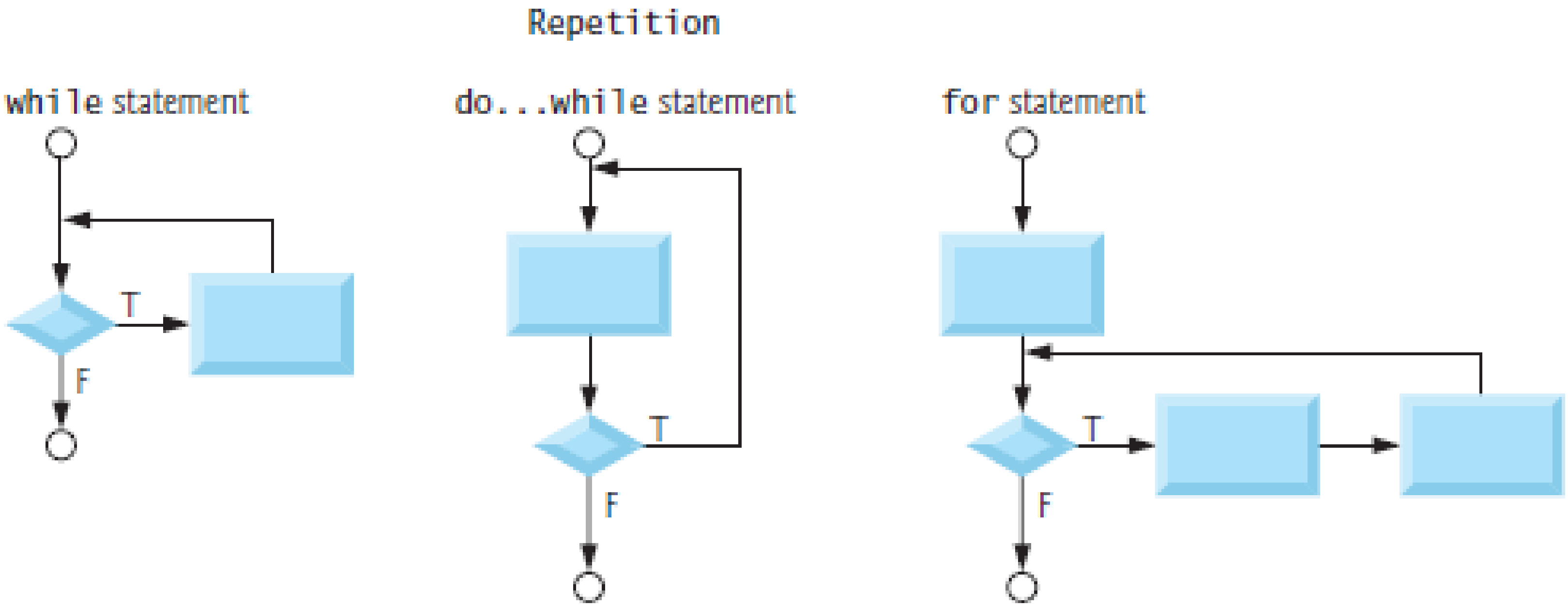
A **loop** is a group of instructions the computer executes repeatedly while some **loop-continuation condition remains true.**



```c
/* Fig. 4.1: fig04_01.c
   Counter-controlled repetition */
#include <stdio.h>

/* function main begins program execution */
int main( void )
{
   int counter = 1; /* initialization */

   while ( counter <= 10 ) { /* repetition condition */
      printf ( "%d\n", counter ); /* display counter */
      ++counter; /* increment */
   } /* end while */

   return 0; /* indicate program ended successfully */
} /* end function main */
```

```
1
2
3
4
5
6
7
8
9
10
```

Previously on CEng 230!



Previously on CEng230!

Repetitions

- while loop

  Initialization;
  while(expr)
  statement;

  Initialization;
  while(expr)
  {
  statement;
  statement;
  statement;
  }

- Bad examples:

```
while( x = 1)
{
        x = getchar();
}


x = 0.0;
while( x != 1.0 )
{
        x += 0.005;
}
```

Example

Previously on CEng 230!

- Factorial

```
int N, fact = 1;
scanf(“%d”, &N);
while( N > 0 )
{   fact *= N--;  }
```

Repetitions

Previously on CEng 230!

- do-while loop

```
Initialization;
do
    statement
while( expr );
     statement;
```

```
Initialization;
do
{
     statement;
      statement;
      statement;
} while( expr );
```

```
do
{
          x = getchar();
         putchar(x);
} while( x != EOF );
```

