Lab 5 - Mathematical Functions and Strings

		Lab
Chapter:	3. Mathematical Functions and Strings	**5**
Time:	80 Minutes	
Week:	**6**	
Date:	06/10/2019 – 10/10/2019	

Objectives

- To familiarize students how to solve practical problems programmatically.
- To solve mathematics problems by using the functions in the math module.
- To represent and process strings and characters.
- To represent special characters using the escape sequence.
- To invoke the print function with the end argument.
- To convert numbers to a string using the str function.
- To use the + operator to concatenate strings.
- To read strings from the keyboard.

Current Lab Learning Outcomes (LLO)

By completion of the lab the students should be able to

- Convert a simple mathematical equation into a Python expression.
- Use the *eval* function to evaluate and convert a string to a numerical value.
- Use the *import* keyword to load a module into a program.
- Use the constants of the *math* module such as pi.
- Use the functions of *math* module such as the *sqrt* and *sin* functions.
- Use the *round* function.
- Use the special character (\n) for inputting a new line into a string.
- Use plus sign (+) to concatenate strings.

Lab Requirements

- PyCharm (IDE).

FACULTY OF COMPUTING
& INFORMATION TECHNOLOGY

KING ABDULAZIZ UNIVERSITY

كلية الحاسبات
وتقنية المعلومات

جامعة الملك عبدالعزيز

FCIT
K A U

Practice Activities with Lab Instructor (20 minutes)

Problem 1   Programming Exercises (3.1)

Write a program that prompts the user to enter the length from the center of a pentagon to a vertex and computes the area of the pentagon, as shown in the following figure.
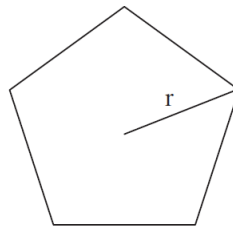
The formula for computing the area of a pentagon is $Area = \frac{3\sqrt{3}}{2}s^2$, where *s* is the length of a side. The side can be computed using the formula $s = 2r\ \sin\frac{\pi}{5}$, where *r* is the length from the center of a pentagon to a vertex.

```
Enter the length from the center to a vertex: 5.5 <enter>
The area of the pentagon is 108.61
```

Solution

Phase 1: Problem-Solving Phase:

1- Ask the user to enter the length from the center to a vertex (r).
   o r = eval(input("message…"))
2- Calculate the length of the side (s).
   o Use the *sin* function in the math module to compute ($\sin\frac{\pi}{5}$)
   o Use the *PI* constant in the math module to get the value of π
   o s = (2 * r) * math.sin(math.PI / 5)
3- Calculate the area.
   o Use the *sqrt* function in the math module to compute ($\sqrt{3}$)
   o Use the *pow* function (pow(s, 3)) or (s ** 3) to compute (s^2)
   o area = ((3 * math.sqrt(3)) / 2) * pow(s, 2)
4- Display the result (area).

Phase 2: Implementation Phase:

1. Create a new project and name it "Lab 5".

FACULTY OF COMPUTING
& INFORMATION TECHNOLOGY
KING ABDULAZIZ UNIVERSITY

FCIT
K A U

كـليـة الـحـاسـبـات
وتـقـنـيـة الـمـعـلـومـات
جامعة الـمـلـك عـبـدالعزيز

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

activity_1.py

```
1   import math
2
3   # Get the length from the center to a vertex
4   r = eval(input("Enter the length from the center to a vertex: "))
5
6   # Calculate the length of the side
7   s = 2 * r * math.sin(math.pi / 5)
8
9   # Calculate the area
10  area = 3 * math.sqrt(3) * s * s / 2
11
12  # Display the result
13  print("The area of the pentagon is", round(area, 2))
```

Problem 2   Programming Exercises (3.1)

Write a program that reads the following information and prints a payroll statement:

      Employee's name (e.g., Smith)
      Number of hours worked in a week (e.g., 10)
      Hourly pay rate (e.g., 9.75)
      Federal tax withholding rate (e.g., 20%)
      State tax withholding rate (e.g., 9%)

A sample run is shown below:

```
Enter employee's name: Smith <enter>
Enter number of hours worked in a week: 10 <enter>
Enter hourly pay rate: 9.75 <enter>
Enter federal tax withholding rate: 0.20 <enter>
Enter state tax withholding rate: 0.09 <enter>

Employee Name: Smith
Hours Worked: 10.0
Pay Rate: $9.75
Gross Pay: $97.5
Deductions:
  Federal Withholding (20.0%): $19.5
  State Withholding (9.0%): $8.77
  Total Deduction: $28.27
Net Pay: $69.22
```

FACULTY OF COMPUTING & INFORMATION TECHNOLOGY

KING ABDULAZIZ UNIVERSITY

FCIT
K A U

كلية الحاسبات
وتقنية المعلومات

جامعة الملك عبدالعزيز

Solution

Phase 1: Problem-Solving Phase:

