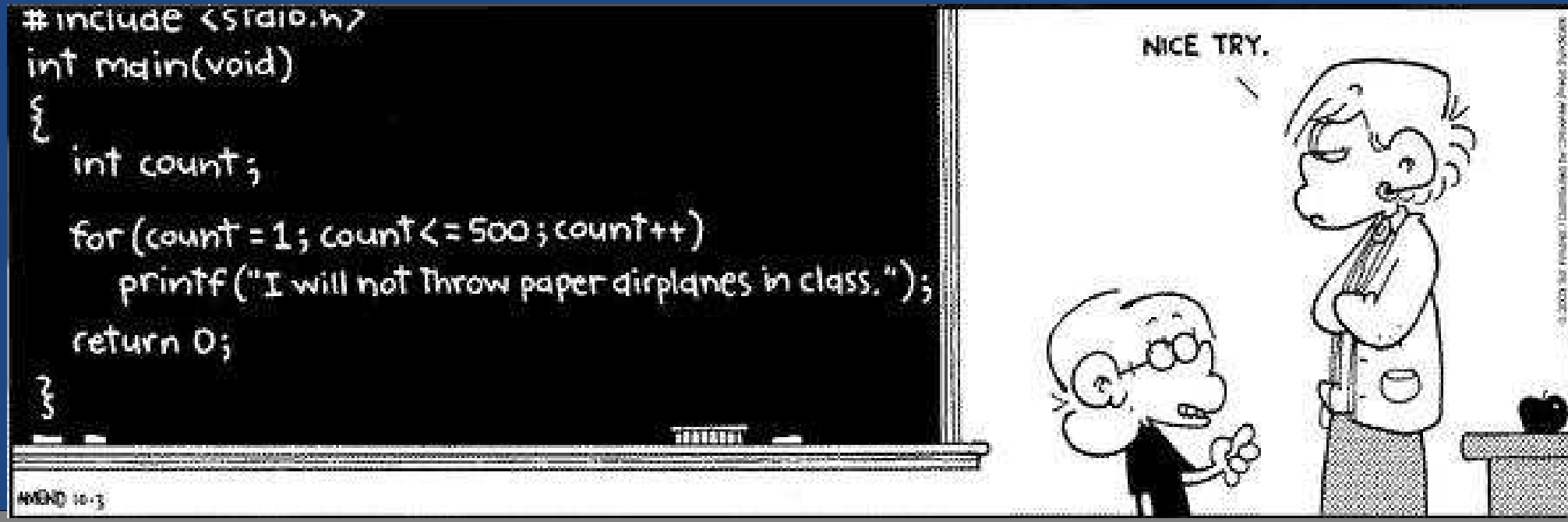
Slides #5.2

While Loops

Chapter 2.4 – 3.4 (some parts)



How can you write a program to...

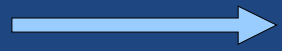
print numbers 1 – 10?

add prime numbers 1 to 1,000?

find 15 digit prime numbers?

simulate 10,000 vaccine ideas?

Increment and Decrement

- Add 1 to x:
  Subtract 1 from x:
- Example: Equivalent:
  - int index = 0;
    index++; 
  - int sum = 100;
    sum--; 
- Prefix vs Postfix:
  - b++ and ++b are a little different; we may cover it later. Just don't do silly things:
    int plainSilly = ++x * y-- - x++;

while

Loop means..

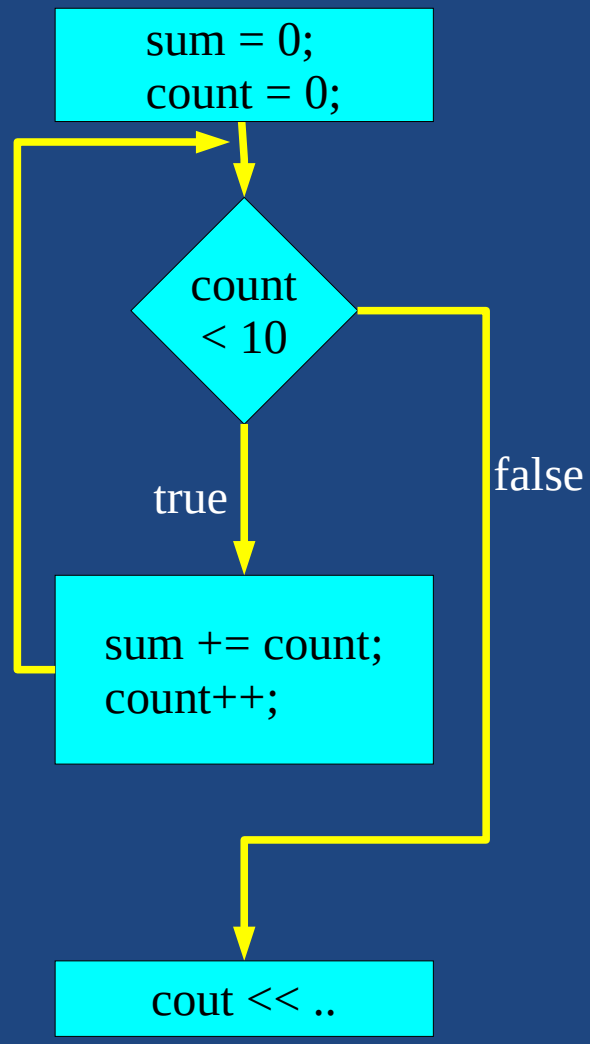
- A while loop executes the body...

```
int sum = 0;

int count = 0;
while (count < 10) {
    sum += count;
    count++;
}

cout << “Total: ” << sum;
```

