MIT-IIT Robotics Program

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

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May 28, 2017

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

Booleans

A New Data Type

Booleans only have two possible values – True or False

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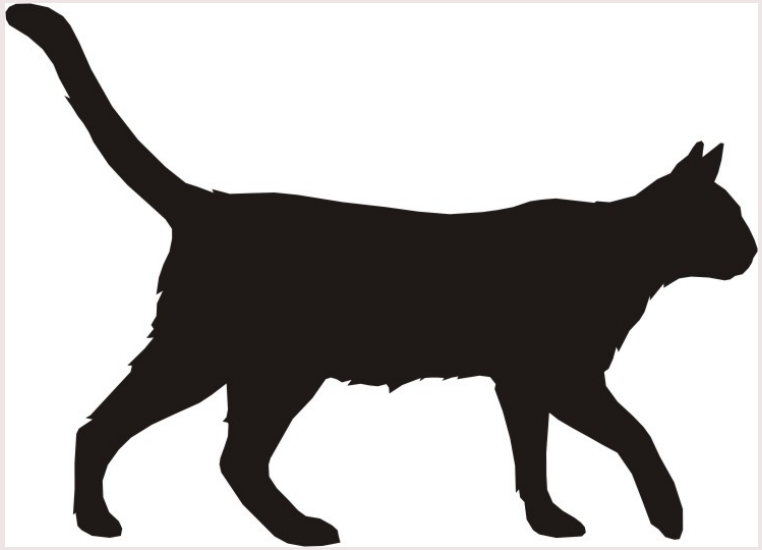
Booleans only have two possible values – True or False

Statement: Schrodinger's cat is dead !

True

False



Booleans

A New Data Type

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```
bool var = true;
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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**

Outline

Relational Operators

Operation	Common Symbol	C++ Symbol	Expression
Equals	$=$	$==$	$(a == b)$
Not Equals	$\neq$	$!=$	$(a != b)$

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Equals	$=$	$==$	$(a == b)$
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Less Than	$<$	$<$	$(a < b)$
Greater Than	$>$	$>$	$(a > b)$
Less Than Equals	$\leq$	$<=$	$(a <= b)$
Greater Than Equals	$\geq$	$>=$	$(a >= b)$

Logical Operators

Operation	Symbol	Expression
And	&&	$(a \mathrel{!}= b)$ && $(a\%2 == 0)$
Or	||	$(a > b)$ || $(a/2 > 4)$
Not	!	$!(a == b)$

Outline

If and Else

The **else** statement is optional.