Example

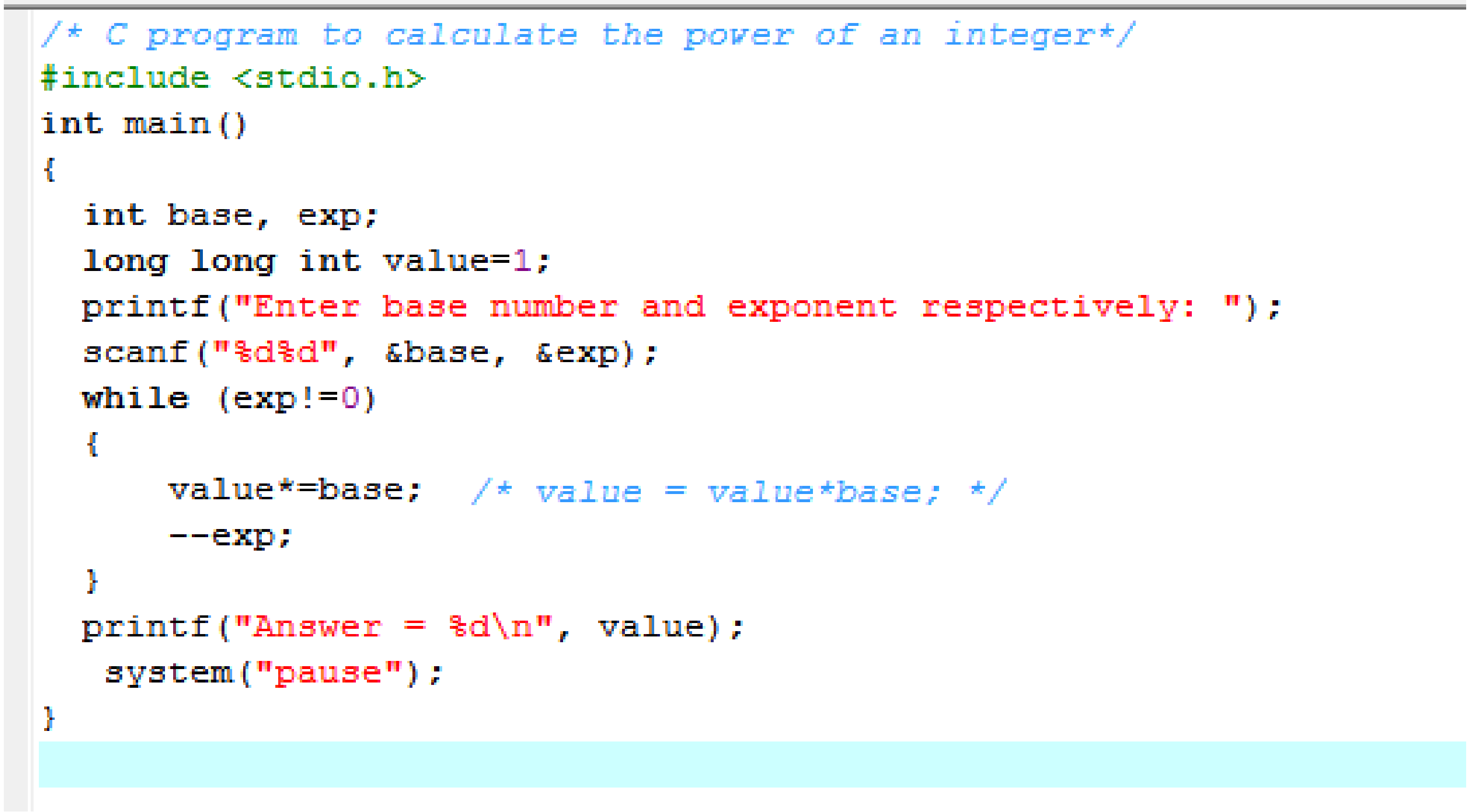
Previously on CEng 230!

- Factorial with do-while:

```
int N, fact = 1;
scanf(“%d”, &N);
do
{ fact *= N--;  }
while( N > 0 );
```

Finding power of a number

Previously on CEng 230!

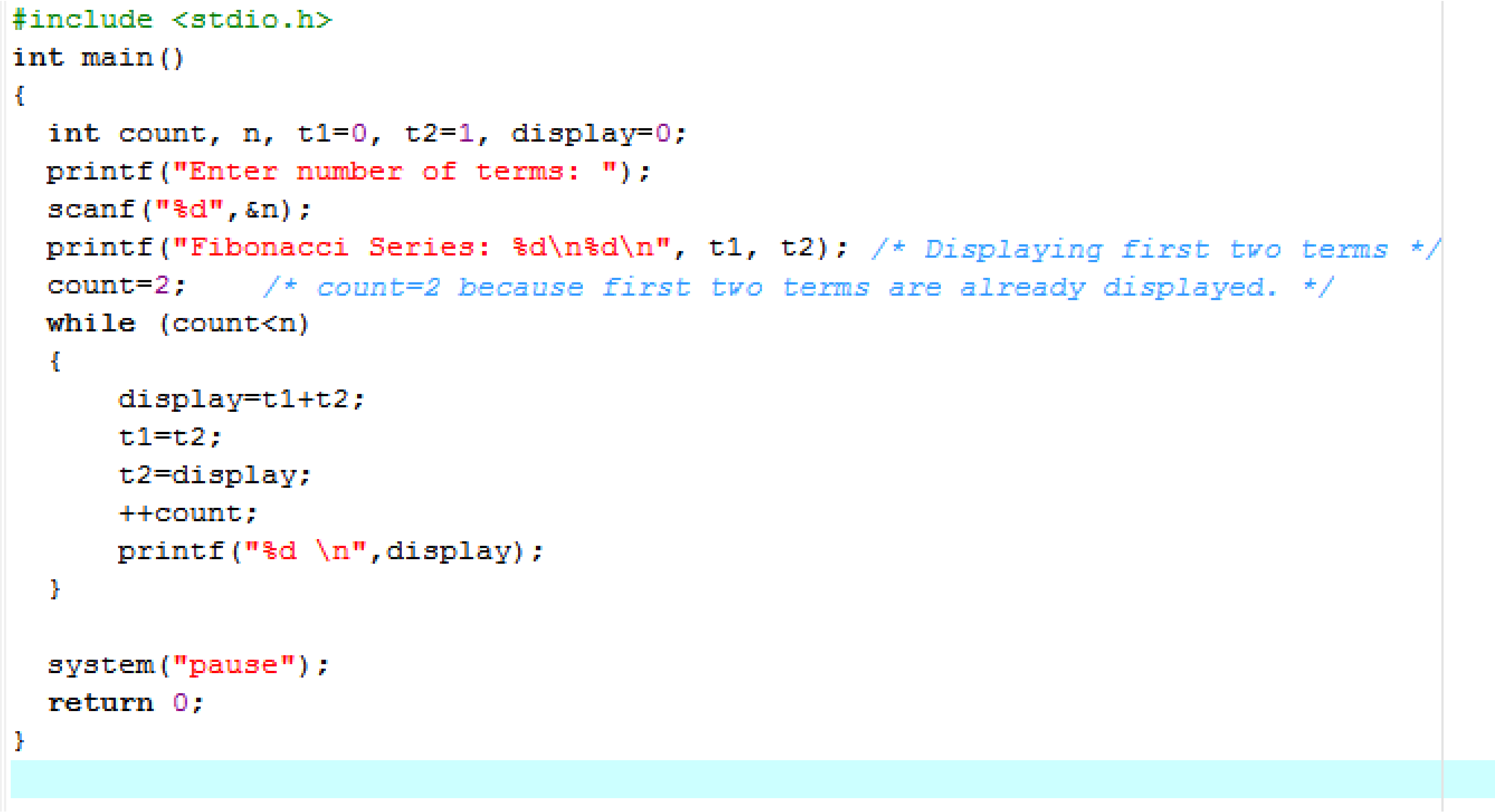


```
/* C program to calculate the power of an integer*/
#include <stdio.h>
int main()
{
  int base, exp;
  long long int value=1;
  printf("Enter base number and exponent respectively: ");
  scanf("%d%d", &base, &exp);
  while (exp!=0)
  {
      value*=base;   /* value = value*base; */
      --exp;
  }
  printf("Answer = %d\n", value);
   system("pause");
}
```

