COMP 1039 Problem Solving and Programming

Practical 9

Create a separate file in order to complete each of the following exercises (refer to practical 1 or ask your supervisor if you are having problems doing so). Your files should include appropriate comments consisting of the following – file name, your details, version number and date, brief program description and the University's academic misconduct statement.

Question 1

The distance of a point with coordinates (x, y) from the origin (0, 0) is $\sqrt{x^2 + y^2}$. Write a function called `distance(x, y)` that if given two numbers x, y, will return the distance of the point (x, y) from the origin. Call function `distance(x, y)` once it has been defined in order to ensure that it is working correctly. Display the distance to the screen with an appropriate message.

Question 2

Write a function called `between(no1, no2, no3)` that returns True if no3 is between no1 and no2, False otherwise. . Call function `between(no1, no2, no3)` once it has been defined in order to ensure that it is working correctly. Display an appropriate message to the screen.

Question 3

Write a function called `count_letter` that accepts a string and a letter (string of one character) as parameters and returns how many times the letter appears in the string.

For example: calling the function `count_letter` like so `count_letter("fanta", "a")` will return the number 2.

Call function `count_letter` once it has been defined in order to ensure that it is working correctly. Ask the user to enter the string and letter and pass that information to the function.

Question 4

Define a function called `generate_chars()` that takes an integer called `number` and a character called `char` and returns a string, `number` characters long, consisting only of `char`s. For example, `generate_chars(5,"x")` should return the string "xxxxx". Call function `generate_chars()` once it has been defined in order to ensure that it is working correctly. *You are not allowed to use the following 5*"x" in order to solve this problem. You must use a loop in your solution.*

Question 5

Write a function that accepts a number (positive integer) as a parameter and calculates the hailstone sequence for that number (http://en.wikipedia.org/wiki/Collatz_conjecture). Display each step taken within the function. The function returns the number of steps it took to reach 1. Call the function once it has been defined in order to ensure that it is working correctly. The program should ask the user to enter a number and then pass it to the function. Display the number of steps it took to reach 1 to the screen. See sample output below:

The algorithm for the hailstone sequence can be described as follows:
    Pick a positive integer and call it n
    If n is even, divide it by two (n/2)
    If n is odd, multiply it by three and add one (3n + 1)
    Continue this process until n is equal to one.

Sample output:

```
Please enter a number: 15

15 is odd, so I calculate 3n + 1: 46
46 is even, so I divide by 2: 23
23 is odd, so I calculate 3n + 1: 70
70 is even, so I divide by 2: 35
35 is odd, so I calculate 3n + 1: 106
106 is even, so I divide by 2: 53
53 is odd, so I calculate 3n + 1: 160
160 is even, so I divide by 2: 80
80 is even, so I divide by 2: 40
40 is even, so I divide by 2: 20
20 is even, so I divide by 2: 10
10 is even, so I divide by 2: 5
5 is odd, so I calculate 3n + 1: 16
16 is even, so I divide by 2: 8
8 is even, so I divide by 2: 4
4 is even, so I divide by 2: 2
2 is even, so I divide by 2: 1


The hailstone sequence took 17 steps to reach 1
```

Question 6

Write a function called `display_with_dash` that accepts a word (string) as a parameter and displays the word with a '-' in between each of its characters. For example: `Elvis` would be displayed as `E-l-v-i-s`.

Show how you would call function `display_with_dash` so that the following list of words (strings):
```
words = ['Elvis', 'has', 'left', 'the', 'building!']
```

is displayed to the screen as follows:
```
E-l-v-i-s
h-a-s
l-e-f-t
t-h-e
b-u-i-l-d-i-n-g-!
```

Hint: You will need to **call** the function `display_with_dash()` **within a loop**.

Question 7

Write a function called `calculate_sum()` that accepts a series of single-digit numbers (as a string) with nothing separating them. The function calculates and returns the sum of all the single digit numbers in the string. For example, if the function is passed the string "2514", the function should return the integer number 12, which is the sum of 2, 5, 1 and 4. You may assume that the string does not contain non-digit characters.
The string (series of single-digit numbers) passed in as a parameter must be a default argument.
i.e. number_string="0000".

Show how you would call function `calculate_sum()` and display the value returned from the function to the screen.
(Modified: Gaddis, Tony. Programming Exercises, Chapter 9).

Question 8

Write a function called `countDigits` that counts the number of characters in a string that are digits (i.e. characters '0' to '9'). The function will take a string as a parameter and return the number of digit characters in the string. You will need to use a for loop in your solution. Call function `countDigits` once it has been defined in order to ensure that it is working correctly.

