

# 1 ICS 104 - Introduction to Programming in Python and C

## 1.1 Decision Structures - Lab 1

## 2 Lab Learning Outcomes

- To learn how to program simple and complex decisions.
- To implement decisions using if statements
- To write statements using Boolean expressions

## 3 Topics: if Statement

### 3.1 Worked Example

- Problem Statement: Your task is to extract a string containing the middle character from a given string. For example, if the string is "crate", the result is the string "a". However, if the string has an even number of letters, extract the middle two characters. If the string is "crates", the result is "at".

- [Step 1](#): Decide on the branching condition.
- We need to take different actions for strings of odd and even length. Therefore, the condition is
  - "Is the length of the string odd?"

- In Python, you use the remainder of division by 2 to find out whether a value is even or odd. Then the test to determine if the length of the string is odd becomes
  - `len(string) % 2 == 1`

- [Step 2](#): Give pseudocode for the work that needs to be done when the condition is true.

- We need to find the position of the middle character. If the length is 5, the position is 2.

c	r	a	t	e
0	1	2	3	4

- In general,
- `position = len(string)/2` (with the remainder discarded)  
`result = string[position]`

- **Step 3:** Give pseudocode for the work (if any) that needs to be done when the condition is *not true*.
- Again, we need to find the position of the middle characters. If the length is 6, the starting position is 2, and the ending position is 3. That is, we would call

**`result = string[2] + string[3]`**

c	r	a	t	e	s
0	1	2	3	4	5

- In general
- `position = len(string)/2-1` (with the remainder discarded)  
`result = string[position]+[position+1]`

- **Step 4:** Double-check relational operators.
- Do we really want `len(string) % 2 == 1`? For example, when the length is 5, `5 % 2` is the remainder of the division `5 / 2`, which is 1. In general, dividing an odd number by 2 leaves a remainder of 1. Therefore, our condition is correct.

- [Step 5](#): Remove duplication.
- Here is the statement that we have developed:

```
If len(string) % 2 == 1
    position = len(string) / 2 (with remainder discarded)
    result = string[position]
Else
    position = len(string) / 2 - 1 (with remainder discarded)
    result = string[position] + string[position + 1]
```

- The first statement in each branch is almost identical. Could we make them the same? We can, if we adjust the position in the second branch:

```
If len(string) % 2 == 1
    position = len(string) / 2 (with remainder discarded)
    result = string[position]
Else
    position = len(string) / 2 (with remainder discarded)
    result = string[position - 1] + string[position]
```

- Now we can move the duplicated computation outside the if statement:

```
position = len(string) / 2 (with remainder discarded)
if len(string) % 2 == 1
    result = string[position]
Else
    result = string[position - 1] + string[position]
```

- Test both branches.
- We will use a different set of strings for testing. For an odd-length string, consider "monitor". We get

```
position = len(string) / 2 = 7 / 2 = 3 (with remainder discarded)
result = string[3] = "i"
```

- For the even-length string "monitors", we get

```
position = len(string) / 2 = 4
result = string[3] + string[4] = "it"
```

Assemble the if statement in Python. Complete code is as follows:

```
In [5]: 1 string = input("Enter a string: ")
        2
        3 position = len(string) // 2
        4 if len(string) % 2 == 1 :
        5     result = string[position]
        6 else :
        7     result = string[position - 1] + string[position]
        8
        9 print("Middle: " + result)
```

Enter a string: welcome

3

Middle: c

## 4 Exercises

- [Exercise# 1](#): Write a program that reads in the name and salary of an employee. Here the salary will denote an hourly wage, such as \$9.25. Then ask how many hours the employee worked in the past week. Be sure to accept fractional hours. Compute the pay. Any overtime work (over 40 hours per week) is paid at 150 percent of the regular wage. Print a paycheck for the employee.