Today

- Continue with repetitions
    - More examples
    - “for” loops

Finding fibonacci series



```c
#include <stdio.h>
int main()
{
  int count, n, t1=0, t2=1, display=0;
  printf("Enter number of terms: ");
  scanf("%d",&n);
  printf("Fibonacci Series: %d\n%d\n", t1, t2); /* Displaying first two terms */
  count=2;    /* count=2 because first two terms are already displayed. */
  while (count<n)
  {
      display=t1+t2;
      t1=t2;
      t2=display;
      ++count;
      printf("%d \n",display);
  }

  system("pause");
  return 0;
}
```

Repetitions

- **for** loop

  Initialization;
  for(expr1; expr2; expr3)
      statement

  Initialization;
  for(expr1; expr2; expr3)
  {
      statement;
      statement;
      statement;
  }

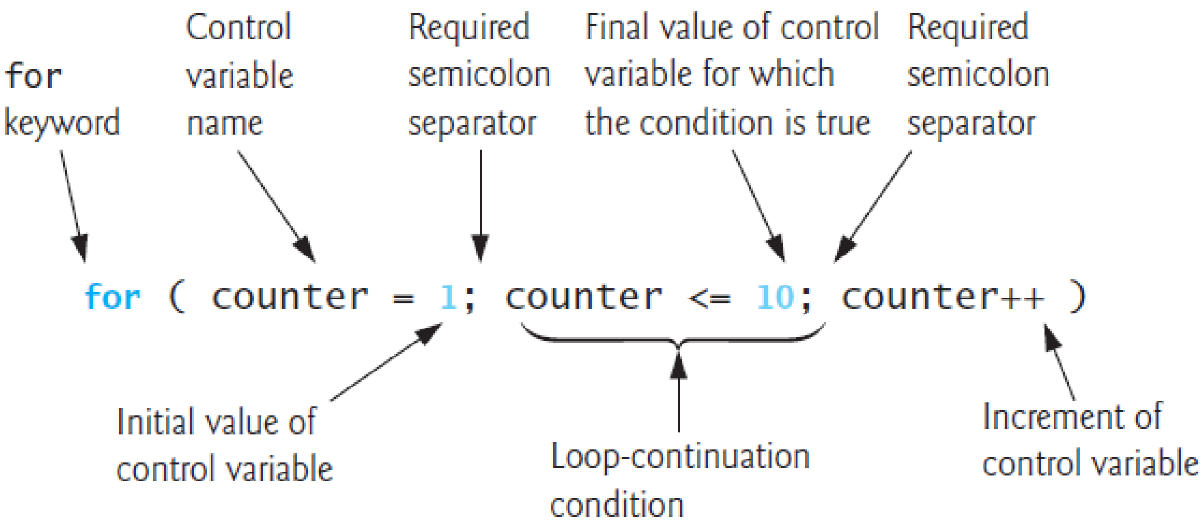
```
for( j = 0; j < N; j++)
        printf(“j: %d\n”, j);
```

```
for(i=0, j=0;
        i < 0 & j > N; i++, j--);
```

```
for(   ;    ; i++ )
{
        if( i > 0 ) return 0;
}
```

```c

/* function main begins program execution */
int main( void )
{
   int counter; /* define counter */

   /* initialization, repetition condition, and increment
      are all included in the for statement header. */
   for ( counter = 1; counter <= 10; counter++ ) {
      printf( "%d\n", counter );
   } /* end for */

   return 0; /* indicate program ended successfully */
} /* end function main */
```

Fig. 4.2 | Counter-controlled repetition with the for statement. (Part 2 of 2.)



```
for ( counter = 1; counter <= 10; counter++ )
```

`for` keyword

Control variable name

Required semicolon separator

Final value of control variable for which the condition is true

Required semicolon separator

Initial value of control variable

Loop-continuation condition

Increment of control variable

1. Vary the control variable from 1 to 100 in increments of 1.

```
for ( i = 1; i <= 100; i++ )
```

2. Vary the control variable from 100 to 1 in increments of -1 (decrements of 1).

```
for ( i = 100; i >= 1; i-- )
```

3. Vary the control variable from 7 to 77 in steps of 7.

```
for ( i = 7; i <= 77; i += 7 )
```

4. Vary the control variable from 20 to 2 in steps of -2.

```
for ( i = 20; i >= 2; i -= 2 )
```

5. Vary the control variable over the following sequence of values: 2, 5, 8, 11, 14, 17.

```
for ( j = 2; j <= 17; j += 3 )
```

6. Vary the control variable over the following sequence of values: 44, 33, 22, 11, 0.

```
for ( j = 44; j >= 0; j -= 11 )
```

```c
/* Fig. 4.5: fig04_05.c
   Summation with for */
#include <stdio.h>

/* function main begins program execution */
int main( void )
{
   int sum = 0; /* initialize sum */
   int number; /* number to be added to sum */

   for ( number = 2; number <= 100; number += 2 ) {
      sum += number; /* add number to sum */
   } /* end for */

   printf( "Sum is %d\n", sum ); /* output sum */
   return 0; /* indicate program ended successfully */
} /* end function main */
```

