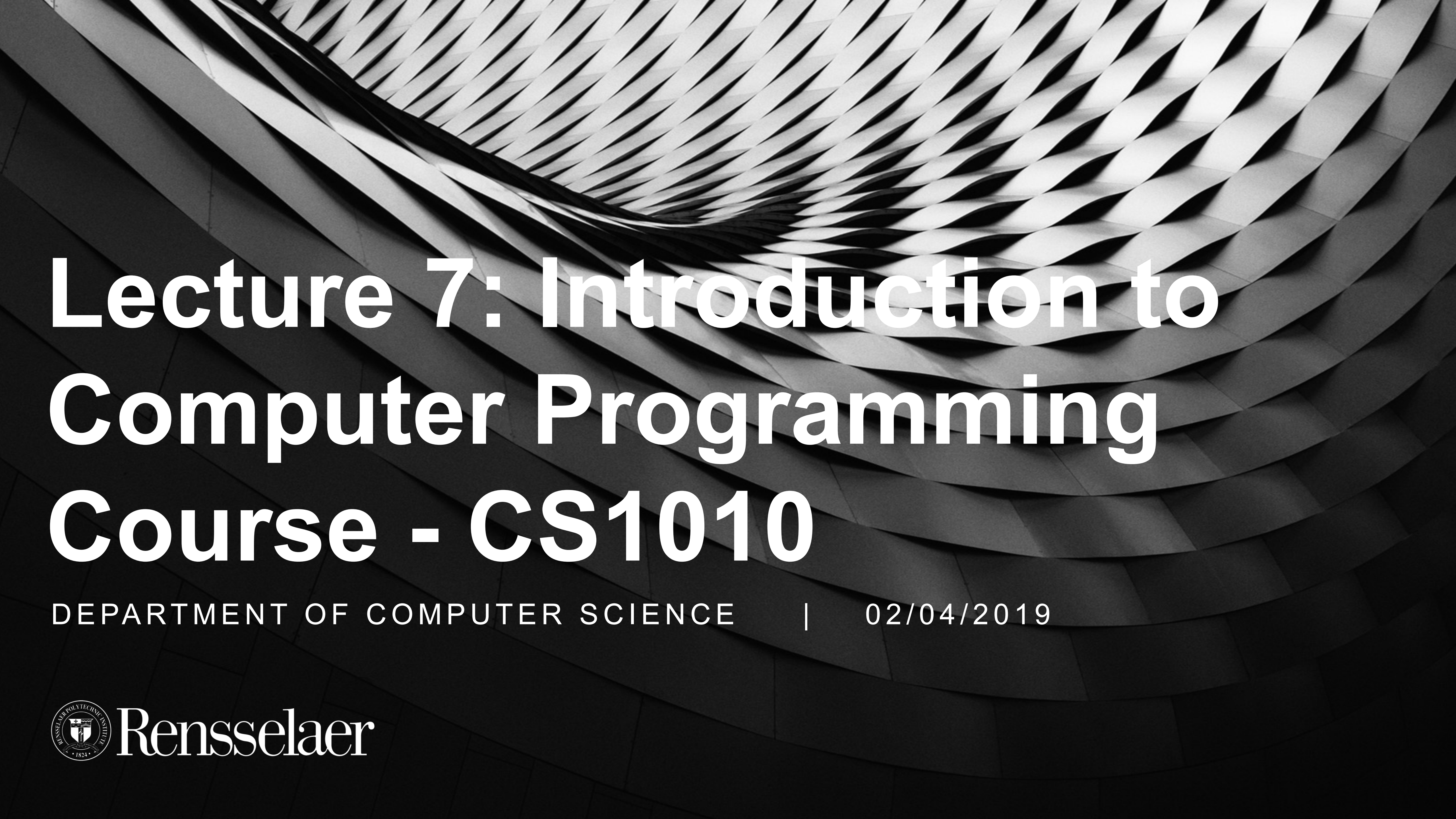


Lecture 7: Introduction to Computer Programming Course - CS1010

DEPARTMENT OF COMPUTER SCIENCE | 02/04/2019

Rensselaer

Announcements

1

Homework 4 is Posted and is due in a week

2

Exam 1 will be on February 14 (in-class)