1. Ask the user to enter the employee's name (name).
   - the name is a string value, so you shouldn't use the eval function.
   - `name = input("message…")`
2. Ask the user to enter the number of hours worked in a week (hours).
   - `hours = eval(input("message…"))`
3. Ask the user to enter the hourly pay rate (payRate).
   - `payRate = eval(input("message…"))`
4. Ask the user to enter the federal tax withholding rate (fedTaxWithholdingRate).
   - `fedTaxWithholdingRate = eval(input("message…"))`
5. Ask the user to enter the state tax withholding rate (stateTaxWithholdingRate).
   - `stateTaxWithholdingRate = eval(input("message…"))`
6. Calculate the gross Pay (grossPay).
   - `grossPay = hours * payRate`
7. Calculate the federal Withholding (stateTaxWithholding).
   - `fedTaxWithholding = grossPay * fedTaxWithholdingRate`
8. Calculate the state Withholding (stateTaxWithholding).
   - `stateTaxWithholding = grossPay * stateTaxWithholdingRate`
9. Calculate the total deduction (totalDeduction).
   - `totalDeduction = fedTaxWithholding + stateTaxWithholding`
10. Calculate the net pay (netPay).
    - `netPay = grossPay - totalDeduction`
11. Store, prepare and format the output into a string (out).
    - You can concatenate strings using plus sign (+).
    - You can write this (out += "appended string") instead of this (out = out + "appended string")
    - You can convert a numerical value to a string by using the *str* function.
    - You can use the "\n" special character to insert a new line to a string.
    - You can use the *int* function to convert a float or string value to integer.
    - You can use the "\" continuation symbol to write a statement in multiple lines.
    - percentage = rate * 100
12. Display the result (out).

Phase 2: Implementation Phase:

1. Open the project "Lab 5" 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:

FACULTY OF COMPUTING
& INFORMATION TECHNOLOGY
KING ABDULAZIZ UNIVERSITY

كلية الحاسبات
وتقنية المعلومات
جامعة الملك عبدالعزيز

FCIT
KAU

activity_2.py

```python
1    # Get the employee's name
2    name = input("Enter employee's name: ")
3
4    # Get the number of hours worked in a week
5    hours = eval(input("Enter number of hours worked in a week: "))
6    # Get the hourly pay rate
7    payRate = eval(input("Enter hourly pay rate: "))
8    # Get the federal tax withholding rate
9    fedTaxWithholdingRate = eval(input("Enter federal tax withholding rate: "))
10   # Get the state tax withholding rate
11   stateTaxWithholdingRate = eval(input("Enter state tax withholding rate: "))
12
13   # Calculate the gross Pay
14   grossPay = hours * payRate
15   # Calculate the federal Withholding
16   fedTaxWithholding = grossPay * fedTaxWithholdingRate
17   # Calculate the state Withholding
18   stateTaxWithholding = grossPay * stateTaxWithholdingRate
19   # Calculate the total deduction
20   totalDeduction = fedTaxWithholding + stateTaxWithholding
21   # Calculate the net pay
22   netPay = grossPay - totalDeduction
23
24   # Store, prepare and format the output into a string
25   out = "Employee Name: " + name + "\n\n"
26   out += "Hours Worked:  " + str(hours) + '\n'
27   out += "Pay Rate: $" + str(payRate) + '\n'
28   out += "Gross Pay: $" + str(grossPay) + '\n'
29   out += "Deductions:\n"
30   out += "  Federal Withholding (" + str(fedTaxWithholdingRate * 100) + \
31       "%): $" + str(int(fedTaxWithholding * 100) / 100.0) + '\n'
32   out += "  State Withholding (" + str(stateTaxWithholdingRate * 100) + "%):"  + \
33       "  $" + str(int(stateTaxWithholding * 100) / 100.0) + '\n'
34   out += "  Total Deduction:" + "  $" + \
35       str(int(totalDeduction * 100) / 100.0) + '\n'
36   out += "Net Pay:" + "   $" + str(int(netPay * 100) / 100.0)
37
38   # Display the result
39   print(out)
```

FACULTY OF COMPUTING
& INFORMATION TECHNOLOGY
KING ABDULAZIZ UNIVERSITY

FCIT
KAU

كلية الحاسبات
وتقنية المعلومات
جامعة الملك عبدالعزيز

Individual Activities (60 minutes)

Problem 3
Programming Exercises (3.4)

The area of a pentagon can be computed using the following formula (*s* is the length of a side):

$$Area = \frac{5 \times s^2}{4 \times \tan\left(\frac{\pi}{5}\right)}$$

Write a program that prompts the user to enter the side of a pentagon and displays the area. Here is a sample run:

```
Enter the side: 5.5 <enter>
The area of the pentagon is 53.04444136781625
```

Problem 4
Programming Exercises (3.11)

Write a program that prompts the user to enter a four-digit integer and displays the number in reverse order. Here is a sample run:

```
Enter an integer: 3125 <enter>
The reversed number is 5213
```

FACULTY OF COMPUTING
& INFORMATION TECHNOLOGY
KING ABDULAZIZ UNIVERSITY

FCIT
KAU

كـلـيـة الـحـاسـبـات
وتـقـنـيـة الـمـعـلـومـات
جامعة الـملـك عـبـدالعزيز

Extra Exercises (Homework)

From the Textbook

- Programming Exercises:
  - 3.2
  - 3.3
  - 3.5
  - 3.8

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

- 3.3
  - 51835
  - 51755
  - 51756
  - 51839
  - 51869
- 3.6
  - 51028

Upload Your Solutions

Upload your solutions of the lab activities to Blackboard.