Condition tested..



Explain this code

```
#include <iostream>
using namespace std;

int main()
{
	const int MAX = 10;
	cout << "Enter value between 1 and 9: ";
	int choice = 0;
	cin >> choice;

	// ..
	// ..
	while (choice >= MAX) {
		cout << "ERROR: Re-enter a value: ";
		cin >> choice;
	}

	cout << "Great choice of "
		<< choice << endl;

	// ..
	// ..
	cout << "#s between 1 and "
		<< choice << ":\n";
	int i = 1;
	while (i <= choice) {
		cout << i << endl;
		i++;
	}

	return 0;
}
```

Looping Through Letters

```
// Print a phrase down the diagonal
#include <iostream>
#include <iomanip>
using namespace std;

int main()
{
    cout << "Enter a word: ";
    string word;
    cin >> word;

    int i = 0;
    while (i < word.length()) {
        cout << setw(i + 1) << word.at(i) << endl;
        i++;
    }
    return 0;
}
```

```
Enter a word: Hello!
H
 e
  l
   l
    o
     !
```

Get the i^{th} letter of the word (0 indexed)

Infinite Loops

- Infinite Loop:..
  - Example: a while loop with its condition always true.

```
while (true) {
    cout << “Still going.....”;
}
```

- or:

```
int index = 0;
while (index < 10) {
    cout << “Not done.”;
    index --;
}
```

More Infinite Loops

- Mystery Infinite Loop #1:

```
int i = 0;
while (i < 10); {
    cout << “Not done.”;
    i ++;
}
```

Loop runs the empty statement an infinite number of times.

- Mystery Infinite Loop #2:

```
int j = 0;
while (j < 10)
    cout << “Not done.”;
    j ++;
```

j++ is the first statement after the loop (not part of it).

Review

- What is printed to the screen?

```
int i = 0;
if (i < 4) {
    cout << i << endl;
} else {
    cout << 4 << endl;
}
```

- What is printed to the screen?

```
int i = 5;
while (i > 0) {
    cout << i;
    i -= 2;
}
```

Nested Loops

```
How many people in your group? (-1 to quit)
: 1
Please stand on square 1
How many people in your group? (-1 to quit)
: 3
Please stand on square 7
Please stand on square 13
Please stand on square 19
How many people in your group? (-1 to quit)
: -1
```

```
// Help space out users in a line
#include <iostream>
using namespace std;

int main()
{
    const int BLANK_SQUARES_BETWEEN_PEOPLE = 6;

    int nextSquareToStandOn = 1;
    int choice = 0;
    while (choice >= 0) {
       cout << "How many people in your group? (-1 to quit)" << endl;
       cout << ": ";
       cin >> choice;

       int i = 0;
       while (i < choice) {
          cout << "Please stand on square " << nextSquareToStandOn << endl;
          nextSquareToStandOn += BLANK_SQUARES_BETWEEN_PEOPLE;
          i++;
       }
    }

    return 0;
}
```

= standHere.cpp

Arbitrary Nested Loops

- You can nest loops:

```
int i = 0;
while (i < 3) {
    int j = 0;
    while (j <= i) {
        cout << j;
        j++;
    }
    cout << endl;
    i++;
}
```

What is the output?

Review

- What will each of these print?

```
const int LOOPS = 5;
int count = 0;
while (count < LOOPS) {
	cout << "Loop " << count << endl;
	count++;
}
```

```
const int LOOPS = 5;
int num = LOOPS;
while (num > 0) {
	int count = num;
	while (count < LOOPS) {
		cout << count << “, “;
		count++;
	}
	cout << endl;
	num --;
}
```

Suggested Questions

- Write a program which outputs the following:

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

- What is the output of the following code:

```
int i = 0;
while (i < 4) {
    int j = i;
    while (j >= 0) {
        cout << “$”;
        j--;
    }
    cout << “\n”;
    i++;
}
```

Summary

- Loops execute code many times (0 or more)

```
while ( condition ) {
    myStatements();
    iWantTo();
    repeat();
}
```