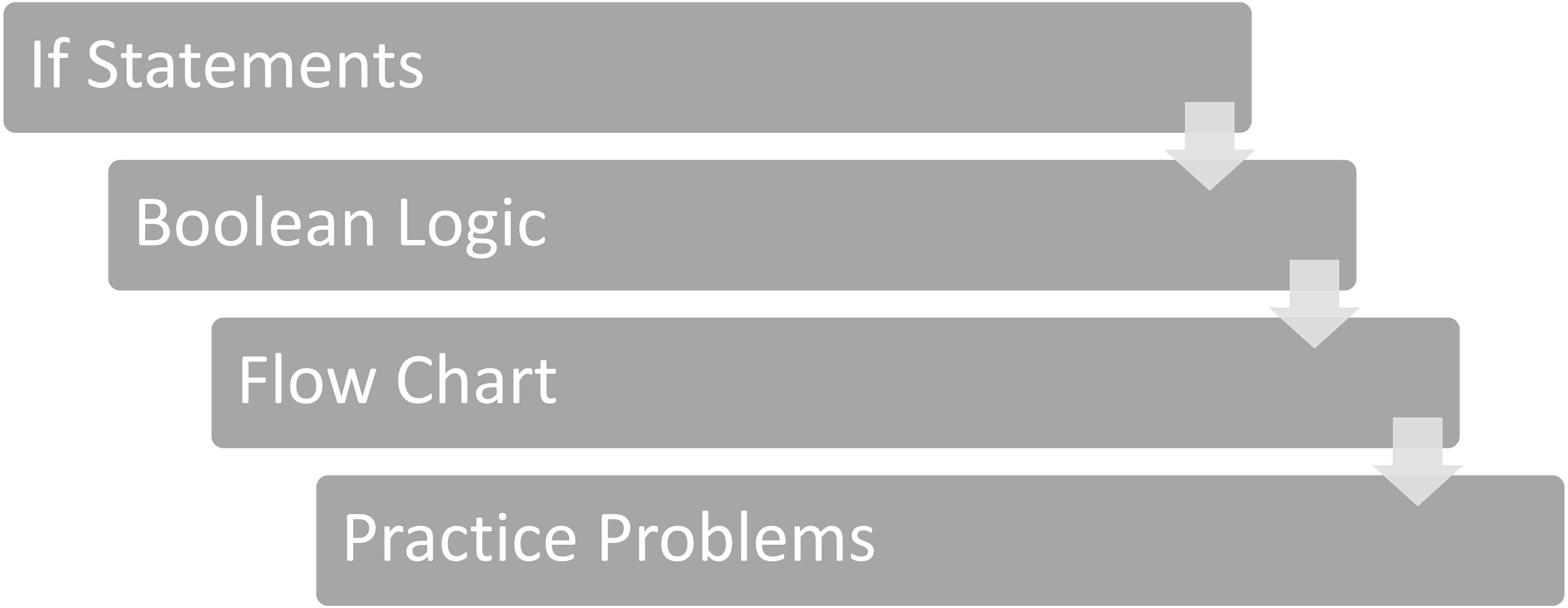
3

It will be a closed book, closed computers exam.

4

You can bring 2 pages(A4) of handwritten notes!

Goals for Today



If Statements

Boolean Logic

Flow Chart

Practice Problems

Decision Making

Similar to real life in programming also, we need to make decisions

Based on these decision we execute the next block/chunk of code.

In programming languages like Python, decision making statements decide the direction in which your program flows

Decision making statements available in python are:

if statement

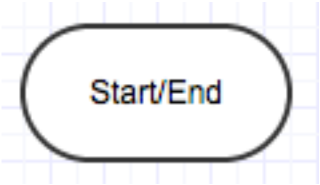
if..else statements

nested if statements

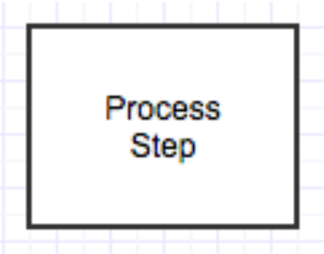
if-elif ladder

How to flowchart

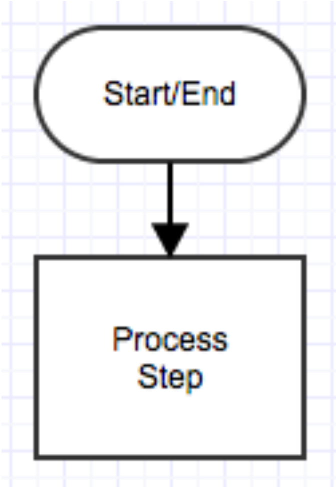
- A diagram that shows step-by-step progression through a procedure or system especially using connecting lines and a set of conventional symbols.



