Module 3: Control Structures

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Topics to be covered in Module 3,

- Decision making and Branching
- if, if – else, nested if, multi-way if-elif statements
- Looping - While loop, For loop, else clauses in the loop,
- Nested loop
- Break, Continue, and Pass Statements

Decision Making

Decision Making and Branching

- Refer to the ability of the code to execute different actions or pathways based on certain conditions.
- In Python, this is typically done using if, elif, and else statements.

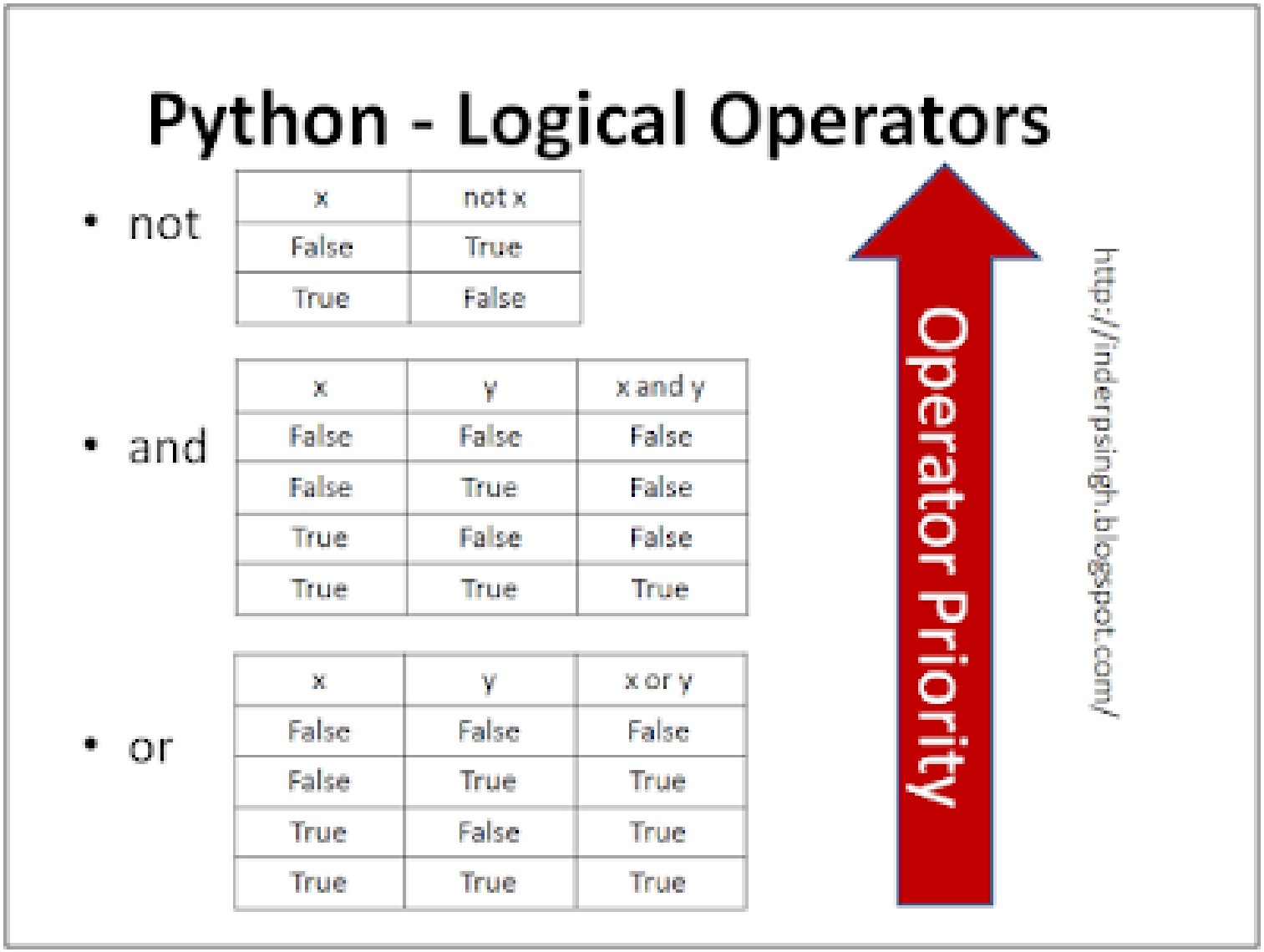
Comparison operator

- $>$ - Greater than
- $>=$ - Greater than or equal to
- $<$ - Less than
- $<=$ - Lesser than or equal to
- $==$ - Equal to
- $!=$ - Not equal to

