FACULTY OF COMPUTING
& INFORMATION TECHNOLOGY
KING ABDULAZIZ UNIVERSITY

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وتقنية المعلومات
جامعة الملك عبدالعزيز

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Lab 6 - Selections

Chapter:	4. Selections	**Lab**
Time:	80 Minutes	**6**

Objectives

- To write Boolean expressions using comparison operators.
- To generate random numbers using the *random.randint(a, b)* or *random.random()* functions.
- To implement selection control using one-way if statements.
- To implement selection control using two-way if-else statements.
- To implement selection control with nested if and multi-way if-elif-else statements.
- To avoid common errors in if statements.
- To program with selection statements.
- To combine conditions using logical operators (and, or, and not).

Current Lab Learning Outcomes (LLO)

By completion of the lab the students should be able to

- Use the *random.randint(a, b)* function to generate random numbers between two values.
- Use the comparison operators to implement selection control.
- Use the one-way if statements.
- Use the nested if and multi-way if-elif-else statements.
- Use the logical operators (and, or, and not).
- Avoid the common errors in if statements.

Lab Requirements

- PyCharm (IDE).

Practice Activities with Lab Instructor (20 minutes)

Problem 1	Programming Exercises (4.1)

The two roots of a quadratic equation, for example $ax^2 + bx + c = 0$, can be obtained using the following formula:

$$\text{Two Roots:} \quad r1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad r2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$b^2 - 4ac$ is called the discriminant of the quadratic equation. If it is positive, the equation has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

$$\text{One Root:} \quad r1 = \frac{-b}{2a}$$

Write a program that prompts the user to enter values for a, b, and c and displays the result based on the discriminant. If the discriminant is positive, display two roots. If the discriminant is 0, display one root. Otherwise, display The equation has no real roots.

Here are some sample runs:

```
Enter a, b, c: 1.0, 3, 1 <enter>
The roots are -0.381966 and -2.61803
```

```
Enter a, b, c: 1, 2.0, 1 <enter>
The root is -1.0
```

```
Enter a, b, c: 1, 2, 3 <enter>
The equation has no real roots
```

Solution

Phase 1: Problem-Solving Phase:

1- Ask the user to enter the values for a, b, and c (a, b, c).
   - o `a, b, c = eval(input("message…"))`
2- Calculate the discriminant of the quadratic equation (discriminant).
   - o Note: $a^2 = a * a = a ** 2$
   - o `discriminant = (b ** 2) - (4 * a * c)`

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3- Check discriminant and calculate the roots if the equation has any root (r1, r2):

- o If (discriminant < 0) Then:
  - Print "The equation has no real roots"
- o Else If (discriminant == 0) Then:
  - The equation has one root (r1).
  - r1 = -b / (2 * a)
  - Display the result (r1)
- o Else:
  - The equation has two roots (r1, r2) because discriminant > 0
  - Note: $\sqrt{a} = a^{0.5} = a ** 0.5 = math.sqrt(a)$
  - Note: discriminant = (b ** 2) – (4 * a * c) = $b^2 - 4ac$
  - r1 = (-b + math.sqrt(discriminant)) / (2 * a)
  - r2 = (-b - math.sqrt(discriminant)) / (2 * a)
  - Display the result (r1, r2)

Phase 2: Implementation Phase:

1. Create a new project and name it "Lab 6".
2. Create a new file and name it "activity_1.py".
3. Write the following code in the file:

activity_1.py

```python
1   # To use sqrt function, we need to import math module first
2   import math
3
4   # Ask the user to enter the values for a, b, and c
5   a, b, c = eval(input("Enter a, b, c: "))
6
7   # Calculate the discriminant of the quadratic equation
8   discriminant = (b ** 2) - (4 * a * c)
9
10  # Check discriminant and calculate the roots if it has any root
11  if discriminant < 0:
12      print("The equation has no real roots")
13  elif discriminant == 0:
14      r1 = -b / (2 * a)
15      print("The root is " + str(r1))
16  else:
17      # (discriminant > 0)
18      r1 = (-b + math.sqrt(discriminant)) / (2 * a)
19      r2 = (-b - math.sqrt(discriminant)) / (2 * a)
20      print("The roots are", r1, "and", r2)
```

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Problem 2	Programming Exercises (4.4)

Write a program that generates two integers under 100 and prompts the user to enter the sum of these two integers. The program then reports true if the answer is correct, false otherwise. Also, the program displays the correct result if the answer was wrong.