Start/End



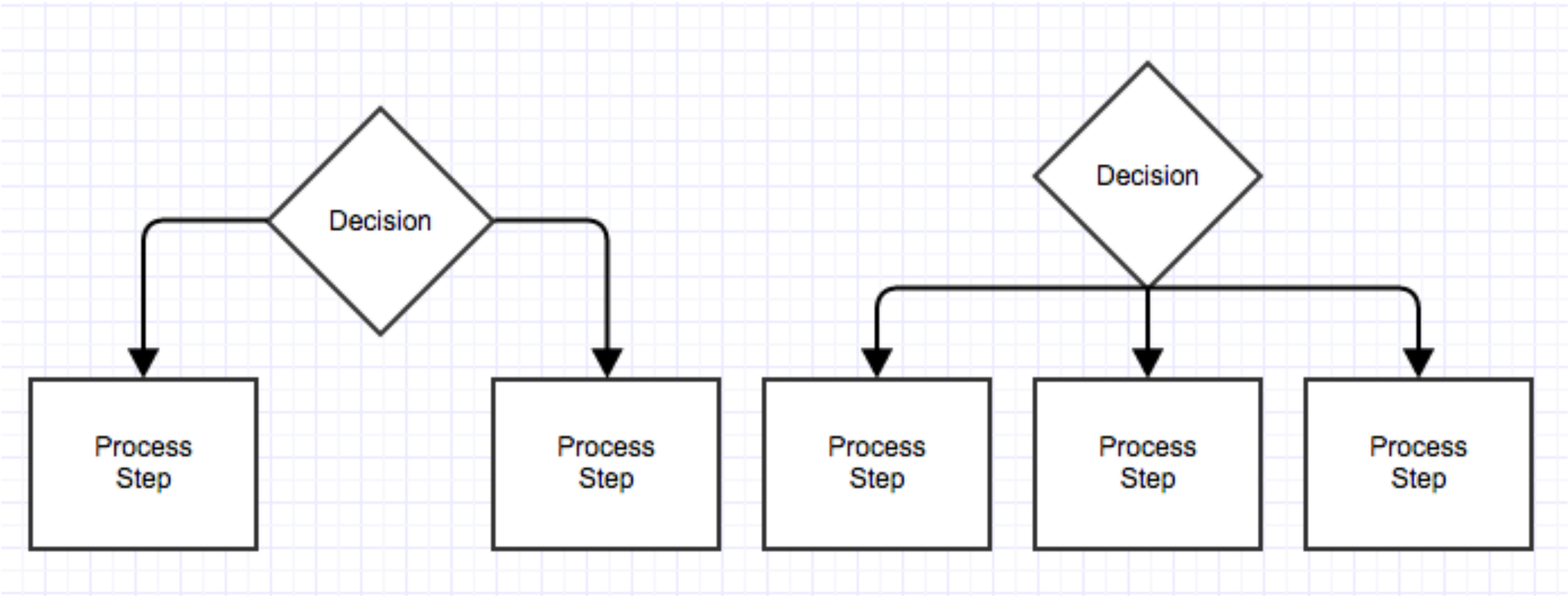
Process Step



Start/End

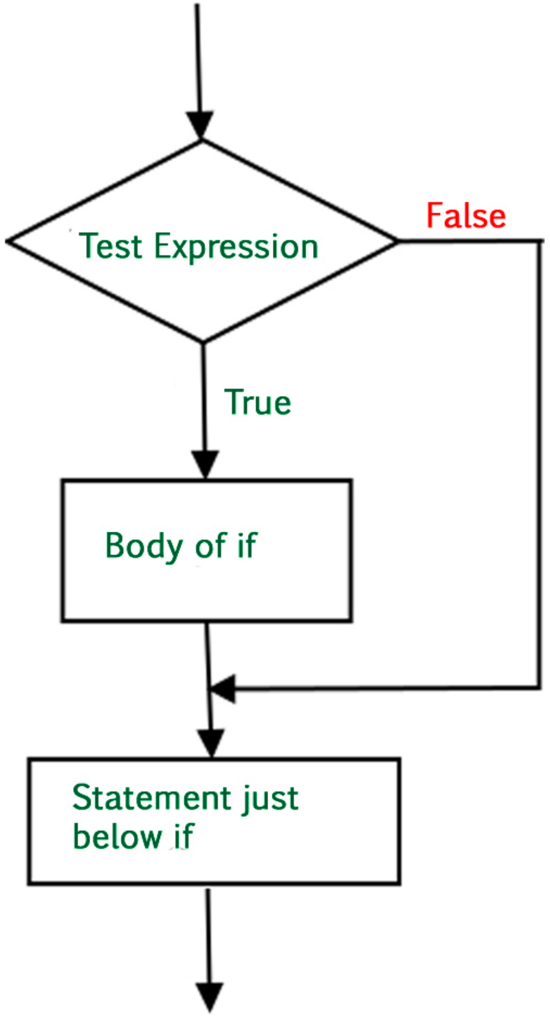
Process Step

Decision-Flow Chart



If Statements

- if statement is used to decide whether a certain block of code will be executed or not based on a given criteria.
- The control will go inside the body of the code ’when’ the condition is True