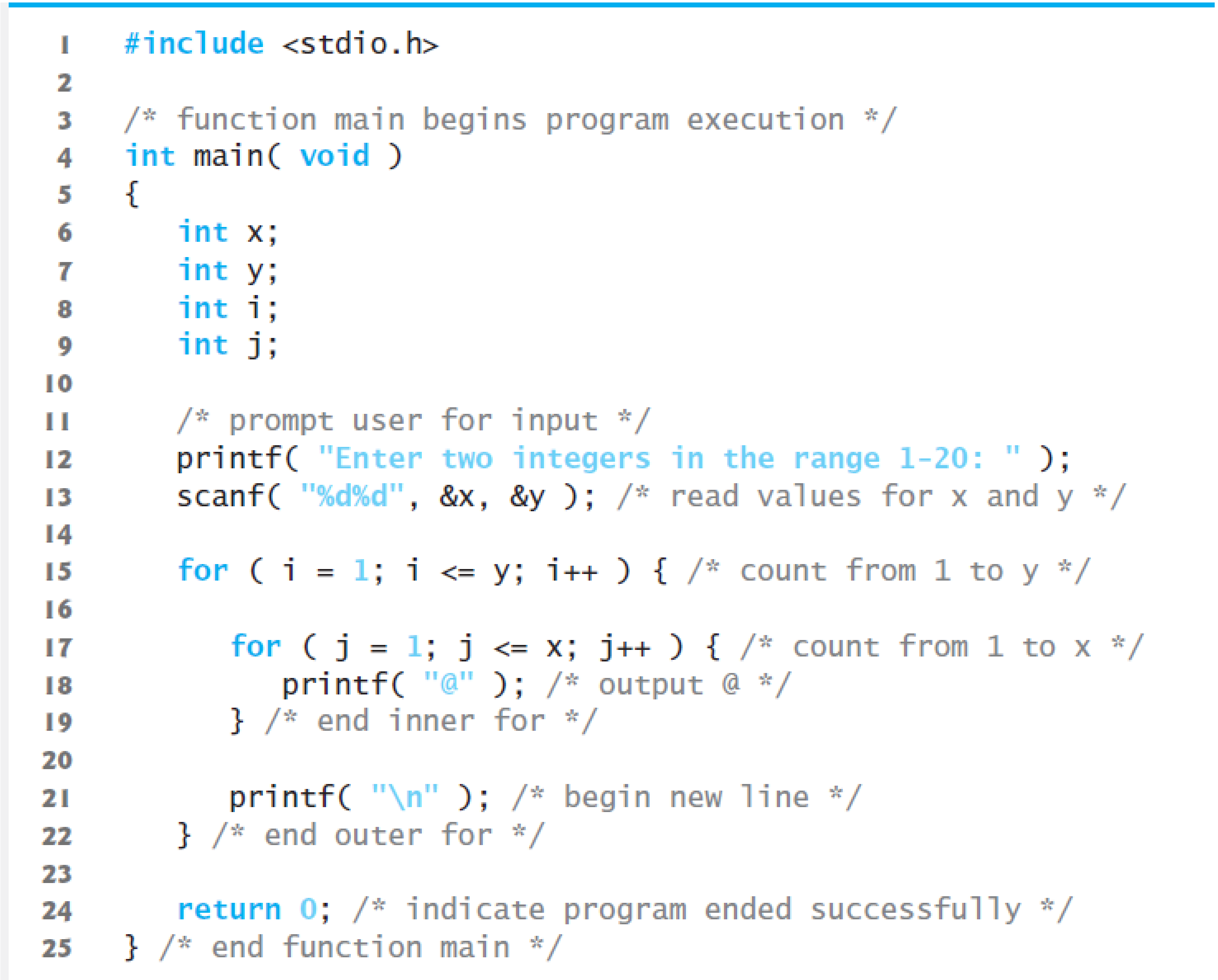
```
Sum is 2550
```

Nested Loops

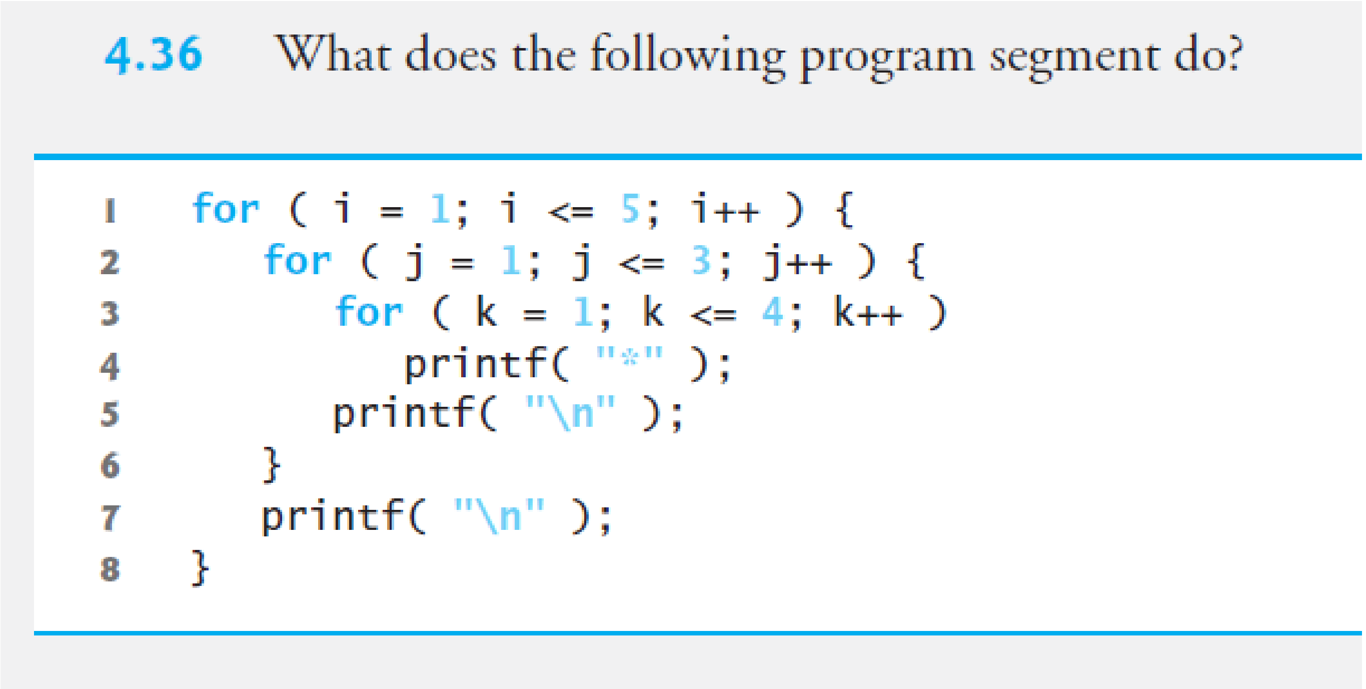
- You can have loops within loops:

```
for(i=0; i<N; i++)
{
   for(j=0; j<N; j++)
   {
      ….
   }
}
```