Logical operator

- A and B - and
- A or B - or
- not A - not

Logical operator



Bit Manipulation

Example (Logical understanding)

1. Bitwise AND - Returns 1 for each bit position where both bits are 1; otherwise, it returns 0
2. Bitwise OR - Returns 1 for each bit position where at least one of the bits is 1.
3. Biwise XOR - Returns 1 for each bit position where the corresponding bits are different.
4. Bitwise NOT - Inverts all the bits (flips 1 to 0 and 0 to 1
5. Bitwise Left Shift - Shifts the bits to the left by a specified number of positions, filling with 0s on the right
6. Bitwise Right Shift - Shifts the bits to the right by a specified number of positions, filling with the sign bit on the left.

Bitwise AND (&)

Example (Python Snippet)

```
a = 12
b = 10
result = a & b
print(result)
```

Bitwise OR (|)

Example (Python Snippet)

```
a = 12
b = 10
result = a | b
print(result)
```

Bitwise XOR ()̂

Example (Python Snippet)

```
a = 12
b = 10
result = a ^ b
print(result)
```

Bitwise NOT ()̃

Example (Python Snippet)

```
a = 12
result = ~a
print(result)
```

Bitwise Left Shift (<<)

Example (Python Snippet)

```
a = 12
result = a << 2
print(result)
```

Bitwise Right Shift (>>)

Example (Python Snippet)

```
a = 12
result =  a >> 2
print(result)
```

If statement

- The if statement is one of the fundamental tools in programming used to make decisions.
- It allows the program to execute a certain block of code only if a specified condition is true.
- If the condition is not true, the block of code will be skipped.

If statement

Example (Syntax)

```
if condition:
    # Code to execute if the condition is true
```

Example 1: Check if a number is positive

Example (Python snippet)

```
number = int(input("Enter a number: "))

if number > 0:
    print("The number is positive.")
```

If statement - Problems to solve!

- Check if a person is eligible to vote
- Check if a number is between 1 and 50
- Check if a user is logged in (Boolean)
- Check if a student passed

Example 2: Check if a person is eligible to vote

Example (Python snippet)

```
age = int(input("Enter your age: "))

if age >= 18:
    print("You are eligible to vote.")
```

Example 3: Check if a number is between 1 and 50

Example (Python snippet)

```
number = int(input("Enter a number: "))

if number > 0 and number <= 50:
    print("The number is between 1 and 50")
```

Example 4: Check if a user is logged in

Example (Python snippet)

```
is_python = True

if is_python:
    print("Welcome back, user!")
```

Example 5: Check if a student passed

Example (Python snippet)

```
score = int(input("Enter your score: "))

if score >= 50:
    print("You passed!")
```