If Statement

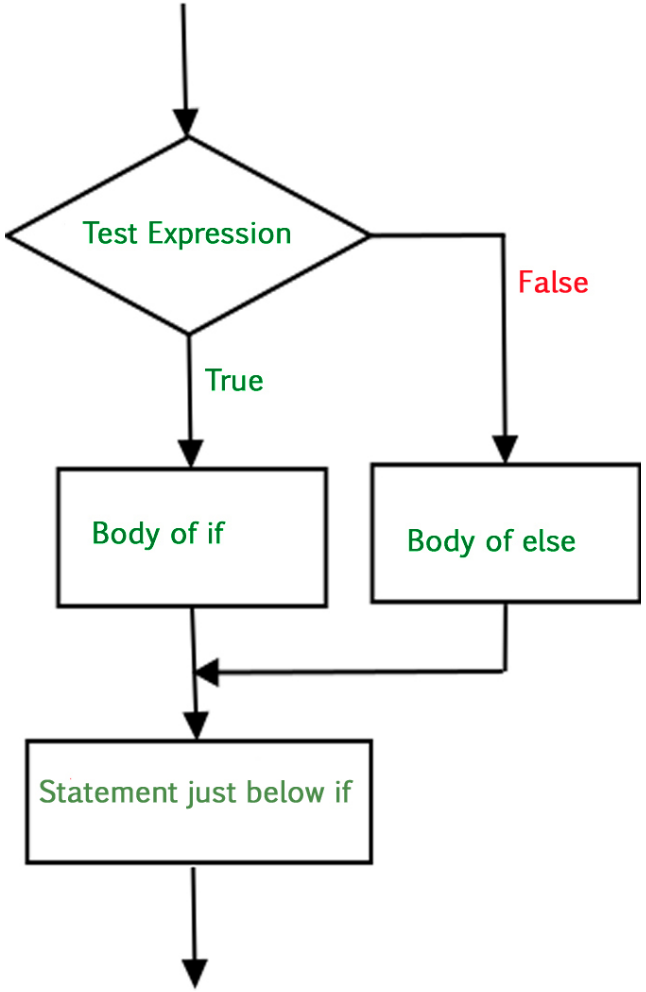
```
i =10
If (i>20):
    print (‘I am statement inside if’)
print(‘I am outside the if block’)
```

OUTPUT:

```
I am outside the if block
```

If-Else Statements

- We can use the else statement to execute another block of code when the if condition is false.



