COME103 / CENG111 Computer Programming I

Lab - 6 Before LAB Examples

3 November 2021

1. TRUE / FALSE QUESTIONS

T ___T___ To assign a value to a global variable in a function, the global variable must be first declared in the function.

___T___ The math function `ceil(x)` returns the smallest integer that is greater than or equal to `x`.

___T___ A value-returning function is like a simple function except that when it finishes it returns a value back to the part of the program that called it.

T ___F___ Some library functions are built into the Python interpreter.

___T___ Complex mathematical expressions can sometimes be simplified by breaking out part of the expression and putting it in a function.

___T___ IPO charts provide only brief descriptions of a function's input, processing, and output, but do not show the specific steps taken in a function.

___F___ The math function `atan(x)` returns one tangent of `x` in radians.

___T___ A function in Python can return more than one value.

2. COMPLETION QUESTIONS: Fill in the blanks.

a) To refer to/use a function in a module, Python uses ___dot___ notation.

b) In Python, a module's file name should end in ___. py___.

c) The trigonometric functions in Python accepts arguments in ___units of degrees___.

d) A value-returning function has a(n) ___return.___ statement that sends a value back to the part of the program that called it.

e) The 'P' in the acronym IPO refers to ___processing___

3. ALGORITHM WORKBENCH QUESTIONS

a) The following statement calls a function named `half`, which returns a value that is half that of the argument. (Assume the `number` variable references a float value.)
Write code for the `half` function.

```
result = half(number)
```

b) Write a function named factorial that receives a positive integer number as a parameter from the caller then returns the factorial to the caller.
Factorial of a positive integer number: `n! = 1.2.3...(n-1).n`

c) Write a statement that generates a random number in the range of 1 through 100 and assigns it to a variable named `rand`.

d) Write a function named `distance` that takes 4 values (coordinates of two points in Cartesian coordinates) as parameter from the caller then it calculates and return the distance between these two points to the caller.

e) Write a function named `sum_of_odds` that takes a positive integer number the caller then then it calculates and return the summation of the odd numbers from 1 to that number and returns the result to the caller.

MULTIPLE CHOICE QUESTIONS

4. This standard library function returns a random floating-point number within a specified
a) `range of values.`
b) `random`
c) `randint`
d) `random_integer`
e) `uniform`

5. This type of function returns either `True` or `False`.
a) Binary
b) true_false
c) Boolean
d) logical

6. Which of the following will assign a random integer in the range of 1 through 50 to the variable number?
a) `random(1, 50) = number`
b) `number = random.randint(1, 50)`
c) `randint(1, 50) = number`
d) `number = random.randrange(1, 50)`

7. A value-returning function is
a) a single statement that performs a specific task
b) called when you want the function to stop
c) a function that will return a value back to the part of the program that called it
d) a function that receives a value when called

8. What will be the output after the following code is executed?

```
def main():
      name2 = "Tony"
      name1 = "Gaddis"
      fullname = pass_it(name1, name2)
      print(fullname)
def pass_it(x, y):
     z = x + ", " + y
     return(z)
main() # Calling Main
```

a) `Tony Gaddis`
b) `Gaddis Tony`
c) `Tony, Gaddis`
d) `Gaddis, Tony`
e) Nothing, this code contains a syntax error.

9. What will display after the following code is executed?

```
def main():
    print("The answer is", magic(5))
def magic(num):
    answer = num + 2 * 10
    return answer
main()
```

a) 70
b) 25
c) 100
d) The statement will cause a syntax error.

10. What will be displayed after the following code is executed?

```
def pass_it(x, y):
    z = x*y
    result = get_result(z)
    return(result)
def get_result(number):
    z = number + 2
    return(z)
num1 = 3
num2 = 4
answer = pass_it(num1, num2)
print(answer)
```

a) 12
b) 9
c) 14
d) Nothing, this code contains a syntax error.

