

# Control structures

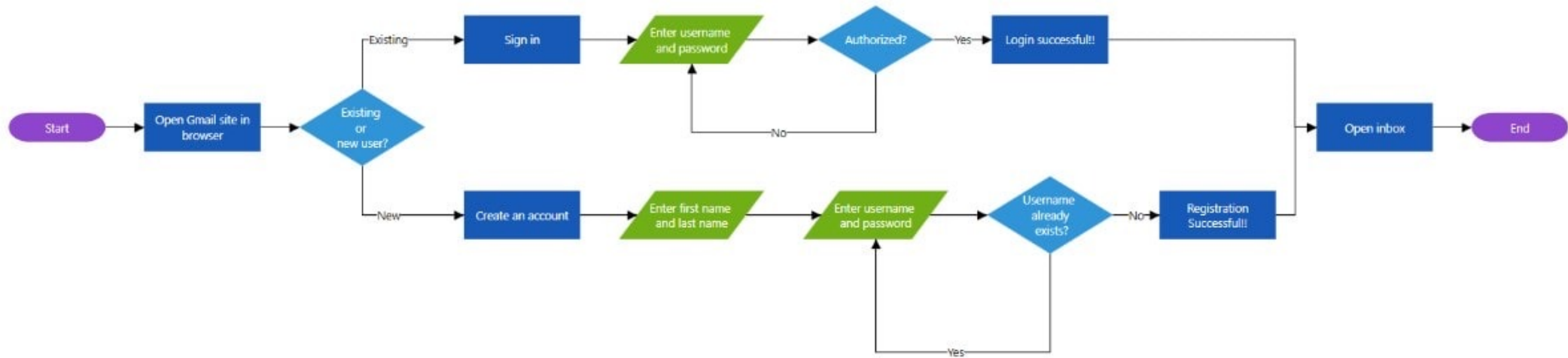
C++ Lecture 3

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# Motivation

- We need our program to perform differently under certain circumstances
- We need to repeat parts of our program under certain circumstances



# Lecture Goals

- Today is devoted to programming control structures
  - Conditionals
  - Loops
  - When to use them...

# Conditionals (control flow)

if statements

(if the condition is true, execute the block of code)

```
// if statement -----  
int a = 5;  
if(a > 0) {  
    std::cout << "a is positive" << std::endl;  
}
```

If-else statements

(if the condition is true, execute the block of code. Otherwise execute the other block)

```
// if-else statement -----  
int b = -1;  
if(b > 0) {  
    std::cout << "b is positive" << std::endl;  
} else {  
    std::cout << "b is not positive" << std::endl;  
}
```


If-else if-else statements

(check multiple conditions. If all are false, execute the else block)

```
// if-else if-else statement -----  
int c = 0;  
if(c > 0) {  
    std::cout << "c is positive" << std::endl;  
} else if(c < 0) {  
    std::cout << "c is negative" << std::endl;  
} else {  
    std::cout << "c is zero" << std::endl;  
}
```

# What's a Condition?

- A condition is any evaluation which results in a Boolean data-type
  - A Boolean variable
  - OR
  - A Boolean expression (using `&&` , `||`, `>`, `<`, `<=`, `>=`, `==`,...)



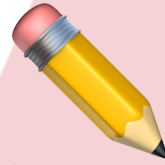
```
if(  ) {  
    // Statements to execute if condition is true  
}
```



# Conditional Examples

- Checking single variables in a conditional
- Using Boolean expressions in a conditional
- if, if-else, if-if else-else
- Nested conditionals



# Mini Task



1. Go to [https://github.com/iastate/VRAC\\_REU\\_Programming](https://github.com/iastate/VRAC_REU_Programming)
2. Under **challenges/** read rollerCoasterCheck.md 
3. Make a new project and code 

# Loops (iterative flow)

- Loops allow us to repeat sections of code as long as a **condition** is met
- 2 main types of loops
  - For loop
  - While loop



# For Loop Anatomy

```
for(int i = 0; i < 5; i++) {  
    std::cout << "i: " << i << std::endl;  
}
```

**Initialization** of loop variable run once only before entering the loop

**Condition** check run every time before entering the loop

**Action** Run after each iteration of the loop

# For Loop

- Normally used when we know exactly how many iterations we want

This will print "0 1 2 3 4"

```
// for loop -----  
/*  
    int i = 0; // initialize  
    i < 5; // condition  
    i++ // increment  
*/  
for(int i = 0; i < 5; i++) {  
    std::cout << "i: " << i << std::endl;  
}
```

# While Loop Anatomy

```
int j = 0;
while(j < 5) {
    std::cout << "j: " << j << std::endl;
    j++;
}
```

**Condition** check run every time before running loop

# While loop

- Normally used when we don't know how many iterations we need

This will print "0 1 2 3 4"

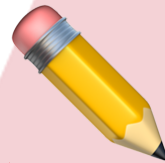
```
// while loop -----  
/*  
    int i = 0; // initialize  
    i < 5; // condition  
    i++ // increment  
*/  
int j = 0;  
while(j < 5) {  
    std::cout << "j: " << j << std::endl;  
    j++;  
}
```


# Loop Examples

- Printing out numbers 1 to 10 (for loop)
- Printing out numbers 10 to 1 (for loop)
- Making a looping program → when do we quit? (while loop)
- Looping through an array (for loop)



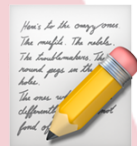
# Mini Task




1. Go to [https://github.com/iastate/VRAC\\_REU\\_Programming](https://github.com/iastate/VRAC_REU_Programming)
2. Under **challenges/** read `sevensOnly.md` 
3. Make a new project and code 



**Questions?**



# Assignment

1. Go to [https://github.com/iastate/VRAC\\_REU\\_Programming](https://github.com/iastate/VRAC_REU_Programming)
2. Under **challenges/** read `guessingGame.md` 
3. Make a new project and code 