If-Else Statement

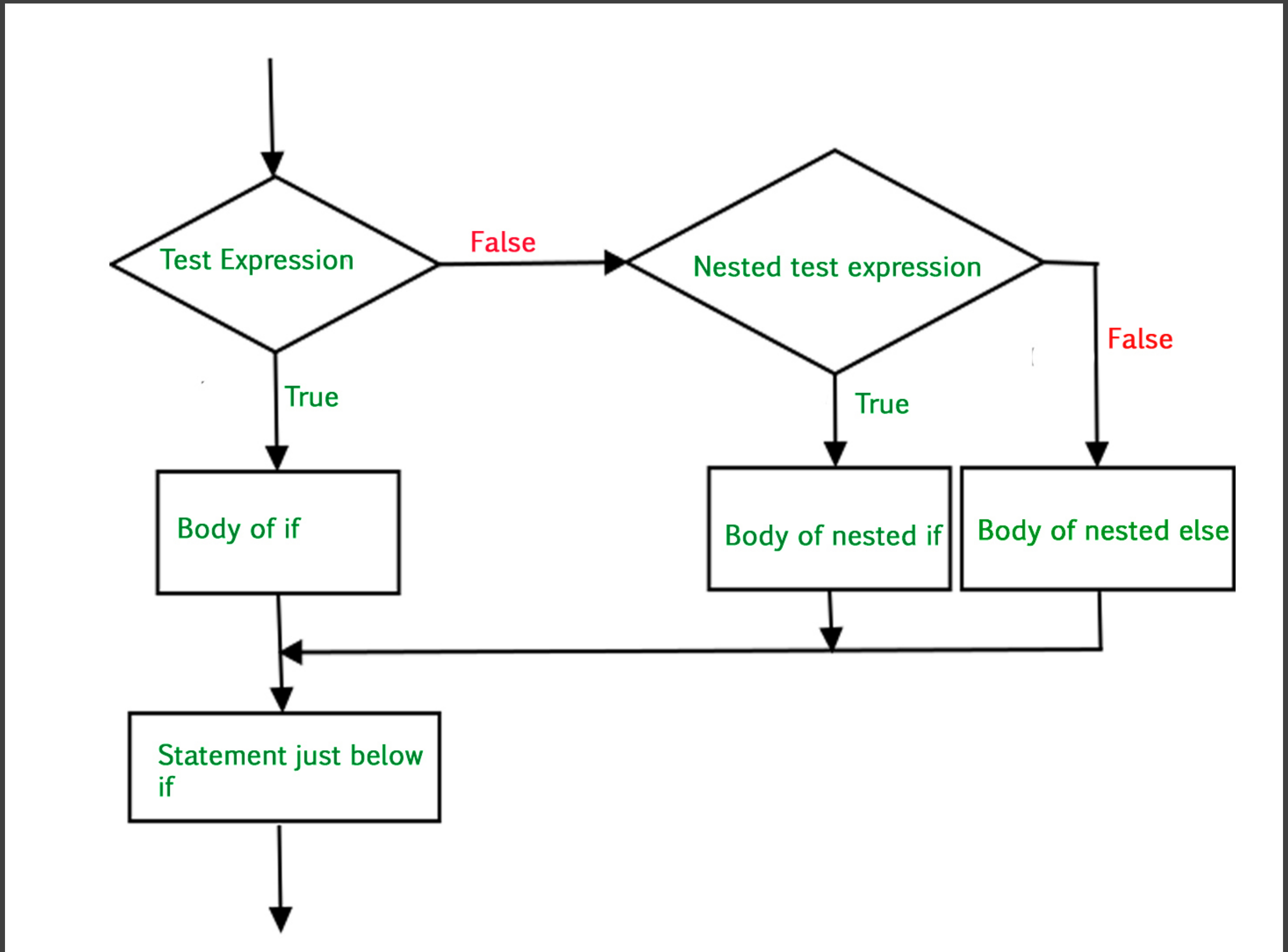
```
j = 30;
if (j < 15):
    print (”j is in if block")
else:
    print (”j is in else block")
print (”j is neither in if and nor in else Block")
```

OUTPUT:

```
j is in else block
j is neither in if and nor in else Block
```

Nested If Statements

Multiple if, if-else statements can be enclosed within an if or an else condition



