CISC 1600/1610 Computer Science I

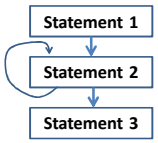
Flow of control - Loops

Professor Daniel Leeds
dleeds@fordham.edu
JMH 328A

Alternatives to "linear execution"

Repeated actions

```
> ./myProgram
Infinite bottles of beer. Take one down.
Infinite bottles of beer. Take one down.
Infinite bottles of beer. Take one down.
Infinite bottles of beer. Take one down.
>
```



The `while` loop

```
while ( condition )
   statement_to_repeat;

                OR

while (condition)
{
   statement_to_repeat1;
   . . .
   statement_to_repeatN;
}
```

block of statements

`condition` – a Boolean expression

Just a reminder from our earlier `if-else` slides

- Boolean expressions are either true or false
- Conditions often consist of **comparisons**
  - age ≥ 21 // can buy drinks
  - age < 4 // can ride subway for free
  - year = 2 // you are a sophomore

How can we output "Hello world" 4 times?

```
int x=4;
while ( x>0 )
{
   cout << "Hello world.\n";
   x--;
}
```

Remember `x--;` same as `x=x-1;`

Repeats until x≤0

Execution of while loop

- If `condition` is true, enter `while` loop
  - Complete all statements in block
  - Return to top (re-evaluate `condition`)
- Otherwise, continue to statements beyond loop

Execution of while loop

- If `condition` is `true`, enter `while` loop
  - Complete all statements in block
  - Return to top (re-evaluate `condition`)
- Otherwise, continue to statements beyond loop

```
int x=2;
while ( x>0 )
{
   x--;
   cout << "Hello world.\n";
}
```

How many "Hello world"s are output?

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What code will do this for us?

```
> ./myProgram
1 mississippi
2 mississippi
3 mississippi
4 mississippi
5 mississippi
>
```

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do-while loop

- `while` evaluates `condition`, then performs statements if `condition` is **`true`**
- `do-while` performs statements, then evaluates `condition` to determine whether to perform statements again

```
do
{
   statement1;
   . . .
   statement N;
}
while ( condition );
```

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What does this code do?

```
int main () {
   int a=5;
   do {
      cout << "one ";
      a-=2;
      cout << "two\n";
   } while ( a > 0);
   return 0;
}
```

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What does this code do?

```
int main () {
   int a=5;
   do {
      cout << "one ";
      a-=2;
      cout << "two\n";
   } while ( a != 0);
   return 0;
}
```

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Beware infinite loops!

- Loops that never stop are called infinite loops
- Typically, write code so each loop will stop

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`for` loop

a `while` loop alternative

```
for ( init; condition; update )
{
   statement1;
   . . .
   statement N;
}
```

typical example:

```
int i, product=1;
for ( i=1; i<=5; i++)
{
   product = product*i;
}
```

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`init` – initializes variable

`condition` – statement about variable, must stay true for loop to keep running

`update` – updates the variable after each loop execution

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Reviewing scope

Counter `i` exists outside of loop

```
int i, product=1;
for ( i=1; i<=5; i++)
{
   product = product*i;
}
```

Counter `i` exists **only** inside of loop

```
int product=1;
for ( int i=1; i<=5; i++)
{
   product = product*i;
}
```

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What does this code do?

```
int main () {
   int i, product=1;
   for ( i=1; i<=5; i++);
      product = product*i;
   cout << i << "! = " << product << endl;

   return 0;
}
```

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Beware the misplaced `;`

Placing a semicolon after the parentheses of a `for` loop causes an empty statement as the body of the loop

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Picking a loop

- `do-while` if you need to perform the action at least once
- `for` if there is a standard repeated mathematical update to your loop variable (e.g., count++)
- `while` loop for less-standard loop variable updates

"loop variable" is the variable tested by the condition in your given loop

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