11. A _____ variable is accessible to all the functions in a program file.
a) Keyword
b) Local
c) Global
d) String

12. It is recommended that programmers avoid using _____ variables in a program whenever possible.

a) local
b) global
c) string
d) keyword

13. This is a math module function.

a) `derivative`
b) `factor`
c) `sqrt`
d) `differentiate`

14. The Python standard library's _____ module contains numerous functions that can be used in mathematical calculations.

a) `math`
b) `string`
c) `random`
d) `number`

15. What will be the output after the following code is executed?

```
def pass_it(x, y):
    z = y**x
    return(z)
num1 = 3
num2 = 4
answer = pass_it(num1, num2)
print(answer)
```

a) 81 **b)** 64 **c)** 12 **d)** 48 **e)** None

16. What will be displayed after the following code is executed?

```
def pass_it(x, y):
    z = x*y
    result = get_result(z)
    return(result)
def get_result(number):
    z = number + 2
    return(z)
num1 = 3
num2 = 4
answer = pass_it(num1, num2)
print(answer)
```

a) `12`
b) `9`
c) `14`
d) Nothing, this code contains a syntax error.

PROGRAMS

17. (Sum the digits in an integer) Write a function that computes the sum of the digits in an integer. Use the following function header: `def sumDigits(n):`
For example, sumDigits(234) returns 9 (Hint: Use the % operator to extract digits, and the // operator to remove the extracted digit. For instance, to extract 4 from 234, use 234 % 10 To remove 4 from 234, use 234 // 10
Use a loop to repeatedly extract and remove the digits until all the digits are extracted.) Write a test program that prompts the user to enter an integer and displays the sum of all its digits.

18. (Display an integer reversed) Write the following function to display an integer in reverse order: `def reverse(number):`
For example, reverse(3456) displays 6543. Write a test program that prompts the user to enter an integer and displays its reversal.

19. (Conversions between Celsius and Fahrenheit) Write a module that contains the following two functions:

```
# Converts from Celsius to Fahrenheit
def celsiusToFahrenheit(celsius):

# Converts from Fahrenheit to Celsius
def fahrenheitToCelsius(fahrenheit):
```

The formulas for the conversion are:

```
celsius = (5 / 9) * (fahrenheit - 32)
fahrenheit = (9 / 5) * celsius + 32
```

Write a test program that invokes these functions to display the following tables:

```
Celsius     Fahrenheit   |   Fahrenheit   Celsius

40.0        104.0        |   120.0        48.89
39.0        102.2        |   110.0        43.33
...
32.0        89.6         |   40.0         4.44
31.0        87.8         |   30.0         -1.11
```

20. (Use the isPrime Function) as we have learned in the lecture, the isPrime(number) function for testing whether a number is prime. Use this function to find and display the number of prime numbers less than 10,000.

21. (Math: pentagonal numbers) A pentagonal number is defined as $n(3n-1)/2$ for $n = 1, 2, 3, \ldots$ and so on. So, the first few numbers are 1, 5, 12, 22, ... Write a function with the following header that returns a pentagonal number for any n:

```
def getPentagonalNumber(n):
```

Write a test program that uses this function to display the first 20 pentagonal numbers such that there will be 5 numbers on each line.

22. Write a program that generates printable addition tests. The tests should consist of 5 questions which present a simple addition question in the following format, where the question number goes from 1 to 5, and `num1` and `num2` are randomly generated numbers between 1 and 10:

```
Question 1
num1 + num2 = _____
…
Question 5
num1 + num2 = _____
```

The program should simply display the 5 questions – it should not prompt the user for any input. No input is received from user numbers are all randomly generated.

23. (Estimate π) π can be computed using the following series:

$$m(i) = 4\left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \ \ldots \ + \frac{(-1)^{i+1}}{2i-1}\right)$$

Write a function that returns `m(i)` for a given `i` and write a test program that displays the following table: *For example m(101) should return 3.1515*

i	m(i)
1	4.0000
101	3.1515
201	3.1466
301	3.1449
401	3.1441
501	3.1436
601	3.1433
701	3.1430
801	3.1428
901	3.1427

24. Write a program that generates a random number in the range of 1 through 100, and asks the user to guess what the number is. If the user's guess is higher than the random number, the program should display "Too high, try again." If the user's guess is lower than the random number, the program should display "Too low, try again." If the user guesses the number, the application should congratulate the user then finish.

Optional Enhancement: (Even more!) Enhance the game so it keeps count of the number of guesses that the user makes. When the user correctly guesses the random number, the program should display the number of guesses. You may also modify program as giving points as 1st guess 100 and each guess points go down -5 and after twenty guess when the points become 0, it says you have failed. Try making this program with different approaches so hopefully you will learn more on programming.

25. One can simulate a coin toss by considering random number as 1 (Heads) and 2 (Tails). Write a program that simulates the tossing of a coin by randomly generating a number in the range of 1 to 2. Your program should toss the coin 1000000 times. Your program will keep track of how many heads and tails came out and print the results in tabular form for every 10000th toss.

