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FOR APPLIED SCIENCE AND TECHNOLOGY

ECT 121
Computer Programming I

Dr. Amina Elhawary

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Lecture four

Repetition and Loop Statements

- While Statement
- Do-While Statement
- For Statement

What is Looping?

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- A loop is a repetition control structure.
- That is, you can execute particular statements more than once in a controlled fashion.
- Statements are executed as long as some condition remains true.

While Statement

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- **Syntex**

```
while ( condition )
{       .
        .       /*loop body */
        .
}
```

- **Note :** Loop body can be a single statement, a null statement, or a block.

While Statement

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- Is a Looping control structure in which the loop condition is tested **before** each iteration of the loop.

- Every while loop will always contain three main elements:
  - Intialization : intialize your variables.
  - Testing : test against some known condition.
  - Updating : update the variables that is tested.

Example (1)- Count controlled loop

```
int   count ;

count  =  0;

while (count < 4)

{

        cout<<count<<endl;

            count ++;

}

cout<<“Done”;
```

1. Initialization

2. Test Condition

3. Update

Example (1)~ Count controlled loop (Cont.)

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```
int   count ;

count  =  0;

while (count < 4)
{
        cout<<count<< endl;

        count ++;
}
cout<<"Done";
```

Model Answer

trace	output
count	
~~0~~	0
~~1~~	1
~~2~~	2
~~3~~	3
4	Done

Example (2)- Count controlled loop

```
int   count, limit ;
count  =  0;
cin>>limit;       // assume limit = 4
while (count  < limit)
{
        cout<<count<< endl;
        count ++;
}
cout<<"Done";
```

Model Answer

Trace		Output
limit	count	
4	~~0~~	0
	~~1~~	1
	~~2~~	2
	~~3~~	3
	4	Done

Example (3)~ event controlled loop


```
int   count ;
cin>>count ;

while (count > 0)
{
        cout<<(++count)/2<< endl;     /* repeated action */
        cin>>count ;

 }
 cout<<"Done";
```

1. Initialization
2. Test Condition
3. Update

Example (4)

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```
int   count, limit ;
count  =  0;
cin>>limit;       // assume limit = 4
while (1) {
    if ( count < limit) {
          cout<<count<< endl;
          count ++;
    }
    else
          break;
}
cout<<"Done";
```

Model Answer

Trace

limit	count
4	~~0~~
	~~1~~
	~~2~~
	~~3~~
	4

Output

0
1
2
3
Done

Do~ While Statement

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- SYNTAX

```
do
{       .
        .       /*loop body */
        .
} while ( condition );
```

- NOTE:

  Loop body can be a single statement, a null statement, or a block.

Do~ While Statement

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- Is a looping control structure in which the loop condition is tested **after** each iteration of the loop.
- Every do-while loop will always contain three main elements:
  - Initialization: initialize your variables.
  - Testing: test against some known condition.
  - Updating: update the variable that is tested.

Example (5) Count controlled loop

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```
int   count , grade, total;
count  =  1;                        /* initialization */
total=0;
do
{
        cin>>grade;
        total=total + grade;
        count ++;                   /* update */
} while (count <= 4);               /* test condition */
cout<<"total grades ="<<total;
```

Trace:

count	grade	total
1	-	0
1	5	5
2	4	9
3	7	16
4	-1	15
5 (STOP)		

Output:

total grades = 15

Example (6)~ event controlled loop

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```
int grade , total;
total = 0 ;
cout<<"Enter the grade (-1 to stop) :";
cin>>grade;                          /* initialization */
do
{
    total = total + grade ;
    cout<<"Enter the grade (-1 to stop) :";
    cin>>grade;                      /* update */
} while ( grade != -1 ) ;
cout<<"total grades ="<<total;
```

Trace:

grade	total
5	0
	5
4	5
	9
7	9
	16
-1 (STOP)	

Output:

total grades = 16

While-Loop vs Do-While Loop

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While Loop

- PRE-TEST loop (entry-condition)
- The looping condition is tested before executing the loop body.
- Loop body may not be executed at all

Do-While Loop

- POST-TEST loop (exit-condition)
- The looping condition is tested after executing the loop body.
- Loop body is always executed at least once.

