`for` Loops

Lecture 14
Sections 5.1 - 5.6

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1. Loops Controlled by a Counter

2. `for` Loops

3. Assignment

Outline

1. Loops Controlled by a Counter

2. `for` Loops

3. Assignment

Loops Controlled by a Counter

- If we know in advance the number of times a loop should be executed, then we can count the iterations and quit at the proper time.
- Establish a counter and do the following.
    - Initialize the counter to 0.
    - Test the counter on each iteration.
    - Increment the counter.

Loops Controlled by a Counter

- If the counter controls the loop, then the testing does not involve the input.
- Therefore, the pattern prompt-read-test-action is no longer in effect.
- Indeed, there may not be any input.
- If there is input, then it is typically part of the action.

Unrolling the Loop

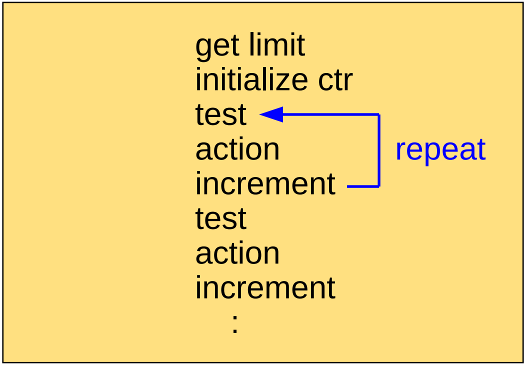
- The sequence should be
  1. Get the desired number of iterations (the limit)
  2. Initialize a counter to 0
  3. Compare the counter to the limit (test)
  4. Perform the action
  5. Increment the counter
  6. Test the counter
  7. Perform the action
  8. Increment the counter
  9. ⋮

Loops Controlled by a Counter

```
get limit
initialize ctr
test
action
increment
test
action
increment
   ⋮
```

The “unrolled” loop

Loops Controlled by a Counter

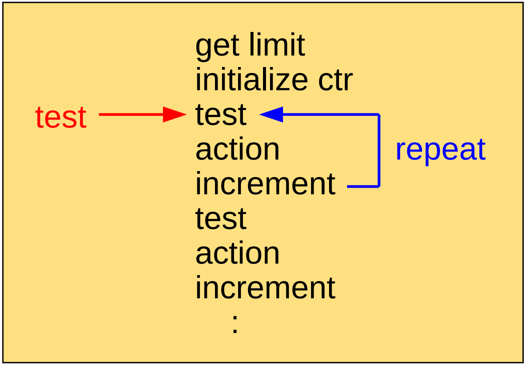


get limit
initialize ctr
test
action
increment
test
action
increment
:

repeat

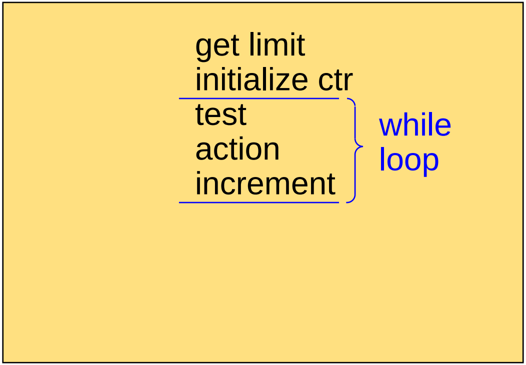
Repeat after incrementing

Loops Controlled by a Counter



The *test* is here

Loops Controlled by a Counter



get limit
initialize ctr
test
action
increment

while
loop

This must be the **`while`** loop

Loops Controlled by a Counter

Loops Controlled by a Counter

```
int limit;
cin >> limit;           // Get the limit
int counter = 0;        // Initialize the ctr
while (counter < limit) // Test
{
    action              // Action
    counter++;          // Increment
}
```

Example of a Counter

- Example
  - `CounterSum.cpp`

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The **for** Statement

The **for** Statement

```
for (init-ctr; test-ctr; incr-ctr)
{
    action
}
```

- The form of the **for** statement.

The **for** Statement

Example

```
int limit;
cin >> limit;
int sum = 0;
for (int i = 0; i < limit; i++)
{
    cout << "Enter a number:  ";
    cin >> number;
    sum += number;
}
```

- Add up 10 numbers.

Examples of a `for` Loop

- Examples
  - `ForSum.cpp`
  - `CountLetters.cpp`

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Assignment

Assignment

- Read Sections 5.1 - 5.6.