

MIT-IIT Robotics Program

Logic Flow – Booleans, Logical & Relational Operators, Conditionals, While Loops

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Outline

- 1 Recap
- 2 Logical Expressions
 - Booleans
 - New Operators
- 3 Conditionals
 - If Else Statements
 - Nested Conditionals
 - Exercises
- 4 Loops
 - While Loop
 - Counters
 - Exercises

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Outline

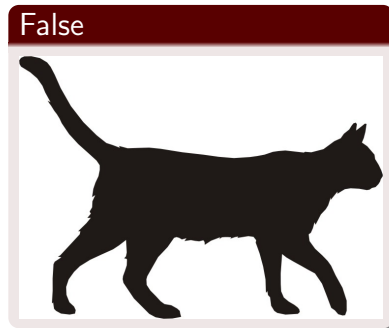
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Booleans

A New Data Type

Booleans only have two possible values – True or False

Statement: Schrodinger's cat is dead !



Booleans

A New Data Type

- In C++ we have a **bool** data-type

```
bool var = true;
```
- Actually stored as integer (**true** is 1 and **false** is 0)

Booleans

A New Data Type

- In C++ we have a **bool** data-type

```
bool var = true;
```

- Actually stored as integer (**true** is 1 and **false** is 0)
- In the other direction
 - Zero value is **true**
 - Non-Zero value is **false**

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Relational Operators

Operation	Common Symbol	C++ Symbol	Expression
Equals	$=$	<code>==</code>	$(a == b)$
Not Equals	\neq	<code>!=</code>	$(a != b)$
Less Than	$<$	<code><</code>	$(a < b)$
Greater Than	$>$	<code>></code>	$(a > b)$
Less Than Equals	\leq	<code><=</code>	$(a \leq b)$
Greater Than Equals	\geq	<code>>=</code>	$(a \geq b)$

Logical Operators

Operation	Symbol	Expression
And	<code>&&</code>	$(a \neq b) \ \&\& \ (a \% 2 == 0)$
Or	<code> </code>	$(a > b) \ \ (a/2 > 4)$
Not	<code>!</code>	$!(a == b)$

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If and Else

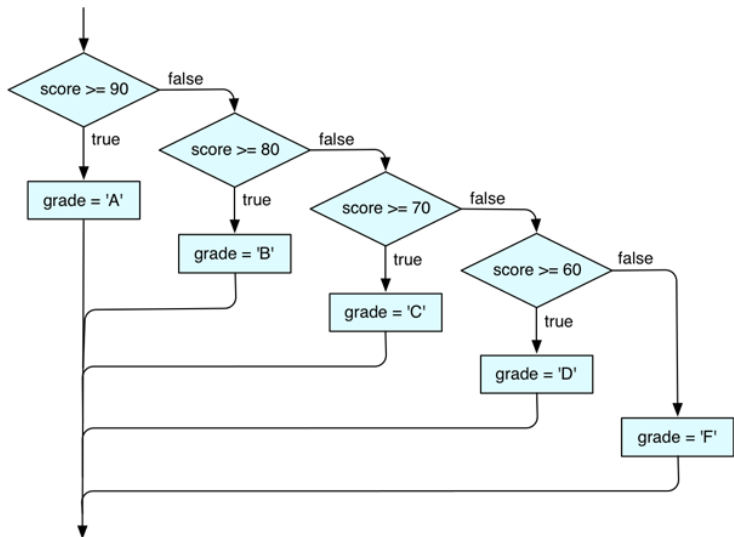
The **else** statement is optional.

```
if (temperature >= 38)
    cout << "Buy an ice cream cone" << endl;
else
    cout << "Buy a lollipop" << endl;
```

Must use a block (surrounded by curly braces) for more than one line.

```
if (number_of_lines > 1) {
    cout << "More than one line.";
    cout << "Have to use a block.";
}
else{
    cout << "Curly braces are optional.";
}
```

The if...else if...else Statement



The if...else if...else Statement

To test multiple conditions, we can cascade if statements

```
if (temperature >= 35) {  
    cout << "Buy an ice cream cone" << endl;  
}  
else if (temperature >= 25) {  
    cout << "Buy a lollipop" << endl;  
}  
else if (temperature >= 15) {  
    cout << "Buy a coffee" << endl;  
}  
else {  
    cout << "Buy a sweater !" << endl;  
}
```

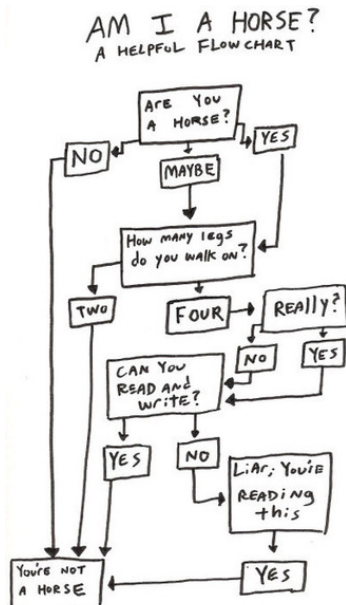
The **if...else if...else** Statement

- The first statement must be an *if*.
- After this, there can be any number of *if else* statements.
- At the end, there can be one (or zero) *else* statement.