Example (7)

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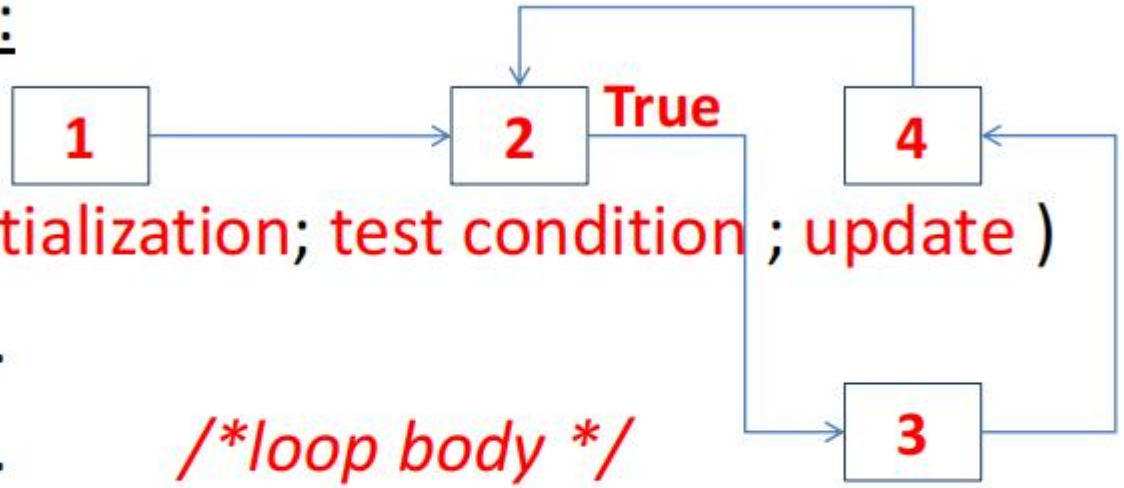
Write a program that reads 30 even values (ignore the odd values), compute their sum then print their average.

```
#include <iostream>
using namespace std;

int main() {
    int x, count = 1, sum = 0;

    cout << "Enter your data:" << endl;

    while (count <= 30) {
        cin >> x;
        if (x % 2 == 0) {
            sum += x;
            count++;
        }
    }

    cout << "Average = " << (sum / 30.0) << endl;

    return 0;
}
```

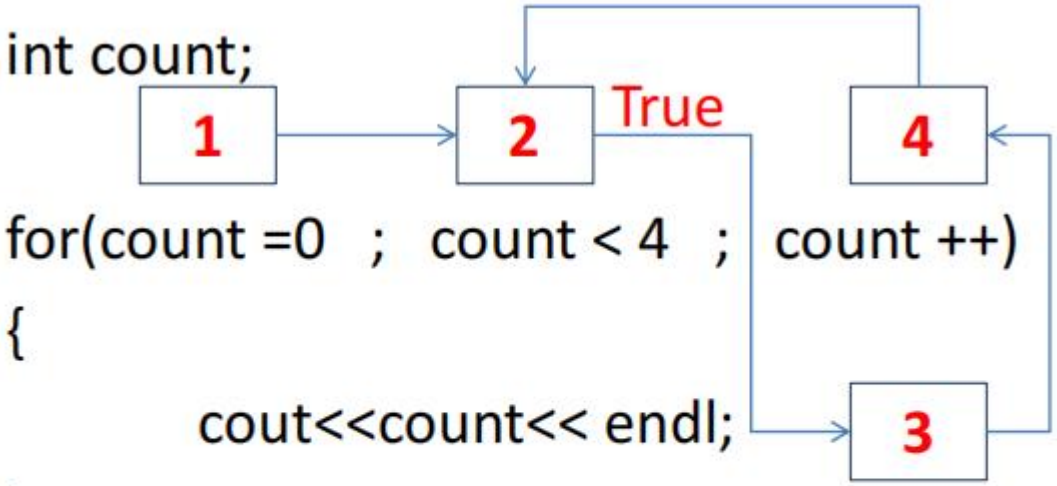
For~ Statements

Syntax:




```
for( initialization; test condition ; update )
{       .
        .       /*loop body */
        .
}
```

Example (1)