Nested loops



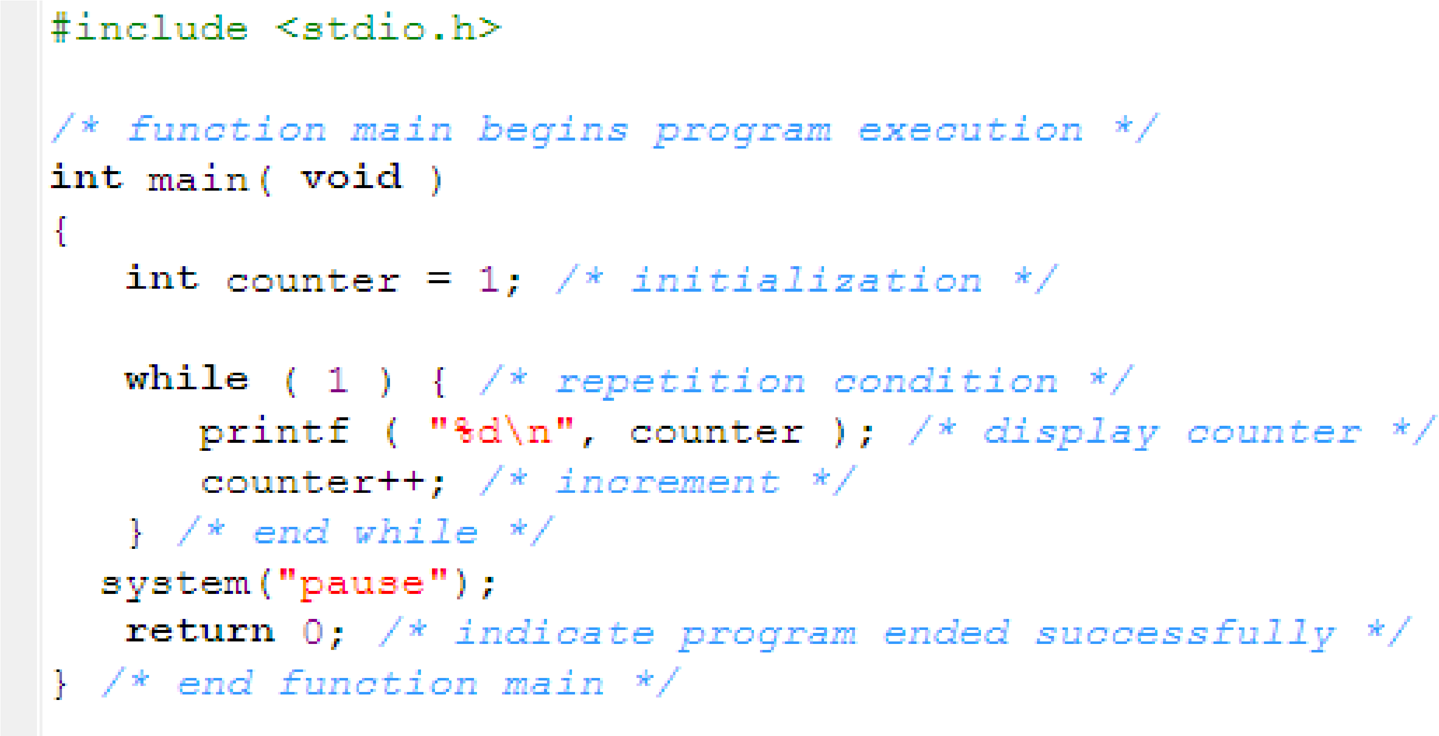
```c
#include <stdio.h>

/* function main begins program execution */
int main( void )
{
   int x;
   int y;
   int i;
   int j;

   /* prompt user for input */
   printf( "Enter two integers in the range 1-20: " );
   scanf( "%d%d", &x, &y ); /* read values for x and y */

   for ( i = 1; i <= y; i++ ) { /* count from 1 to y */

      for ( j = 1; j <= x; j++ ) { /* count from 1 to x */
         printf( "@" ); /* output @ */
      } /* end inner for */

      printf( "\n" ); /* begin new line */
   } /* end outer for */

   return 0; /* indicate program ended successfully */
} /* end function main */
```