Sample runs are shown below:

```
What is 30 + 43? 50 <enter>
30 + 43 = 50 is False
The correct answer is 73
```

```
What is 30 + 43? 111 <enter>
15 + 96 = 111 is True
```

Solution

Phase 1: Problem-Solving Phase:

1- Generate two numbers randomly between 0 and 99 inclusive (number1, number2).
   o Use random.randint(FromNumber, ToNumber) to generate a random number.
   o number1 = random.randint(0, 99)
   o number2 = random.randint(0, 99)
2- Calculate the sum of two numbers (sum).
   o sum = number1 + number2
3- Ask the user to enter the answer (answer).
   o answer = eval(input("message…"))
4- Check the user answer (answer) with the correct answer (sum):
   o If (answer == sum) Then:
      ▪ Print "number1 + number2 = answer is True"
   o Else:
      ▪ Print "number1 + number2 = answer is False"
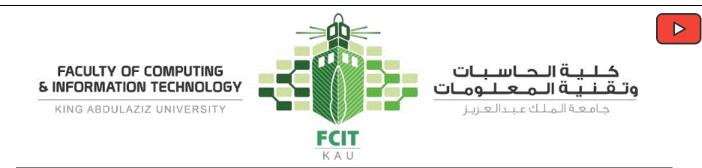   ▪ Display the correct result (sum)

Phase 2: Implementation Phase:

1. Open the project "Lab 6" if it was not opened or create it if it was not existing.
2. Create a new file and name it "activity_2.py".
3. Write the following code in the file:

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activity_2.py

```python
1   # To use randint function we need to import random module
2   import random
3
4   # Generate two numbers randomly between 0 and 99 inclusive
5   number1 = random.randint(0, 99)
6   number2 = random.randint(0, 99)
7
8   # Calculate the sum of two numbers
9   sum = number1 + number2
10
11  # Ask the user to enter the answer
12  answer = eval(input("What is " + str(number1) + " + "
13                      + str(number2) + "? "))
14
15  # Check the user answer (answer) with the correct answer (sum)
16  print(number1, "+", number2, "=", answer, "is", answer == sum)
17
18  # Display the correct answer if the answer is wrong
19  if sum != answer:
20      print("The correct answer is ", sum)
```

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Individual Activities (60 minutes)

Problem 3
<div align="right">Programming Exercises (4.9)</div>

Suppose you shop for rice and find it in two different-sized packages. You would like to write a program to compare the costs of the packages. The program prompts the user to enter the weight and price of each package and then displays the one with the better price.

Here is a sample run:

```
Enter weight and price for package 1: 50, 24.59 <enter>
Enter weight and price for package 2: 25, 11.99 <enter>
Package 2 has the better price.
```

Problem 4
<div align="right">Programming Exercises (4.17)</div>

Write a program that plays the popular scissor-rock-paper game. (A scissor can cut a paper, a rock can knock a scissor, and a paper can wrap a rock.) The program randomly generates a number 0, 1, or 2 representing scissor, rock, and paper. The program prompts the user to enter a number 0, 1, or 2 and displays a message indicating whether the user or the computer wins, loses, or draws.

Here is sample runs:

```
scissor (0), rock (1), paper (2): 1 <enter>
The computer is scissor. You are rock. You won.
```

```
scissor (0), rock (1), paper (2): 2 <enter>
The computer is paper. You are paper too. It is a draw.
```

```
scissor (0), rock (1), paper (2): 2 <enter>
The computer is scissor. You are paper. You lost.
```

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Extra Exercises (Homework)

From the Textbook

- Programming Exercises:
  - 4.2
  - 4.3
  - 4.5
  - 4.12
  - 4.15

From MyProgrammingLab (https://pearson.turingscraft.com)

- 4.2
  - 51052
  - 51053
  - 51055
  - 51059
  - 51891
  - 51882
  - 51883
- 4.4
  - 51114
  - 51115
  - 51116
  - 51117
  - 51160
- 4.6
  - 51118
  - 51119
  - 51120

- 4.7
  - 51121
  - 51122
  -
- 4.11
  - 51109
  - 51113
  - 51063
  - 51167
  - 51111
  - 51903
  - 51903
  - 51915
  - 51911

Upload Your Solutions

Upload your solutions of the lab activities to Blackboard.