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Nested Conditionals



Nested Conditionals

```
if (temperature >= 35) {  
    if (money >= 45) {  
        cout << "Buy a Cornetto" << endl;  
        money -= 45;  
        if (money > 0) {  
            cout << "Buy a candy" << endl;  
        }  
        else  
            cout << "Out of Money :(" << endl;  
    }  
    else  
        cout << "Buy a Pepsi" << endl;  
}  
else {  
    cout << "Buy a lollipop" << endl;  
}
```

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Lab Time !

Write programs for each of the following specifications

Input	Output
Four integers	Maximum and second max value
Three points (vertices of triangle) in terms of (x, y) coordinates	Whether the triangle is equilateral, isosceles, or scalene
Cutoff for A, B, C grades, and also marks of one student (out of 100)	Whether the cutoffs are valid, and what grade the student received.
All number from 1 to 5 ?	d
c	d

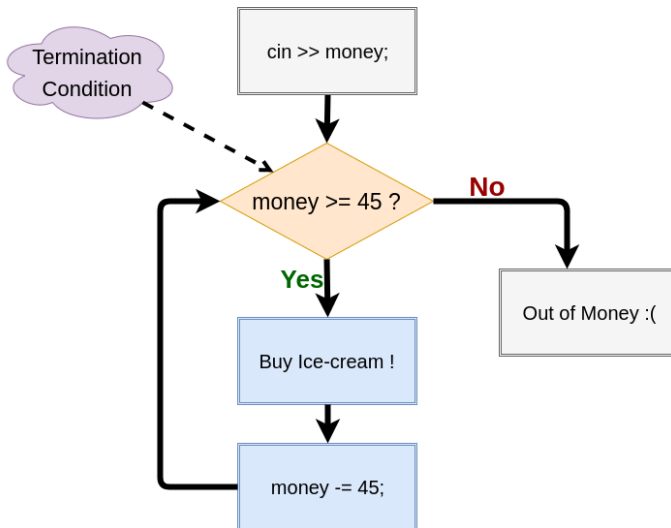
Age Guessing Game

Write a program that asks the user questions of the form "Is your age less than 50". The user can only respond with 1 (yes) or 0 (no).

Challenge – Guess age in seven questions or less.

Iteration

Repeat the Same Instructions many times



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While Loop

```
cin >> money;
while (money >= 45){
    cout << "Buy an ice ceam cone" << endl;
    money -= 45;
    cout << "Money remaining: " << money << endl;
}
cout << "Out of Money" << endl;
```

If the input *money* is 200, this results in the following output.

```
Buy an ice ceam cone
Money remaining: 155
Buy an ice ceam cone
Money remaining: 110
Buy an ice ceam cone
Money remaining: 65
Buy an ice ceam cone
Money remaining: 20
```

Compare this to the If Statement

```
cin >> money;  
if (money >= 45){  
    cout << "Buy an ice ceam cone" << endl;  
    money -= 45;  
    cout << "Money remaining: " << money << endl;  
}  
cout << "Out of Money" << endl;
```

If the input *money* is 200, this results in the following output.

```
Buy an ice ceam cone  
Money remaining: 155
```

While Loop

```
cin >> money;
while (money >= 45){
    cout << "Buy an ice ceam cone" << endl;
    money -= 45;
    cout << "Money remaining: " << money << endl;
}
cout << "Out of Money" << endl;
```

If the input *money* is 200, this results in the following output.

```
Buy an ice ceam cone
Money remaining: 155 . . .
```


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Unknown Number of Inputs

- User specifies the number of inputs
 - Take N inputs and arrange them in ascending order.
 - Find the average of N numbers

- Thoughts ?

- Use a counter variable
 - Initialize counter to zero

```
int counter = 0;
```

- Increment counter at every loop iteration

```
counter += 1; OR counter++;
```

- Terminate when counter hits N

```
while (counter < N) { . . . }
```

Using a Counter

```
int counter = 0, N;  
cin >> N;  
while (counter < N) {  
    // Body of Loop. Take input, process data etc . .  
    counter++;  
    cout << "Counter Value:" << counter << endl;  
}  
cout << "Exited Loop\n";
```

Using a Counter

```
int counter = 0, N;  
cin >> N;  
while (counter < N) {  
    // Body of Loop. Take input, process data etc . .  
    counter++;  
    cout << "Counter Value:" << counter << endl;  
}  
cout << "Exited Loop\n";
```

If the input N is 6, this results in the following output.

```
Counter Value:1  
Counter Value:2  
Counter Value:3  
Counter Value:4  
Counter Value:5  
Counter Value:6  
Exited Loop
```

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