4.36 What does the following program segment do?

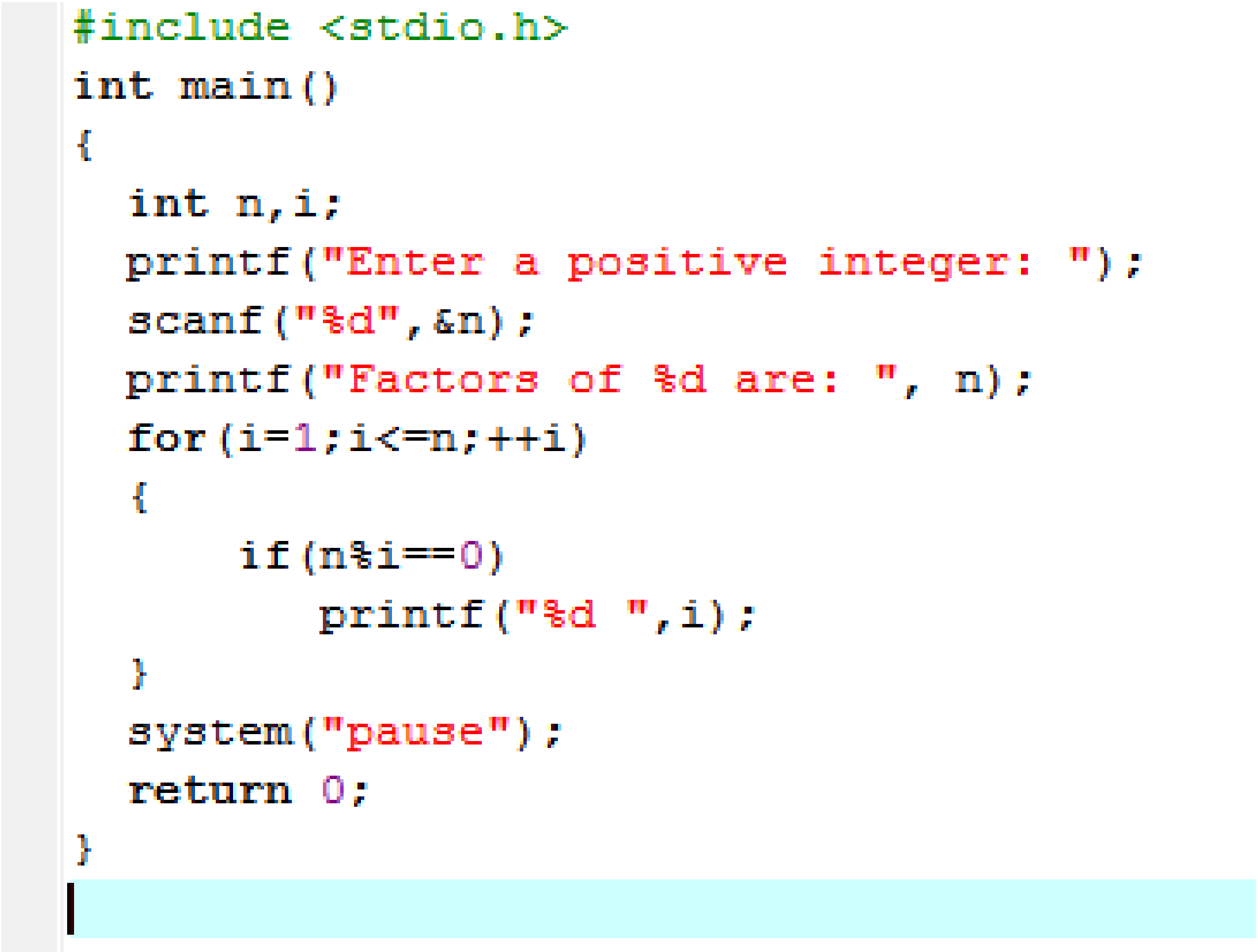
```
for ( i = 1; i <= 5; i++ ) {
   for ( j = 1; j <= 3; j++ ) {
      for ( k = 1; k <= 4; k++ )
         printf( "*" );
      printf( "\n" );
   }
   printf( "\n" );
}
```

infinite loops
(loops that do not finish executing)



```
#include <stdio.h>

/* function main begins program execution */
int main( void )
{
   int counter = 1; /* initialization */

   while ( 1 ) { /* repetition condition */
      printf ( "%d\n", counter ); /* display counter */
      counter++; /* increment */
   } /* end while */
  system("pause");
   return 0; /* indicate program ended successfully */
} /* end function main */
```

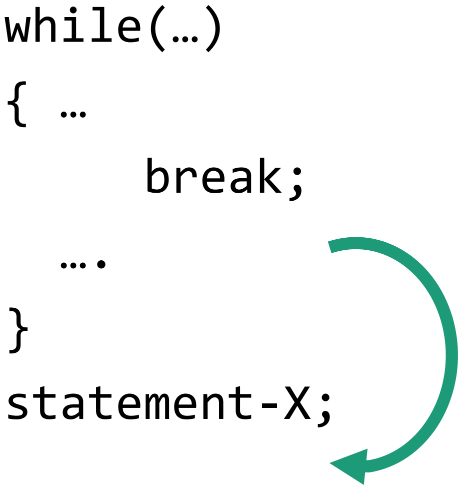
Factors of a number



```
#include <stdio.h>
int main()
{
  int n,i;
  printf("Enter a positive integer: ");
  scanf("%d",&n);
  printf("Factors of %d are: ", n);
  for(i=1;i<=n;++i)
  {
      if(n%i==0)
         printf("%d ",i);
  }
  system("pause");
  return 0;
}
```

break;

- Stop the loop/iteration and continue with the statement after the loop.
- Usable with while, for and do-while



```
while(…)
{ …
      break;
  ….
}
statement-X;
```

```
while( 1 )
{
       c = getchar();
      if( c == EOF)
             break;
       putchar( c );
}
```

continue;

- Skips the remaining statements in the loop and continues with the “loop head”.
- Usable with while, for and do-while

```
while(…)
{ …
     continue;
  ….
}
```

```
Sum = 0;
for(i=0; i<N; i++)
{
      if( i%2 == 0 )
            continue;
      sum = sum + i;
}
```

Homework

- Write a program to read in numbers until the number -1 is encountered. The sum, max and min of all numbers read until this point should be printed out.