Nested If Statement

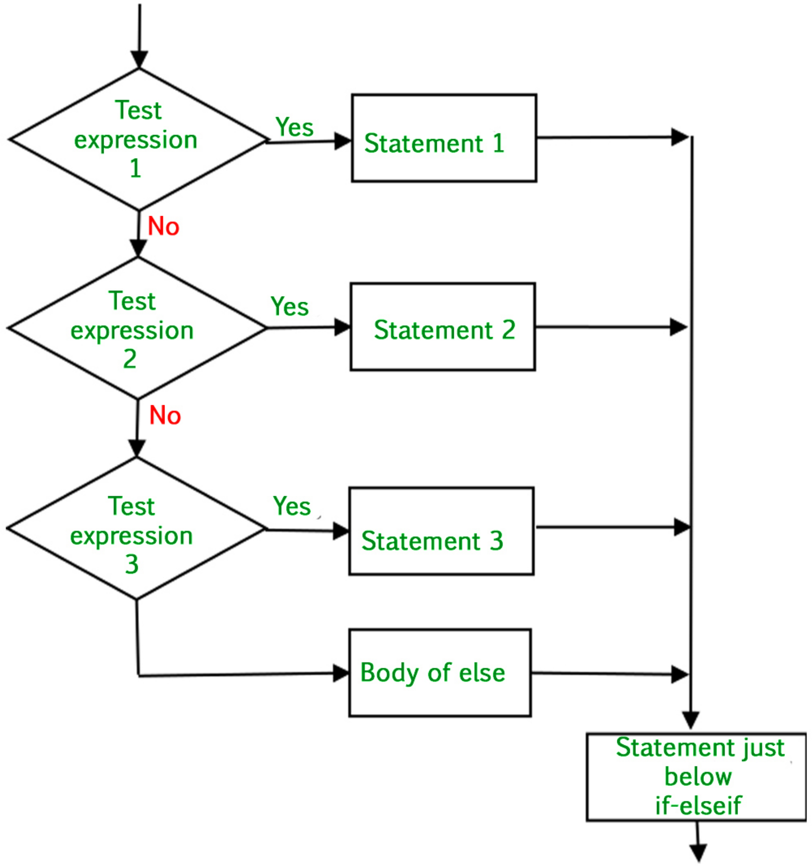
```
k = 10
if (k == 10):
    #  First if statement
    if (k < 15):
        print ("k is is in first if statement")
    # Nested - if statement
    # Will only be executed if statement above
    # it is true
    if (k < 12):
        print ("k is in the nested if")
    else:
        print ("k is in else block of nested if")
```

OUTPUT:

```
k is is in first if statement
k is in the nested if
```

If-Elif-Else

- If Statements are executed from the top
- Under the If-elif-else ladder the control checks for each block i.e. starting from if and moving on to each 'elif'.
- If none of the above is true then it executed the else.



If-elif-else Statement

```
l = 20
if (l == 10):
    print ("l is 10")
elif (l == 15):
    print ("l is 15")
elif (l == 20):
    print ("l is 20")
else:
    print ("l is not present")
```

OUTPUT:

```
l is 20
```

Boolean Algebra

Go to Lecture 3 Slides and look for

Boolean Algebra and also

Truth Tables

- NOT
- AND
- OR

Boolean Values and Expressions

- In Python, the two Boolean values are True and False (the capitalization must be exactly as shown), and the Python type is **bool**.
- type(**True**)
- <class 'bool’>
- A **Boolean expression** is an expression that evaluates to produce a result which is a Boolean value. For example, the operator == tests if two values are equal. It produces a Boolean value:
- 5 == (3 + 2) *# Is five equal 5 to the result of 3 + 2?*
- True

Booleans (From Lecture 3)

- Boolean represents logical values (TRUE or FALSE)
- The **bool()** method is used to return or convert a value to a Boolean value
- The bool() method in general takes only one parameter, on which the standard truth testing procedure can be applied.
- **If no parameter is passed, then by default it returns False**.

Basic Boolean Algebra

- **Boolean Algebra** is a branch of algebra that involves bools, or true and false values.
- They're typically denoted as ***T or 1 for true*** and ***F or 0 for false***.
- Using this simple system we can boil down complex statements into easier/understandable logical statements.

