

More Loops

CMSC 104, Fall 2012
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More Loops



Topics

- Counter-Controlled (Definite) Repetition
- Event-Controlled (Indefinite) Repetition
- for Loops
- do-while Loops
- Choosing an Appropriate Loop
- Break and Continue Statements

Reading

- Sections 4.1 - 4.6, 4.8, 4.9

Counter-Controlled Repetition (Definite Repetition)



- If it is known in advance exactly how many times a loop will execute, it is known as a **counter-controlled loop**.

```
int i = 1 ;  
while ( i <= 10 ) {  
    printf("i = %d\n", i) ;  
    i = i + 1 ;  
}
```

Event-Controlled Repetition (Indefinite Repetition)



- If it is NOT known in advance exactly how many times a loop will execute, it is known as an **event-controlled loop**.

```
sum = 0 ;
printf("Enter an integer value: ");
scanf("%d", &value);
while ( value != -1) {
    sum = sum + value ;
    printf("Enter another value: ");
    scanf("%d", &value);
}
```

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Event-Controlled Repetition (con't)



- An event-controlled loop will terminate when some **event** occurs.
- The event may be the occurrence of a sentinel value, as in the previous example.
- There are other types of events that may occur, such as reaching the end of a data file.

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The 3 Parts of a Loop



```
#include <stdio.h>

int main () {
    int i = 1; // initialization of loop control variable

    /* count from 1 to 100 */
    while ( i < 101 ) { // test of loop termination condition
        printf ("%d ", i);
        i = i + 1; // modification of loop control variable
    }
    return 0 ;
}
```

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The for Loop Repetition Structure



- The **for** loop handles details of the counter-controlled loop “automatically”.
- The initialization of the the loop control variable, the termination condition test, and control variable modification are handled in the **for** loop structure.

```
for ( i = 1; i <= 100; i = i + 1 ) {  
  ↑      ↑      ↑  
  initialization test modification  
}
```

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When Does a for Loop Initialize, Test and Modify?



- Just as with a while loop, a for loop
 - initializes the loop control variable before beginning the first loop iteration,
 - modifies the loop control variable at the very end of each iteration of the loop, and
 - performs the loop termination test before each iteration of the loop.
- The for loop is easier to write and read for counter-controlled loops.

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A for Loop That Counts From 0 to 9



```
for ( i = 0; i < 10; i = i + 1 ) {  
  printf ("%d\n", i);  
}
```

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We Can Count Backwards, Too



```
for ( i = 9; i >= 0; i = i - 1 ) {  
    printf ("%d\n", i);  
}
```

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We Can Count By 2's ... or 7's ... or Whatever



```
for ( i = 0; i < 10; i = i + 2 ) {  
    printf ("%d\n", i);  
}
```

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The do-while Repetition Structure



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

- The body of a **do-while** is ALWAYS executed at least once. Is this true of a **while** loop? What about a **for** loop?

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Example



```
do {
    printf ("Enter a positive number: ");
    scanf ("%d", &num);
    if ( num <= 0 ) {
        printf ("\nThat is not positive. Try again\n");
    }
} while ( num <= 0 );
```

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An Equivalent while Loop



```
printf ("Enter a positive number: ");
scanf ("%d", &num);
while ( num <= 0 ) {
    printf ("\nThat is not positive. Try again\n");
    printf ("Enter a positive number: ");
    scanf ("%d", &num);
}
```

- Note the priming read here—we didn't need one in the equivalent do-while loop

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An Equivalent for Loop



•You can use a *for* loop for an event-controlled loop... but it is very awkward:

```
printf ("Enter a positive number: ");
scanf ("%d", &num);
for ( ; num <= 0; ) {
    printf ("\nThat is not positive. Try again\n");
    printf ("Enter a positive number: ");
    scanf ("%d", &num);
}
```

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So, Which Type of Loop Should I Use?



- Use a **for** loop for counter-controlled repetition.
- Use a **while** or **do-while** loop for event-controlled repetition.
 - Use a **do-while** loop when the loop must execute at least one time.
 - Use a **while** loop when it is possible that the loop may never execute.

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Nested Loops



- Loops may be **nested (embedded)** inside of each other.
- Actually, any control structure (sequence, selection, or repetition) may be nested inside of any other control structure.
- It is common to see nested for loops.

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Nested for Loops



```
for ( i = 0; i < 5; i = i + 1 ) {  
  for ( j = 0; j < 3; j = j + 1 ) {  
    if ( j % 2 == 0 ) { ← How many times is the "if"  
      printf ("O");      statement executed?  
    } else {  
      printf ("X");  
    }  
  }  
  printf ("\n");  
}
```

What is the output ?

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The break Statement



- The **break** statement can be used in **while**, **do-while**, and **for** loops to cause premature exit of the loop.
- THIS IS **NOT** A RECOMMENDED CODING TECHNIQUE.

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Example break in a for Loop



```
#include <stdio.h>
int main () {
    int i;
    for (i = 1; i < 10; i = i + 1) {
        if (i == 5) {
            break ;
        }
        printf ("%d ", i);
    }
    printf ("\nBroke out of loop at i = %d.\n", i);
    return 0 ;
}
```

OUTPUT:

1 2 3 4

Broke out of loop at i = 5.

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The continue Statement



- The **continue** statement can be used in **while**, **do-while**, and **for** loops.
- It causes the remaining statements in the body of the loop to be skipped for the current iteration of the loop.
- THIS IS **NOT** A RECOMMENDED CODING TECHNIQUE.

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Example continue in a for Loop



```
#include <stdio.h>
int main () {
    int i;
    for (i = 1; i < 10; i = i + 1) {
        if (i == 5) {
            continue;
        }
        printf ("%d ", i);
    }
    printf ("\nDone.\n");
    return 0;
}
```

OUTPUT:

1 2 3 4 6 7 8 9

Done.