26. In physics, an object that is in motion is said to have kinetic energy. The following formula can be used to determine a moving object's kinetic energy:

$$KE = \frac{1}{2}mv^2$$

The variables in the formula are as follows: *ke* is the kinetic energy, *m* is the object's mass in kilograms, and *v* is the object's velocity in meters per second.

Write a function named `kinetic_energy` that accepts an object's mass (in kilograms) and velocity (in meters per second) as arguments. The function should return the amount of kinetic energy that the object has. Write a program that asks the user to enter values for mass and velocity, then calls the `kinetic_energy` function to get the object's kinetic energy.

27. Write a program that asks the user to enter five test scores. The program should display a letter grade for each score and the average test score. Write the following functions in the program:

• `calc_average`. This function should accept five test scores as arguments and return the average of the scores.

• `determine_grade`. This function should accept a test score as an argument and return a letter grade for the score based on the following grading scale:

Score	Letter Grade
90–100	A
80–89	B
70–79	C
60–69	D
Below 60	F

28. Write a program that determines the maximum and the minimum of a desired number of integers entered from keyboard then writes the maximum and minimum to the screen. In your program there will be two functions names `max3` and `min3` those receives three integers from the caller (main) and returns the maximum and minimum of the received three integers respectively.

The output of the program is shown below when executed:

```
Enter the first number: 4
Enter the second number: 121
Enter the third number: 3201
Maximum is 3201.
Minimum is 4.
```

29. Write a program that determines the desired power of an integer number. You main program should call a function `power(base, exponent)` that returns the value of $base^{exponent}$

For example, **power**(3, 4) = 3 * 3 * 3 * 3. Assume that exponent and base is an integer number. Function **power** should use "a repetition" to control the calculation. Do not use any math module functions.

Terminal output for program should look as below when executed for different input values.

```
Enter the base number: 3
Enter the power: 4
Result: 81

Enter the base number: 4
Enter the power: 5
Result: 1024
```

30. Design a function named **distance** which calculates the distance between two points *(x_1, y_1)* and (x_2, y_2) lying in the *xy*-plane. All numbers and return values should be of type float. Now write a main program that takes the xy coordinates of two points from the user then prints the distance between these two points by calling the **distance** function.

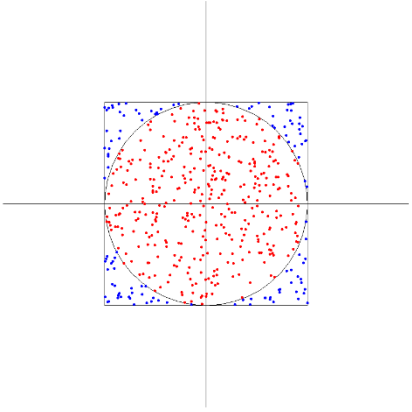
Hint: *Distance between two points in Cartesian coordinates can be evaluated from the formula:*

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\ .$$

Header of the function might look as

```
def distance(x1, y1, x2, y2):
```

31. A Write a program by using turtle graphics and random modules. Your program first draws the square of each side 400 pixel and a circle of radius 200 pixels as shown in the figure. Then your program generates randomly 500 points with coordinates x (-200 ≤ x ≤ 200) and y (-200 ≤ y ≤ 200) and draw each points as a dot on the figure. If the dots are within the circle then they will red otherwise they will be blue.



32. Write a program which takes the x- and y-components of a two dimensional vector from user then prints out the magnitude and direction of the vector in CCW direction from the +x axis. For direction, your program should give the angle for direction in the range [0 – 360). If the vector is along the +x, -x, +y or –y axis or in a quadrant then the program should also clearly state that the vector is along the … axis or in the … quadrant (you may use π=3.141592 and available functions under math module)

Example terminal output of the program for three different cases are given on the right.

Hint: You can use `atan` to find the direction then use `and` logical operator get the direction in CCW direction from +x axis by adding 180 or 360 if it is necessary.

Enter the x-component: -3
Enter the y-component: 4
Magnitude is 5.00
Direction is 126.87 - in the second quadrant

Enter the x-component: -8.1
Enter the y-component: -4.9
Magnitude is 9.47
Direction is 211.17 - in the second quadrant

Enter the x-component: 0
Enter the x-component: -9
Magnitude is 9.00
Direction is 270 – Along the -y axis.