Truth Table

- A **truth table** is a way of organizing information to list out all possible scenarios.
- p denotes proposition (condition) then ~p (read as not p) means everything opposite of the proposition.

p	~p
T	F
F	T

Binary Operators

- AND Operator
  - *Requires* both p and q to be True for the result to be True. All other cases result in False.

p	q	P AND q
T	T	T
T	F	F
F	T	F
F	F	F

- Keyword in Python: **and**

- OR Operator
  - *Requires* only one proposition to be True for the result to be True.

p	q	P OR q
T	T	T
T	F	T
F	T	T
F	F	F

- Keyword in Python: **or**

Operators and Expressions (In Python)

Operators	Expressions	Example
==	If the two operands are equal then the condition will be true	x=3, y=5; (x==y) is not true.
!=	If the two operands are not equal then the condition is true	(x!=y) is true
>	If the value on the left is greater than that on the right, then the condition is true	(x>y) is not true.
<	If the value on the right is greater than that on the left, then the condition is true	(x<y) is true
>=	If the value on the left is greater than or equal to the one on the right, then the condition is true	(x>=y) is false
<=	If the value on the right is greater than or equal to the one on the left, then the condition is true	(x<=y) is true

Simplifying Boolean Expressions

- Although these operations are probably familiar, the Python symbols are different from the mathematical symbols.
- A common error is to use a single equal sign (=) instead of a double equal sign (==).
- Remember that = is an assignment operator and == is a comparison operator.

Boolean Algebra (AND Operator)

- Let x and y be some Boolean and/or integer then
  - x and False == False
  - False and x == False
  - y and x == x and y
  - x and True == x
  - True and x == x
  - x and x == x
- What happens when x is False? Does everything above still hold?

Boolean Algebra (OR and NOT Operator)

  - x or False == x
  - False or x == x
  - y or x == x or y
  - x or True == True
  - True or x == True
  - x or x == x
- NOT Operator:
  - not (not x) == x

The return Statement

- The return statement, depending on whether the function gives a value or is void, allows us to terminate the execution of a function before (or when) we reach the end.
- One reason to use an *early return* is if we detect an error condition:

```
def sqrt(y):
    if x <= 0:
        print(”No negatives or zeroes, please.")
        return
    result = x**0.5
    print("The square root of", x, "is", result)
```

- Using return here ends the function so that the lines after return will not be executed.

Logical Opposites

- Each of the six relational operators has a logical opposite:
  - An example: Suppose you can vote at age 18 or above therefore you can NOT vote at any age other than ’18 or above’.

Logical Operator	Opposite
==	!=
!=	==
<	>=
>	<=
>=	<

Eliminating NOT

```
if not (age >= 18):
    print("Hey, you're too young to vote")
```

- **if** age < 18:
-     print("Hey, you're too young to vote!")

De-Morgan’s Law

- Simplifying Expressions:
  - not (x and y) == (not x) or (not y)
  - not (x or y) == (not x) and (not y)
  - Example:
    - (not(x < 15 and y >= 3) has the same value as (x >= 15 or y < 3)

Type Conversion

- We talked about type conversion/typecasting earlier.
- Let us discuss what we know.
- int()
- float()
- str()

Problem 1

- Give the logical opposites of these conditions
- a > b
- a >= b
- a >= 18 and y == 3
- a >= 18 and y != 3
- a<15 or y>12

Problem 2

- What do these expressions evaluate to?
- 3 == 3
- 3 != 3
- 3 >= 4
- not (3 < 4)

Problem 3

- Write a function **isright** which, given the length of three sides of a triangle, will determine whether the triangle is right-angled. Assume that the third argument to the function is always the longest side. It will return True if the triangle is right-angled, or False otherwise.

Floating Points

- Floating point arithmetic is sometimes inaccurate
- On a piece of paper, divide 10 by 3 and write down the decimal result. You’ll find it does not terminate, so you’ll need an infinitely long sheet of paper.
- The *representation* of numbers in computer memory or on your calculator has similar problems: memory is finite, and some digits may have to be discarded. So small inaccuracies creep in.
- Let’s check in spyder.

Problem 4

- When monkeys get together for a party, they like to have cigars. A monkey party is successful when the number of cigars is between 40 and 60, inclusive. Unless it is the weekend, in which case there is no upper bound on the number of cigars. Return True if the party with the given values is successful, or False otherwise.
- def cigar_party(cigars, is_weekend):
- Test cases:
  - cigar_party(30, False) → False
  - cigar_party(50, False) → True
  - cigar_party(70, True) → True
  - cigar_party(30, True) → False

Problem 5

- Given 2 integers, a and b, return their sum. If sum is in the range 10..19 inclusive, these numbers are forbidden, so in that case just return 20.
- Test Cases
- sorta_sum(3, 4) → 7
- sorta_sum(9, 4) → 20
- sorta_sum(10, 11) → 21

Next Lecture

- Tuples
- Modules
- Images