41) What is the output?

```
 for(i=0; i<=2; i++)
 for(j=1; j<3; j++)
    printf("%d%d",i,j);
printf("%d%d",i,j);
```

[✓ a) 01021112212233]
b) 010211221222
c) 011121021222
d) 01112102122233
e) 01112102122222

42) What is the output?

```
int n=0,i=9,j=0;
for(i=1,j=7; i<=j; i++,j--)
   n++;
printf("%d%d%d",i,j,n);
```

a) 170 b) 443 c) 444 [✓ d) 534] e) 900

43) What is the output?

```
int k=456;
float t=0;
while(k/100>4){
   t=t+k/100;
   k=k-100;
}
printf("%f",t);
```

[✓ **a)** 0.000000]   **b)** 4.000000   **c)** 4.560000

d) 56.000000   **e)** infinite loop

44) What is the output?

```
for(i=0; i<9; i++){
   printf("%d",i);
   for(j=0; j<2; j++)
      i=i+2;
}
```

a) 012345678   **b)** 036   **c)** 048

[✓ **d)** 05]   **e)** compile-time error

45) What is the output?

```
for(i=2;i<10;i++) {
if (i%3==0) continue;
if (i%6==0) break;
printf("%d",i); }
```

a) 2345   **b)** 245   [✓ **c)** 24578]   **d)** 3   **e)** 39

46)
```
for(i=0; i<4; i++){
 for(j=0; j<4-i ; j++)
   printf("%d ",___(1)___);
 printf("\n");    }
```

Which expression should be replaced with ___(1)___ for this output;

```
0 3 6 9
2 5 8
4 7
6
```

a) i*(i+1)+3*j **b)** 3*i+2*j [✓ **c)** 2*i+3*j]
d) (i+j)*3 **e)** 3*i+j*(j+1)

47) What will be the output when the input below?

Input: 200 1000 4 30 -1

```
int n,min=50000,tot=0;
do {
 scanf("%d",&n);
 if (n<min) min=n;
 tot=tot+min;
} while (n!=-1);
printf("%d %d",min,tot);
```

a) 4 204 **b)** 4 408 **c)** -1 203
d) 4 1234 [✓ **e)** -1 407]

48) **What is the output?**

```
int b=1;
while(b<10 && b>-10) {
 b=b*-2;
  printf("%d ",b);
}
```

a) 1 -2 4 -8 [✓ **b)** -2 4 -8 16]
c) 1 -2 4 -8 16 **d)** -2 4 -8
e) no output

49) **How many DONE will be printed with the input 5 ?**

```
int i;
scanf("%d",&i);
do{
printf("DONE");
} while(i<10);
```

a)0 **b)** 1 **c)** 5 [✓ **d)**infinite] **e)**10

50) **What is the output?**

```
int i=0, j=0;
do{
for(i =0 ; i< 5 ; i++)
j+=i;
}while(j<10);
printf("%d %d", i, j);
```

a) 10 10 **b)** 0 10 **c)** 10 5 [✓ **d)** 5 10] **e)** infinite loop

39) Which of the following displays “hello” 5 times ?

a) for(i=-1; i<=2; i+=1)   printf(" hello ");

b) for(i=1; i<6; i+=2) printf(" hello ");

c) for(i=12; i<=16; i+=1) printf(" hello ");

d) for(i=0; i<=4; i-=1) printf(" hello ");

e) for(i=5; i<=0; i-=1)   printf(" hello ");

40) What is the output of the following code segment?

```
s=5;
while(s<10)
{
    s += 2;
    printf("%3d", 2*s);
    s++;
}
```

a) 7 10   **b)** 14 20   **c)** 5 6   **d)** 10 7   **e)** None of them

41) If the following statements display “computers” 3 times, what should be the statement ____(1)____?

```
int i = 7/2;
while (i <= 10)
{    ++i;
     printf("computers");
     _____(1)_____;
}
```

a) i=i+1; **b)** i=i+2; **c)** i=i+3; **d)** i=i+4; **e)** i=i+5

42) What is the output of the following code segment?

```
for( i = 10;  i > 4;  i--)
{          printf("%d ",  i-2);
           i -= 3;
}
```

a) 7 5 **b)** 8 4 **c)** 10 8 **d)** 8 2 **e)** 8 10

43) Which loop outputs 0 1 2 ?

a) for(i=1/2; i<6; i+=2) printf("%3d", i-2);
b) for(i=2; i<6; i+=2) printf("%3d", i-3);
c) for(i=5/2-1; i<9/2; i+=1) printf("%3d", i-1);
d) for(i=0; i<6; i+=2) printf("%3d", i);
e) for(i=2; i<6; i+=1) printf("%3d", i+3);

44) What is the output of the following program segment'

```
k=5;
m=10;
while( k > 0 )
{   if( m%3 )
        printf("%3d", m-- );
     else
        printf("%3d", --m);
        k -= 2;
  }
  printf("%3d", k);
```

a) 10 7 7   1
b) 9 9 7 -1
c) 10 8 8 -1
d) 9 8 7 -1
e) 9 9 8 -1

45) What is the output of the following code segment?

```
int i, k;
k=5/2;
for (i=3;i<=10; i+=2)
{     ++i;
     if(k=3&&i%2)
         printf("BBB");
     else
              printf("AAA");
              k++;
 }
```

a) BBBAAA
b) AAABBBBBB
c) AAABBB
d) AAABBBAAA
e) BBBAAABBB

46) How many times the condition is checked?