If...else statement

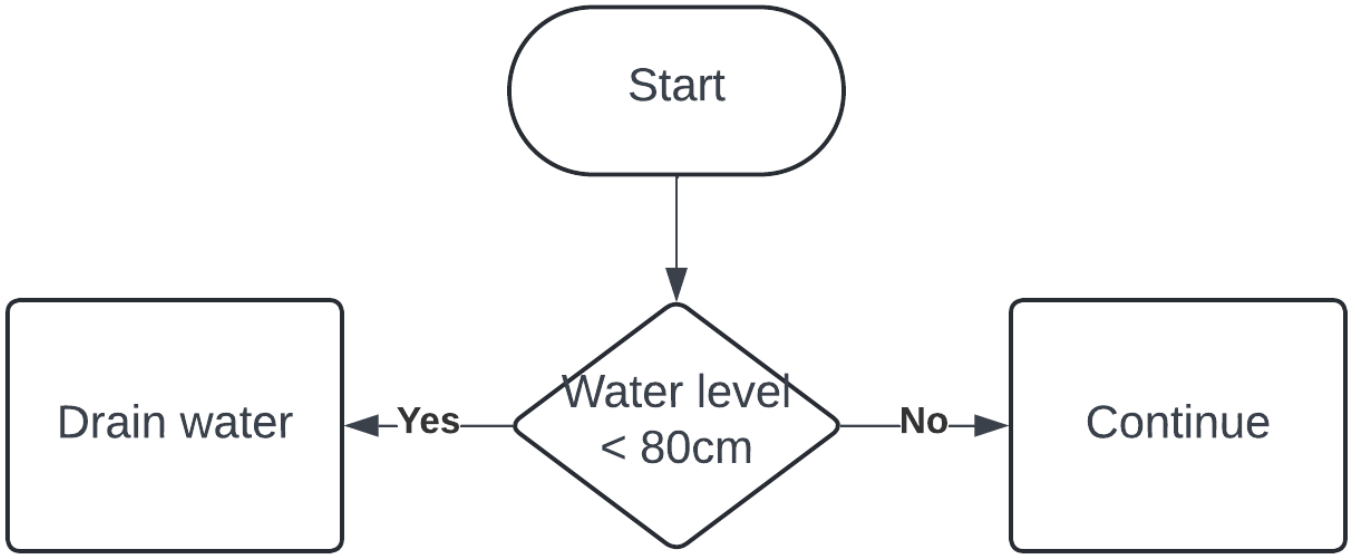
- The if-else statement allows your program to execute one block of code if a condition is true, and another block of code if the condition is false.
- This provides a way to handle two different outcomes.

If...else statement

Example (Syntax)

```
if condition:
    # Code to execute if the condition is true
else:
    # Code to execute if the condition is false
```

Example 1: Water tub

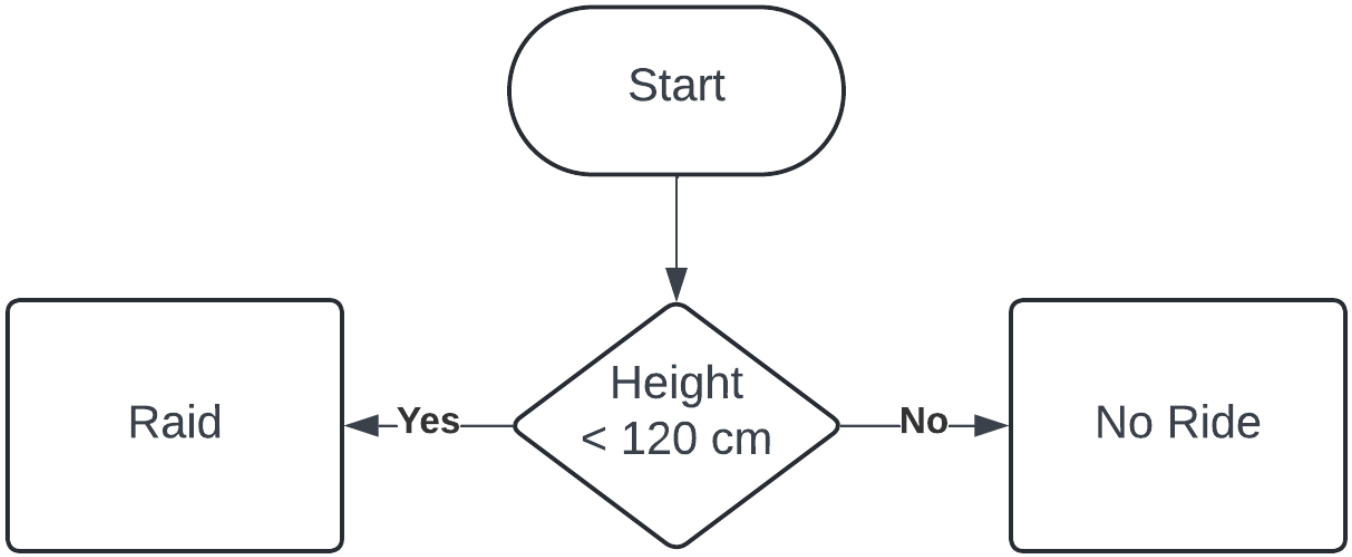


Example 1: Water tub

Example (Python Snippet)

```
water_level = 50
if water_level >80:
    print('Drain water')
else:
    print('continue')
```

Example2: Roller Coaster



Example 2: Roller Coaster

Example (Python Snippet)

```
print('Welcome to the roller coaster!')
height = int(input('Whats your height in cm?))
if height > 120:
    print('You can ride!')
else:
    print('You cannot ride!')
```

If...else statement - Assignment!