Model Answer

trace	output
count	
~~0~~	0
~~1~~	1
~~2~~	2
~~3~~	3
4	Done

More Examples

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- for(count =0 ; count < 10 ; count ++)
- for(count =0 ; count < 10 ; count =count + 1)
- for(count =10 ; count > 0 ; count --)
- for(count =10+y ; count > 0 ; count =count - 1)
- for(count =0 ; count < 100*y ; count =count + 5)
- for(count =0 ; count < 100%y ; count +=5)
- for(count =10*y ; count != 100 ; count +=2)

For Statement vs While Statement

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```
int count;
for( count =0 ; count < 4 ; count ++ )
{
        cout<<count<<"\n";
}
cout<<"Done";
```

```
int count=0 ;
while( count < 4 )
{
    cout<<count<<"\n";

    count ++ ;
}
cout<<"Done";
```

For Statement vs Do-While statement

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```
int count;
for( count =0 ; count < 4 ; count ++ )
{
        cout<<count<<"\n";
}
cout<<"Done";
```

```
int  count=0  ;
do
{
        cout<<count<<"\n";
        count ++ ;
} while( count < 4 );
cout<<"Done";
```

Nested Loops

```
initialize outer loop
while  ( outer loop condition )
{       . . .
        initialize inner loop
        while ( inner loop condition )
        {
                inner loop processing and update
        }
          . . .
}
```

Neested Loops (Cont.)

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```
for(initialization ; test condition ; update)
{
    . . .
        for(initialization ; test condition ; update)
        {
                inner loop processing and update
        }
    . . .
}
```

Example (1)

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```
int rows, columns;
for (rows=1; rows<=5; rows++)
    {
        for (columns=1; columns<=4; columns++)
            cout<<"*";


            cout<<"\n";
     }
```

outer Loop

Inner Loop

output

```
****
****
****
****
****
```

Example (2)


```
int rows, columns;
for (rows=1; rows<=5; rows++)
 {
    for (columns=1; columns<=rows; columns++)
        cout<<"*";


    cout<<"\n";
 }
```

outer Loop

Inner Loop

output

```
*
**
***
****
*****
```

Example (3) ~ Infinite Loops


```
int   count ; ’

  count =1 ;

while (count > 0)
{
      cout<<count<<“\n”;

 }
 cout<<“Done”;
```

1. Initialization

2. Test Condition

Example (4) ~ Infinite Loops

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```
int   count ;

count =1 ;

while (count > 0)
{
    cout<<count<<"\n";


}
cout<<"Done";
```

Example (5)

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Rewrite the following do-while Statement into for statement:

```
int num1, num2, c= 1, x=0;
do
{
    cin>>num1>>num2;
    if (num1 > num2) cout<<num1;
    else cout<<num2;
    ++x;    ++c;
} while(x < 10);
```

Example (6)

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Rewrite the following For-Statement into While-statement:

```
int i=10, s=0;
for (   ; i > 0;    )
{
   if(i % 2 == 0) s += i;
   i--;
}
cout<<s;
```

Example (7)

Show the output of the following program fragment?

```
i=0;
while(i<=5) {
        cout<<i<<10-i<<endl;
                }
```

Example (8)

Show the output of the following program fragment?

```
for (int x=3; x >= 1; x--) {
    for (int y=3; y >= 1; y--)
        if (y < x) break;
        else
        cout << x+y << "\t";
      cout << endl;
}
```

Example (9)

Show the output of the following program

```
int i=10, s=0;
for (   ; i > 5;    ){
        if(i % 2 == 0) s += i;
        i--;
}
cout<<s;
```

Example (10)

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Show the output of the following program fragment?

```
int c=1, x=5, y=6;
while(c<=6) {
   switch(c) {
    case 1: cout<< x++ / --y << endl;
    case 2: cout<< ++x/y << endl;
    case 3: cout<< x++%--y << endl; break;
    case 4: cout<< ++x % y << endl; break;
    default: cout<<"out of range" << endl;
   }
   c++;
}
```

Example (11)

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Write a program that does a survey on a certain question. The question has three possible answers. Run the survey on 50 people and then display the number of people who chose each answer.

Example: What is your favorite city?

A. Alexandria

B. Cairo

C. Luxor

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THANK YOU