

## While Statements

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- We often need to execute code (statements) many times.
- **if** statements only allow us to execute or not execute code. in other words they allow us to execute code 0 or 1 times  
**while** loops allow us to execute code 0 or more times
- Like **if**, **while** loops have a condition but **while** statements execute their body until the condition becomes false

```
while (CONDITION) {  
    stmt1;  
    stmt2;  
    ...  
    stmtn;  
}
```

# While Statements

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- C has other looping constructs - but **while** is all you need
- **for** loops can be a little more concise/convenient  
we'll see them later - for now use **while**
- Often use a **loop counter** variable to count loop repetitions
- Can then have a **while** loop execute **n** times.

## while Loop - Loop Counter Example

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```
// read an integer n  
// print n asterisks  
int loop_counter, n;  
  
printf("How many asterisks? ");  
scanf("%d", &n);  
  
loop_counter = 0;  
while (loop_counter < n) {  
    printf("*");  
    loop_counter = loop_counter + 1;  
}  
printf("\n");
```

## while Loop - Loop Counter Pattern

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Here is the programming pattern for a while that executes  $n$  times:

```
int i = 0;
while (i < n) {
    //
    // statements the loop needs to perform
    //

    i = i + 1;
}
```

## While Statements - Termination

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- Can control termination (stopping) of while loops in many ways.
- Easy to write **while** loop that do not terminate.
- Often a **sentinel** variable is used to stop a while loop when a condition occurs in the body of the loop

## while Loop - Sentinel Variable Example

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```
// read numbers printing whether even or odd  
// stop if zero read  
int stop_loop, numbers;  
  
stop_loop = 0;  
while (stop_loop != 1) {  
    scanf("%d", &number);  
    if (number == 0) {  
        stop_loop = 1;  
    } else if (number % 2 == 1) {  
        printf("%d is odd.\n", number);  
    } else {  
        printf("%d is even.\n", number);  
    }  
}
```

## while Loop - Sentinel Variable Pattern

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Here is the programming pattern for a while loop that executes until the sentinel variable is changed.

```
stop_loop = 0;
while (stop_loop != 1) {
    //
    // statements the loop needs to perform
    //
    if (.....) {
        stop_loop = 1;
    }
    //
    // perhaps more statements
    //
}
```

## Nested While Loops

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- Often need to nest while loops.
- Need a separate loop counter variable for each nested loop.

```
// print a square of 10x10 asterisks

int i = 0;
while (i < 10) {

    int j = 0;
    while (j < 10) {
        printf("* ");
        j = j + 1;
    }

    printf("\n");
    i = i + 1;
}
```



## Nested While Loops

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- Nested while loops are used when repetition of repetition is required.
- This often happens in problems which have a two-dimensional nature, such as printing a square of asterisks.
- Remember to reset the value of the inner while loop's counter variable each time it runs!