- Write a program that takes a student's score as input and categorizes it into "Pass" if the score is 50 or above and "Fail" otherwise.
- Write a program that takes an integer as input and prints "Even" if the number is even and "Odd" if the number is odd.
- Write a program to calculate even or odd by using '&' operator.
- Write a program that takes an integer as input and checks if it is divisible by 5 and 11.
- Write a program that takes a number as input and checks if it falls within the 1 to 100 (inclusive) range.
- Write a program that takes three side lengths as input and checks if they can form a valid triangle. (The sum of any two sides should be greater than the third.)

Example 3: Pass or Fail

Example (Python Snippet)

```
score = int(input("Enter the student's score: "))

if score >= 50:
    print("Pass")
else:
    print("Fail")
```

Example 4: Even or Odd

Example (Python Snippet)

```
number = int(input("Enter an integer: "))

if number % 2 == 0:
    print("Even")
else:
    print("Odd")
```

Example 5: Even or Odd - & operator

Example (Python Snippet)

```
number = int(input("Enter an integer: "))

if number & 1 == 0:
    print("Even")
else:
    print("Odd")
```

Example 6: Checks if divisible by 5 and 11

Example (Python Snippet)

```
number = int(input("Enter an integer: "))

if number % 5 == 0 and number % 11 == 0:
    print(f"{number} is divisible by both 5 and 11.")
else:
    print(f"{number} is not divisible by both 5 and 11.")
```

Example 7: Checks number falls between 1 and 100

Example (Python Snippet)

```
number = int(input("Enter a number: "))

if 1 <= number <= 100:
    print(f"{number} is within the range of 1 to 100.")
else:
    print(f"{number} is not within the range of 1 to 100.")
```

Example 8: Valid triangle

Example (Python Snippet)

```
side1 = float(input("Enter the length of the first side: "))
side2 = float(input("Enter the length of the second side: "))
side3 = float(input("Enter the length of the third side: "))

if (side1 + side2 > side3) and (side1 + side3 > side2)
and (side2 + side3 > side1):
    print("The sides can form a valid triangle.")
else:
    print("The sides cannot form a valid triangle.")
```

Nested if statement

- A nested if statement involves placing one if statement inside another.
- This allows for more complex decision-making structures.

Nested if statement

Example (Syntax)

```
if condition1:
    if condition2:
        # Code block for the second condition
    else:
        # Code block for the else part of the second condition
else:
    # Code block for the else part of the first condition
```

