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IT1010 – Introduction to Programming

Lecture 5 – Repetition statements in C

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Objectives

- At the end of the Lecture students should be able to
  - use the **while** repetition statement to execute statements in a program repeatedly.
  - use the **for** repetition statement to execute statements in a program repeatedly.
  - use the **do…while** repetition statement to execute statements in a program repeatedly.
  - Use **break** and **continue** statements to alter the flow of control.

Counter-Controlled Repetition

- Number of repetitions is known before the loop begins execution.
- A control variable is used to count the number of repetitions.
- The control variable is incremented (usually by 1) each time the group of instructions is performed.
- The repetition terminates when the counter exceeds number of repetitions.

Counter Controlled Repetition cont…

- Counter-controlled repetition requires:
  - The name of a control variable.
  - The initial value of the control variable
  - The increment (or decrement) by which the control variable is modified each time through the loop.
  - The condition that tests for the final value of the control variable.

Counter-Controlled Repetition with the while statement

```
//Counter-controlled repetition
# include <stdio.h>
int main(void)
{
        int counter =  1; // initialization
        while (counter  <=  10)  { //repetition condition
                printf("%d ",  counter); // display counter
                ++ counter; // increment
        } // end while
} //end function main
```

Output

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

General Format of a while Statement

```
while (condition) {
    statements
}
```

- The while statement body may contain single or a compound statement.

Example 02 - while statement

```
// class average program with counter-controlled repetition
# include <stdio.h>
//function main begins program execution
int main(void)
{
        int counter,  grade,  total;
        float average;
        total =0;
        counter = 1;
        while(counter <= 10){ //loop ten times
                printf("Enter grade :");
                scanf("%d", &grade); // read grade from user
                total = total + grade;
                counter = counter + 1; // increment counter
        } //end while
        average = (float)total / 10;
        printf("Class average is %.2f\n", average);
}//end function main
```

output

```
Enter grade : 98
Enter grade : 76
Enter grade : 71
Enter grade : 87
Enter grade : 83
Enter grade : 90
Enter grade : 57
Enter grade : 79
Enter grade : 82
Enter grade : 94
Class average is 81
```

Quiz

- What does the following program print?

```
# include <stdio.h>
int main(void)
{
        int x =  1,  y;
        while ( x  <=  5)  {
                y = x * x;
                printf("%d\n ",  y);
                ++ x;
        } // end while
} //end function main
```

Exercise 01

- Write a program that print all the even integers from 0 to 20.

Sentinel-Controlled Repetition

- When no indication is given of how many times the loop should execute, a sentinel value is used to terminate the loop.
- E.g : type -1 to terminate entering of marks
- A loop should have a statement to obtain data each time the loop is performed.
- Sentinel value must be chosen so that it cannot be confused with an acceptable input value.

Sentinel-Controlled Repetition

```
// class average program with sentinel-controlled repetition
# include <stdio.h>
int main(void)
{
        int grade,  total, counter;
        float average;

        total = 0;
        counter = 0;

        //get first input from the user
        printf("Enter grade, -1 to end :");
        scanf("%d",&grade);

        while(grade != -1){
                total = total + grade;
                counter = counter + 1;
                // get next grade from user
                printf("Enter grade, -1 to end :");
                scanf("%d",&grade);
        } //end while
        average = (float)total / counter;
        printf("Class average is %.2f\n", average);
}//end function main
```

Output

```
Enter grade, -1 to end : 75
Enter grade, -1 to end : 94
Enter grade, -1 to end : 97
Enter grade, -1 to end : 88
Enter grade, -1 to end : 70
Enter grade, -1 to end : 64
Enter grade, -1 to end : 83
Enter grade, -1 to end : 89
Enter grade, -1 to end : -1
Class average is 82.50
```

Exercise 02

- Write a program that calculates and prints the average of several integers. Assume the last value read with scanf is the sentinel 9999.