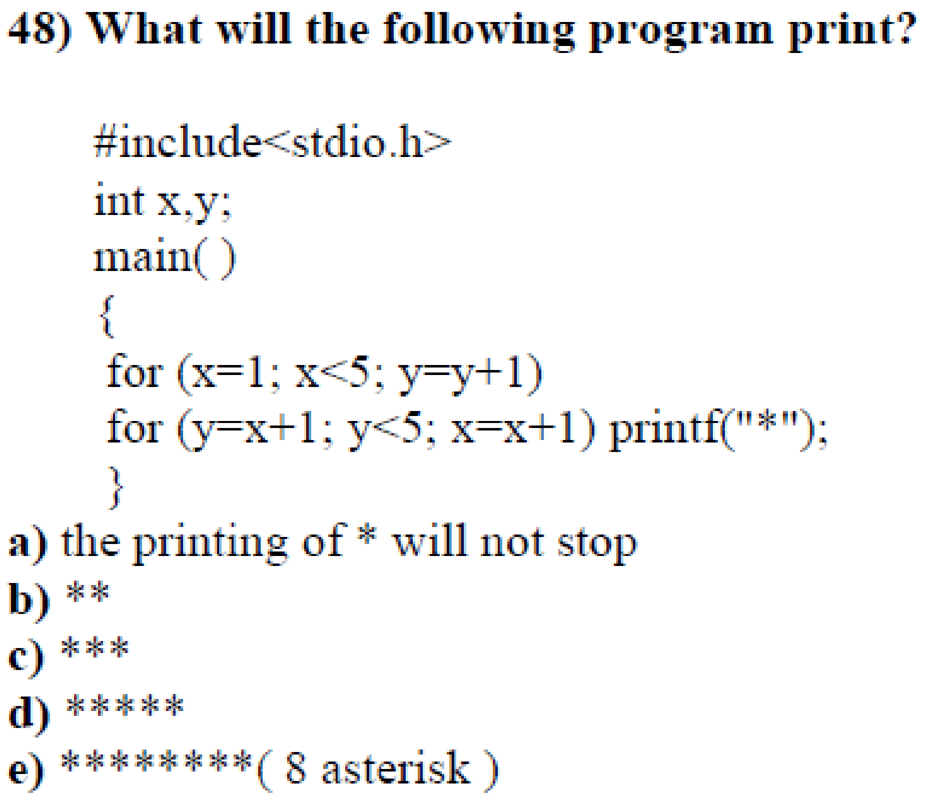
```
i=1;
k=5;
while (i <=10-k)
{    ++i;
     printf("%3d",i);
     k+=2;   }
```

a) 1 **b)** 2 **c)** 3 **d)** 4 **e)** 5

47) What will the following program print?

```
#include<stdio.h>
int x,y;
main( )
{  for (x=1,y=1; x<5 && y<3; x=x+1, y=y+1) printf("*");  }
```

a) Nothing
b) **
c) ***
d) *****
e) ********(8 asterisk)



48) What will the following program print?

```
#include<stdio.h>
int x,y;
main( )
{
 for (x=1; x<5; y=y+1)
 for (y=x+1; y<5; x=x+1) printf("*");
 }
```

a) the printing of * will not stop

b) **

c) ***

d) *****

e) ********(8 asterisk)

49) What will the following program print?

```
#include<stdio.h>
int x,a,b,c;
main( )
{
for (a=5; a>=1; a=a-1)
for (b=1; b<=a; b=b+1)
for (c=1; c<=b; c=c+1) x = x+1;
printf("%d",x);
}
```

a) 18 **b)** 17 **c)** 35 **d)** 70 **e)** 140

50) Which is true for the given program?

```
#include<stdio.h>
int i = 0,  j = 0;
main( ) {
  do { printf("%d ",i+j);
     if((i+j)%2) printf("%d ",i+j);
     i++;
     j++; } while (i<=j<3);
  }
```

a) Will go into an infinite loop.
b) Will output 0 2 4
c) Will output 0 2
d) Will produce a compile time error.

Use below program to answer questions 21-22.

```
#include <stdio.h>
int main() {
   int a=0,b=0,c=0,f,g,h;
   scanf("%d%d%d",&f, &g, &h);
   for (a=g;a<f;a++)
    switch(a) {
     case 1: c++;break;
     default: c += 2;
    }
   printf("%d\n",c);
}
```

21- What is the output of the above program for the input 4 1 1?

a) 1 b) 2 c) 3 d) 4 e) 5

22- What is the output of the above program for the input 5 2 1?

a) 1 b) 4 c) 6 d) 10 e) 7

23- What is the output of the above program for the input 5 1 1?

a) 1 b) 4 c) 5 d) 7 e) 15

```
#include <stdio.h>
int main() {
    int a=0, b=0, c=0, f, g;
    scanf("%d%d",&f, &g);
    c=0;
    for (a=g;a<f;a++)
    for (b=g;b<a;b++)
      c++;
    printf("%d\n",c);
}
```

24- one of the below is the output of the above program for the input 5 2?

a) 3 b) 6 c) 10 d) 12 e) 15

25- one of the below is the output of the above program for the input 6 3?

a) 3 b) 6 c) 10 d) 12 e) 15

32. What will be the output of the below code segment?

```
m=0;
do {
      m=m-2;
} while (m>5)
printf(“%d”,m);
```

a) 0 b) 2 c) [✓ -2] d) 5 e) 7

33. What will be the output of the below code segment?

```
m=0;
while (m>5)
    m=m-2;
printf(“%d”,m);
```

a) [✓ 0] b) 2 c) -2 d) 5 e) 7

34. What will be the value of dif at the end of following code segment?

```
int  m=1;
int myvar,dif;
while(m<=2)
    myvar=m++;
dif=m-myvar;
```

a) 0 b) [✓ 1] c) -1 d) 2 e) -2

Use below program to answer to questions 34-35.

```
counter1 =0
counter2=0;
while (counter1 <3 ) {
    while ( (counter2+counter1)%2==0)
          printf(“%d”,counter2++);
    counter1++;
}
```

35. How many times will the printf statement be executed?

a) 3 **b)** 4 **c)** 7 **d)** 0 **e)** 2

36. What will be the value of the *counter2* after the execution of the above code segment?

a) 3 **b)** 0 **c)** 2 **d)** 4 **e)** 1

13. What will be the value of `x` after the following program segment is executed?

```
int i, x;  x = 0;  i = 100;
while  (i > 0) {
  x++;
  i = i / 2;
}
```

a) 6
b) 7
c) 8
d) 9

15. What will be the output of the following program segment?

```
int n = 12, j = 2;
while (j <= n) {
    if (n % j == 0){
       n = n / j;
       printf(“%d “,j);
    }
    else  j++;
}
```