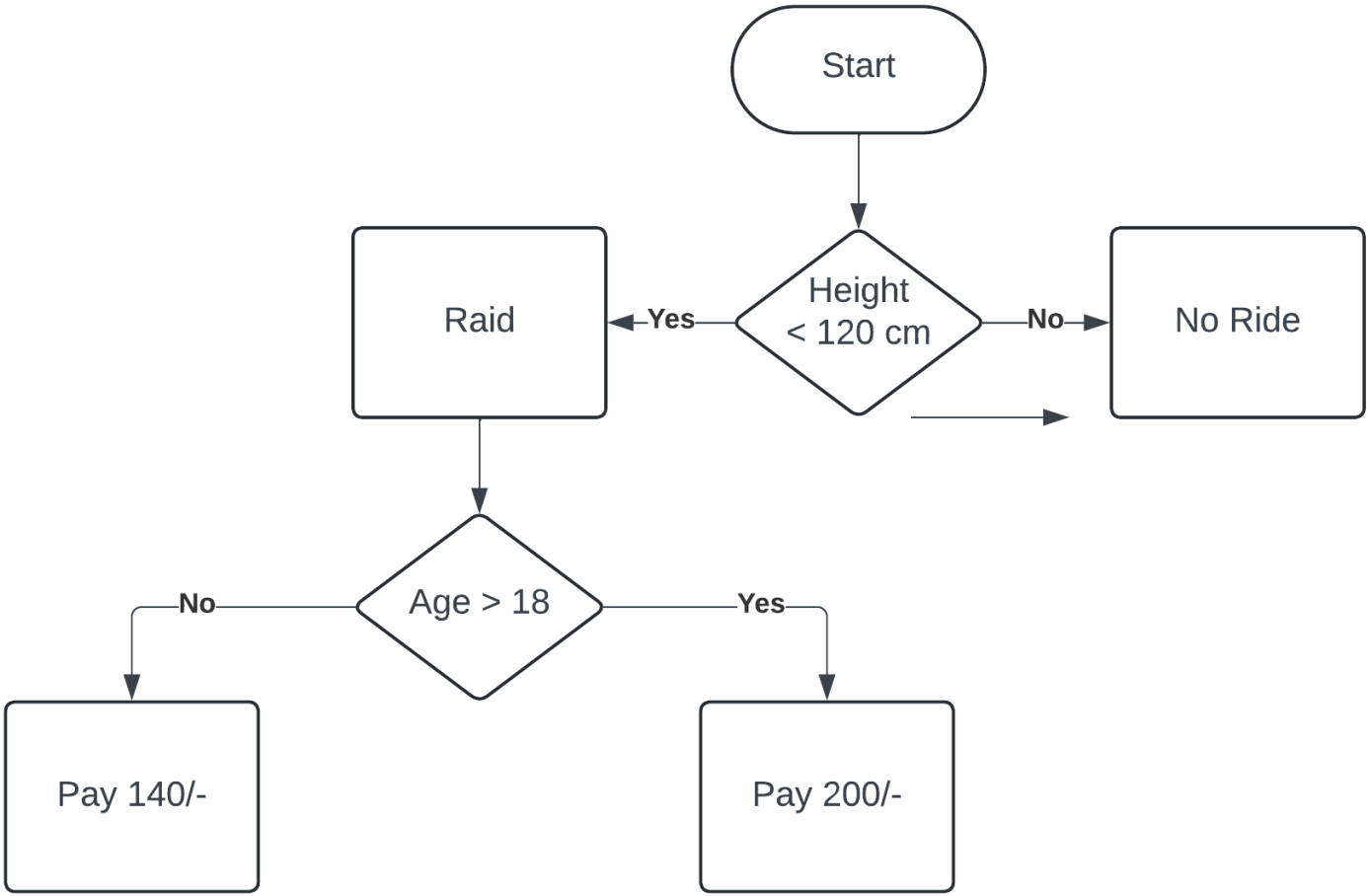
Example :1 Nested if statement

Example (Syntax)

```
age = 25
has_ticket = True

if age >= 18:
    if has_ticket:
        print("You can enter the movie theater.")
    else:
        print("You need a ticket to enter the movie theater.")
else:
    print("You must be at least 18 years old to enter
    the movie theater.")
```

Example2: Roller Coaster



Example 2: Roller Coaster - Nested if

Example (Python Snippet)

```
print('Welcome to the roller coaster!')
height = int(input('Whats your height in cm?))
if height > 120:
    print('You can ride!')
    age = int(input('Whats your age?))
    if age<=18:
        print('Please pay Rs:140/-)
    else:
        print('Please pay Rs:200/-)
else:
    print('You cannot ride!')
```

If... elif... else statement

- if, elif, and else statements are used to handle multiple conditions in a structured way.

if...elif...else statement

Example (Syntax)

```
if condition1:
    # Code block if condition1 is True
elif condition2:
    # Code block if condition1 is False and condition2 is True
elif condition3:
    # Code block if the previous conditions are False and cond
else:
    # Code block if none of the above conditions are True
```

Example 1: Numbers comparison

Example (Python Snippet)

Write a Python program that asks the user to input three integers. The program should check the following conditions:

If the first number is greater than the second number, print "First is greater".
If the second number is greater than the third number, print "Second is greater".
If the first number is equal to the third number, print "First and Third are equal".
If none of the above conditions are true, print "None of the conditions met".

Example 1: Number comparison

Example (Python Snippet)

```
a = int(input("Enter the first number: "))
b = int(input("Enter the second number: "))
c = int(input("Enter the third number: "))

if a > b:
    print("First is greater")
elif b > c:
    print("Second is greater")
elif a == c:
    print("First and Third are equal")
else:
    print("None of the conditions met")
```