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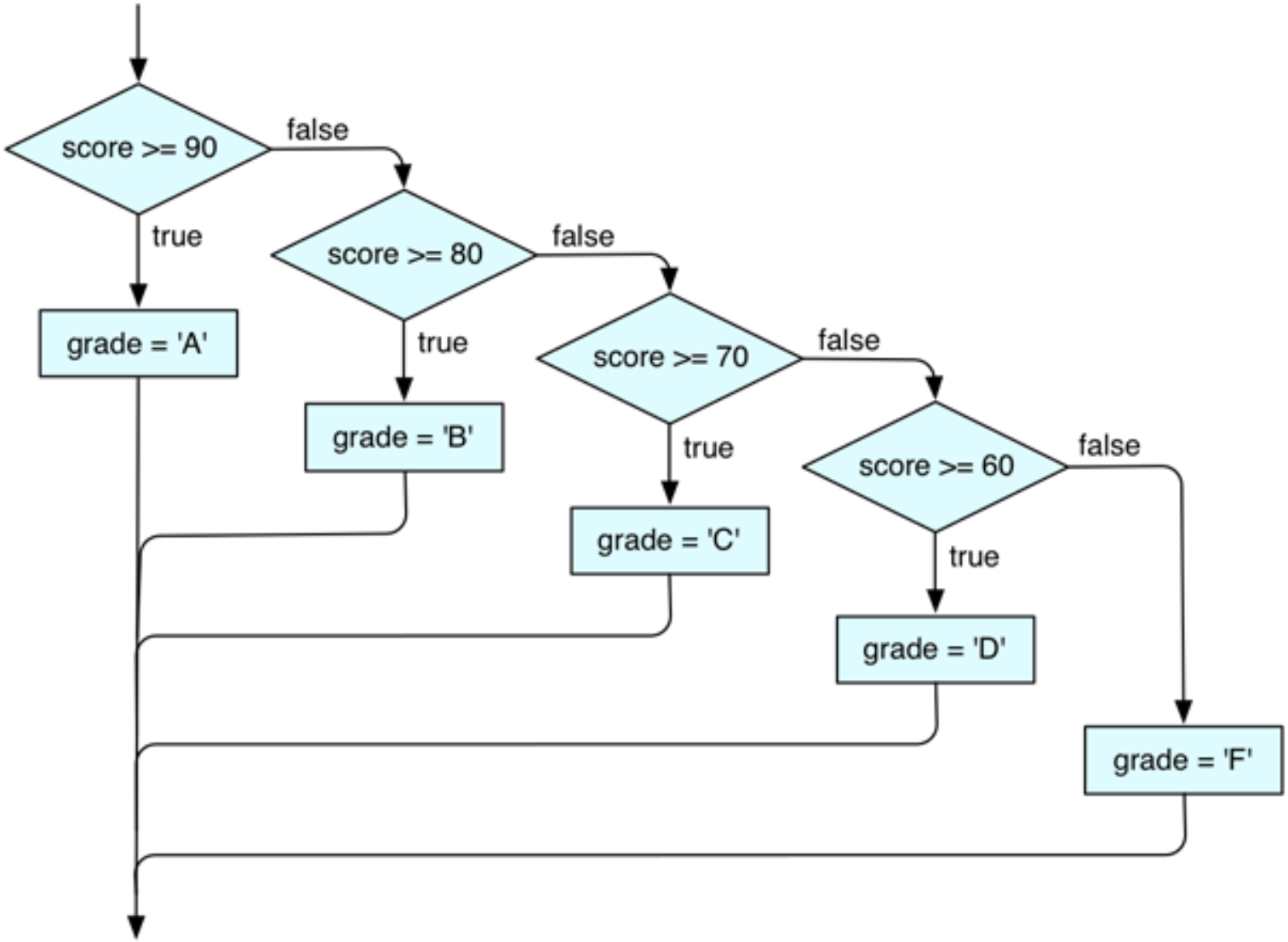
    cout << "Buy a lollipop" << endl;
```

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 ceam 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

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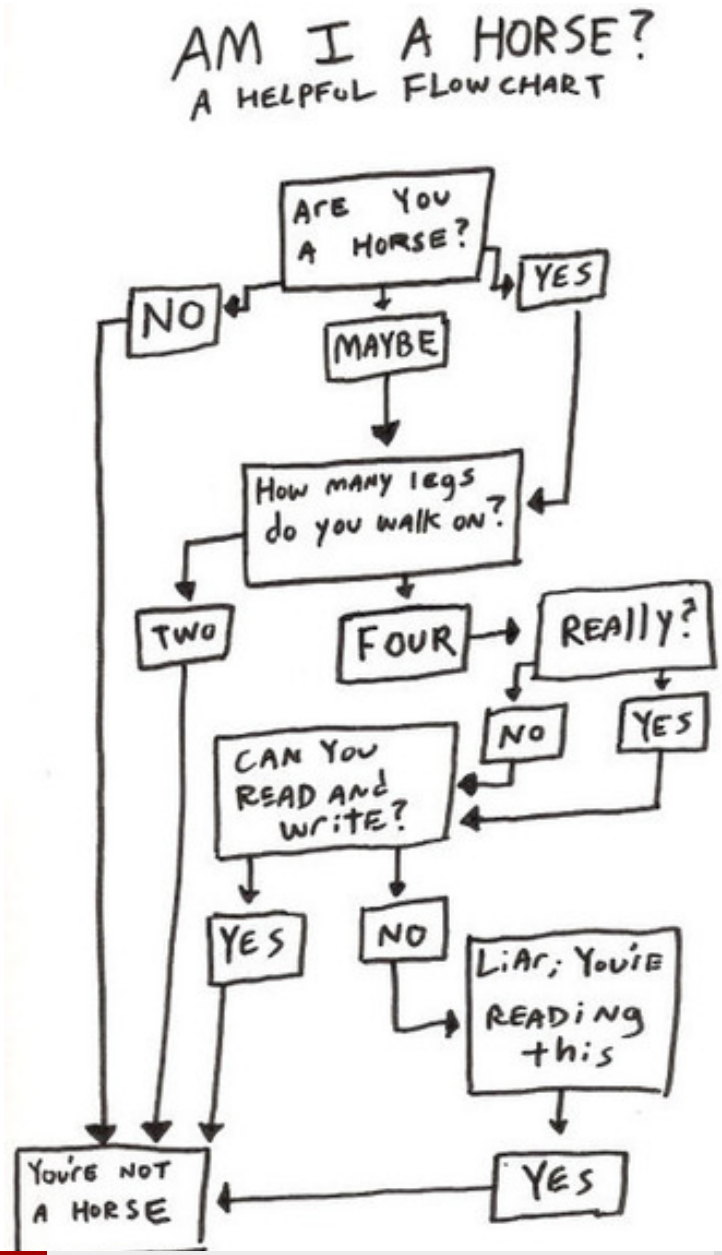
- The first statement must be an **if**.
- After this, there can be any number of **else if** statements.
- At the end, there can be one (or zero) **else** statement.

Outline

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;
}
```

Outline

Lab Time !