Counter-Controlled Repetition with the for statement

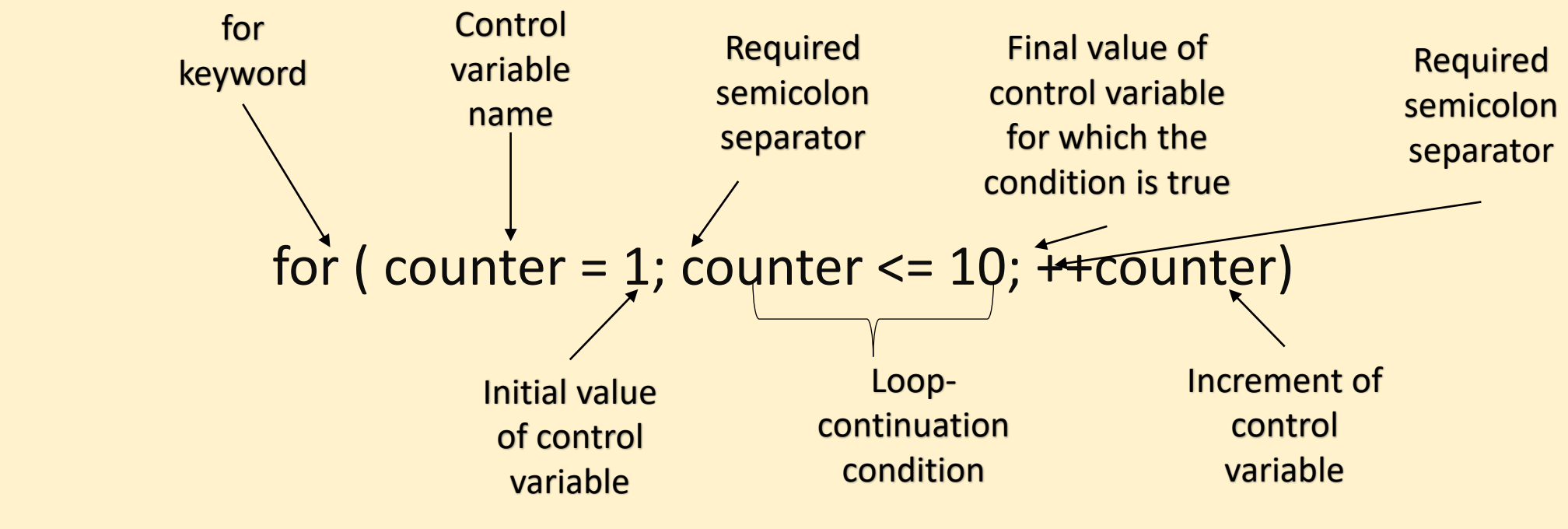
```
# include <stdio.h>
int main(void)
{
        int counter; // define counter

        for( counter  =  1;  counter  <= 10;  ++counter ){
                printf("%d\n", counter);
        }
}
```

Output

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

for Statement Header Components



General Format of a for Statement

```
for ( expression1; expression2; expression3){
        statement
    }
```

- Expressions in the for statement's header are optional
- Increment Expression acts like a standalone statement

Quiz

- What does the following program print?

```
# include <stdio.h>
int main(void)
{
        int  x;
        for( x = 3; x <= 15; x +=3 ){
                printf("%d\n", x);
        }
}
```

Exercise 03

- Write a program that will print the following sequence of values . (Hint : use a for loop)

3, 8, 13, 18, 23

do…while Repetition Statement

- Loop continuation condition is checked after the loop body is performed.
- Therefore, the loop body will be executed at least once.

```
do{
    statement
}while (condition);
```

Counter-Controlled Repetition with the do…while statement

```
# include <stdio.h>
int main(void)
{
        int counter = 1;

        do{
            printf("%d ", counter);
        } while (++counter <= 10);

}
```

Output

1 2 3 4 5 6 7 8 9 10

break statement

- The break statement, when executed in a while, for, do…while statement causes immediate exit from that statement.
- Program execution continues with the next statement.
- Common uses of the break statement are to escape early from a loop.

break statement example

```
//Using a break statement in a while statement
# include <stdio.h>
int main(void)
{
        int x =  1;
        while ( x  <=  10)  {
                if ( x == 5) {
                    break;
                }
                printf("%d ",  x);
                ++ x;
        } // end while
} //end function main
```

Output

```
1 2 3 4
```

continue statement

- The continue statement, when executed in a while, for and do...while statement, skips the remaining statements in the body of that control statement and perform the next iteration of the loop.
- In while and do...while , loop continuation test is evaluated immediately after the continue statement is executed.
- In the for statement, the increment expression is executed.

continue statement example

```
//Using  the continue statement in a while statement
# include <stdio.h>
int main(void)
{
        int x =  1;
        while ( x  <=  10)  {
                if ( x == 5) {
                    ++x;
                    continue;
                }
                printf("%d ",  x);
                ++ x;
        } // end while
} //end function main
```

Output

1 2 3 4 6 7 8 9 10

Nested iteration

```
# include <stdio.h>
int main(void)
{
        int i, j;
        for ( i = 1; i <= 5 ; ++i){
                for ( j = 1; j <= i; ++j){
                        printf(" *" );
                }
                printf("\n");
        }
}
```

Output

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

Exercise 04

- Write a program that will print the following output.

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```