### Sample Run:

Enter your name: Ahmad

Enter your salary: 23.3

Enter the number of worked hours: 43.5

Mr. Ahmad, your payment is 1054.33

### Sample Run:

Enter your name: Ali

Enter your salary: 45.7

Enter the number of worked hours: 20.45

Mr. Ali, your payment is 934.57

In [8]:

```
1  # Exercise # 1 - Source Code
2
3  name = (input("Enter your name: "))
4  salary = float(input("Enter your salary: "))
5  hours= float(input("Enter the number of worked hours: "))
6  percent=1.5
7  if(hours<=40):
8      payment = round(hours*salary, 2)
9      print("Mr. ", name ,", your payment is ", payment )
10
11 else:
12     payment =round(1.5*salary *(hours-40),2) + salary*40
13     print("Mr. ", name ,", your payment is ", payment )
```

Enter your name: Ali

Enter your salary: 45.7

Enter the number of worked hours: 20.45

Mr. Ali , your payment is 934.57

- [Exercise# 2](#): Write a program that reads in three floating point numbers and prints the largest of the three inputs without using the max function.  
For example:  
Enter a number: 4  
Enter a number: 9  
Enter a number: 2.5  
The largest number is 9.0

In [7]:

```
1  # Exercise # 2 - Source Code
2
3  num1 = float(input("Enter a number "))
4  num2 = float(input("Enter a number "))
5  num3 = float(input("Enter a number "))
6  if num1>num2 and num1>num3:
7      print("The largest number is" , num1)
8  else:
9      if(num2>num3):
10         print("The largest number is" , num2)
11     else:
12         print("The largest number is" , num3)
```

Enter a number 4

Enter a number 9

Enter a number 2.5

The largest number is 9.0

- [Exercise# 3](#): Write a program that reads a temperature and its unit (C or F) from the user, then it converts it to the other unit as shown in the sample runs. The following is the formula for converting the temperature from Celsius to Fahrenheit.

$$F = 9/5 C + 32$$

Note: the input can be lower case or upper case

```
1  Sample Runs:
2  Enter current temperature: 100.5
3  Enter it's unit C or F: C
4  100.50 C = 212.90 F
5
6  Enter current temperature: 56.8
7  Enter it's unit: C or F: f
8  56.80 F = 13.78 C
9
10 Enter current temperature: 120.8
11 Enter it's unit: C or F: k
12 Wrong unit
```

In [9]:

```

1  # Exercise # 3 - Source Code
2
3  temp = float(input("Enter current temperature: "))
4  choice = (input("Enter it's unit C or F : "))
5  if(choice == "C" or choice == "c"):
6      result = (9*temp/5) +32
7      print(temp,"C" , "= " , "%.2f" % result,"F")
8  else:
9      if(choice == "F" or choice == "f"):
10         result = (temp-32) * (5/9)
11         print(temp,"F" , "= " , "%.2f" % result,"C")
12     else:
13         print("wrong unit")

```

Enter current temperature: 100.5

Enter it's unit C or F : c

100.5 C = 212.90 F

- [Exercise# 4:](#) Write a program that displays the following menu:

1: Rectangle

2: Circle

The program, then, reads the menu choice and behaves according to the following table:

Menu choice	Program behavior
1	The program prompts for and reads the width and length of a rectangle. It then computes and displays the area the rectangle. $Area = width * length$
2	The program prompts for and reads the radius $r$ of a circle. It then computes and displays the circle. $Area = \pi r^2$ $\pi = 3.14159$ <code>math.pi</code>
Input other than 1, and 2	The program displays the following error message : <b>Error: Wrong menu choice</b> and then terminates.

*Note: Assume that the values read by the program for options 1, and 2 are in centimeters. For these options, your program must display appropriate units in the output as shown below.*

1: Rectangle 2: Circle Enter your choice: 3 Wrong choice	1: Rectangle 2: Circle Enter your choice: 1 Enter width: 25.32 Enter length: 35.68 Rectangle area= 903.42 cm <sup>2</sup>	1: Rectangle 2: Circle Enter your choice: 2 Enter radius: 24.89 Circle area= 1946.25 cm <sup>2</sup>
---	--	--

In [3]:

```
1 # Exercise # 4 - Source Code
2
3 from math import pi
4
5 print ("1 = Rectangle")
6 print ("2 = Circle")
7 choice = int(input("Enter your choice: "))
8 if choice==1:
9     w= input('Enter width: ')
10    l= input('Enter length: ')
11    area= float(w) * float(l)
12    print("Rectangle area= ", round(area,2), "cm^2")
13 else:
14     if(choice==2):
15         radius = input("Enter radius: ")
16         area= pi * float(radius) **2
17         print("Circle area= ", round(area,2), "cm^2")
18     else:
19         print('Wrong choice ')
```

```
1 = Rectangle
2 = Circle
Enter your choice: 2
Enter radius: 24.89
Circle area= 1946.25 cm^2
```