Write programs for each of the following specifications

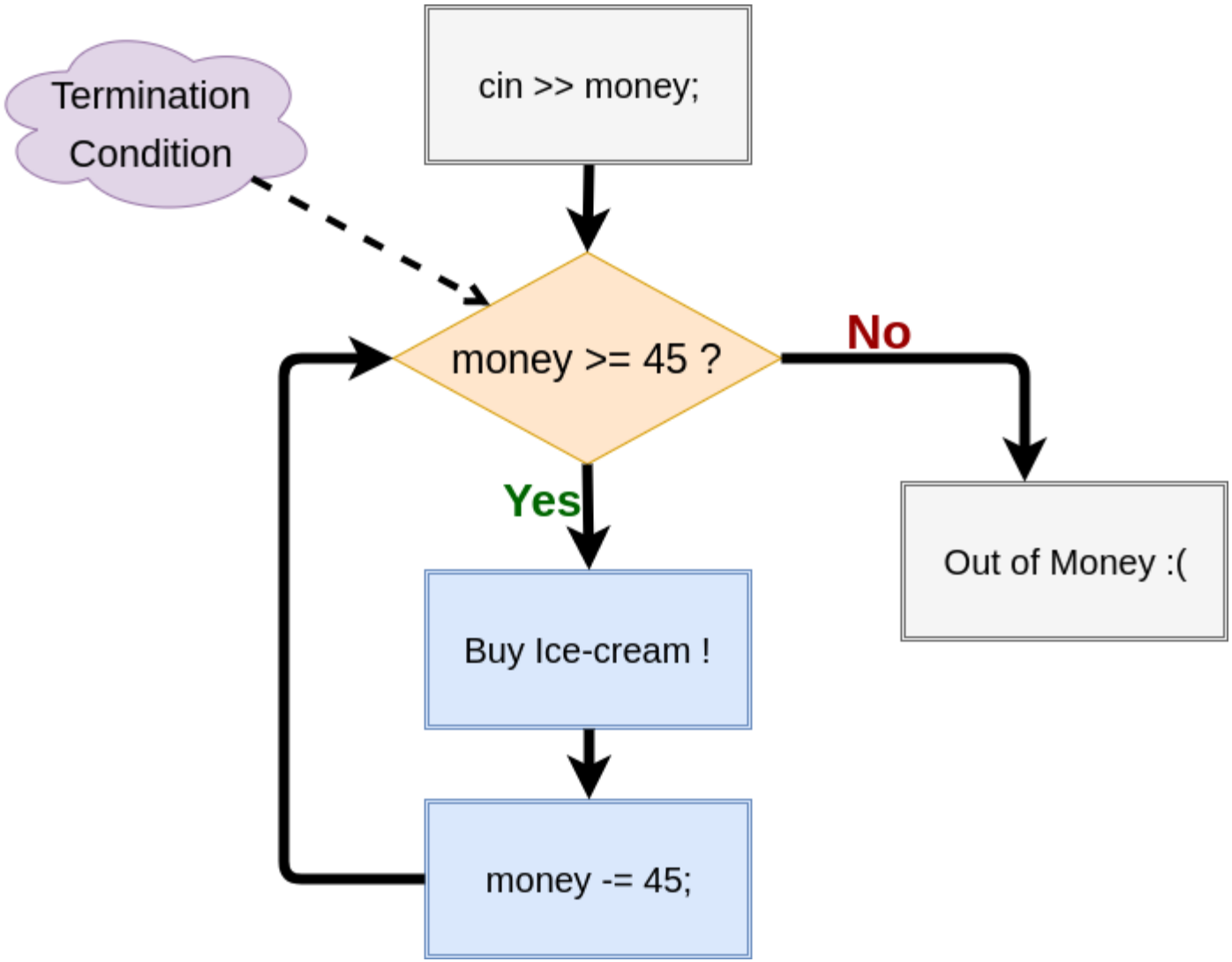
Input	Output
Four integers	Maximum and second max value
Cutoff for A, B, C grades, and also marks of one student (out of 100)	Whether the cutoffs are valid, and what grade the student received.
Three points (vertices of triangle) in terms of (x, y) coordinates	Whether the triangle is equilateral, isosceles,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

Age Guessing Game

Write a program that asks the user qustions 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



Outline

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;
```

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
Buy an ice ceam cone
Money remaining: 110
. . .
```

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

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- Use a counter variable
  - Initialize counter to zero

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int counter = 0;
```

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- User specifies the number of inputs
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```
int counter = 0;
```

  - Increment counter at every loop iteration

```
counter += 1; OR counter++;
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int counter = 0;
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  - 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;                          //Number of inputs
while (counter < N) {
    // Body of Loop. Take input, process data etc . .
    counter++;                     //Increment Counter
    cout << "Counter Value:" << counter << endl;
}
cout << "Exited Loop\n";
```

Using a Counter

```
int counter = 0, N;
cin >> N;                          //Number of inputs
while (counter < N) {
    // Body of Loop. Take input, process data etc . .
    counter++;                     //Increment 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
```

Outline

Lab Time !

Write programs for each of the following specifications

Write a program to find the average of N numbers. Take N as input from the user, and then take in N numbers as input.

Age Guessing Game

Write a program that asks the user qustions 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.