Question 9

Write a function called `determine_initials()` that accepts a string containing a person's full name (first, middle and last names) as a parameter, builds a new string containing their first, middle, and last initials. The function returns the new string containing the person's initials. For example, if the function is passed the name "John William Smith", the function should return the string: "J. W. S." (Modified: Gaddis, Tony. Programming Exercises, Chapter 9).

a) Show how you would call function `determine_initials()` so that the following name:
   ```
   John William Smith
   ```

   is displayed to the screen as follows:
   ```
   J. W. S.
   ```

b) Show how you would call function `determine_initials()` so that the following list of names:

   ```
   name_list= ["Peter Gene Hernandez", "Steveland Judkins", "Norma Jean
   Mortensen", "Ramon Antonio Gerard Estevez", "Declan Patrick McManus"]
   ```

   Are displayed to the screen as follows:
   ```
   P.G.H.
   S.J.
   N.J.M.
   R.A.G.E.
   D.P.M.
   ```

   Hint: You will need to **call** the function `determine_initials()` **within a loop**.

Question 10

Using the following variable definitions:

```
secretWord = ['p', 'y', 't', 'h', 'o', 'n']

blanks = '_' * len(secretWord)
blankWord = list(blanks)

guess = 't'
```

Write code that will determine whether the character assigned to variable guess is in the word secretWord (you will need to use a for loop and if statement to do this). If the character is in secretWord, update blankWord by placing the character in blankWord at the position it is found in secretWord. The following algorithm may help you with this:

```
FOR  k in 0 to length(secretWord)
     IF secretWord(k) is equal to guess
         Copy letter from secretWord to blankWord at pos k
              i.e. blankWord(k) = secretWord(k)
     ENDIF
ENDFOR
```

Question 11

Write a Python program that allows the user to enter a list of positive integer values, terminated by zero or a negative value, and then prints the values in descending order (largest to smallest). After printing the values, print the largest, smallest, and median value (if the sorted list of numbers has an odd number of values, the median is the middle value, otherwise it is the average of the two 'middle' values. Hint: you will need to use a list for this.

Question 12 - Crack the Code, Save the World!

If you have not already done so, take the Python code fragments you have received by completing the 'Crack the Code, Save the World' challenges and place them in the correct order. Complete the program by reordering the code so that it can be used to decipher the information found in the `'intercepted2.txt'` file. Just in case you missed the code- it is listed here for you again... of course, in no particular order:

Note: You won't need to use all the code fragments. Don't forget to indent.

```
infile = open("intercepted.txt", "r")

outfile.close()

    giving_me_the_splits = line.split()

for line in linesList:

        asciiNo = int(number)

outfile = open("translated.txt", "w")

        character = chr(asciiNo)

infile.close()

        asciiNo = ord(character)

    for number in giving_me_the_splits:

        outfile.write(str(asciiNo) + " ")

        outfile.write(str(character))

    print(line, end="")

linesList = infile.readlines()
```

Optional Practical Work: A little bit more with the graphics module - the Text Object… :)

Text(anchorPoint, string)
Constructs a text object that displays the given string centered at anchorPoint. The text is displayed horizontally.

You can construct a Text object centred at coordinates (x, y) using Point(x, y).

For example:
The following code creates a Text object centred at coordinates (250, 250) and displays the string "This is FUN!".

```
import graphics

# create graphics window for example
win = graphics.GraphWin("Text Example!", 500, 500)

win.setBackground("White")


# The following code creates a Point object at coordinates (250, 250).
point = graphics.Point(250, 250)

# The following code creates a Text object centered at point, and
# displays the string "This is FUN!" to the window
string = graphics.Text(point, "This is FUN!")

string.draw(win)


win.getMouse()
win.close()
```

Text methods

setText(string)
Sets the text of the object to string.

getText()
Returns the current string.

setFace(family)
Changes the font face to the given family. Possible values are: 'helvetica', 'courier', 'times roman', and 'arial'.

setSize(point)
Changes the font size to the given point size. Sizes from 5 to 36 points are legal.

setStyle(style)
Changes font to the given style. Possible values are 'normal', 'bold', 'italic', and 'bold italic'.

setTextColor(color)
Sets the color of the text to color. Note: setFill has the same effect.

For example:
The following code creates a Text object centred at coordinates (250, 250) and displays the string "This is FUN!" with font size set to 15, font set to arial, and colour set to red.

```
import graphics

# create graphics window for example
win = graphics.GraphWin("Text Example!", 500, 500)

win.setBackground("White")


# The following code creates a Point object at coordinates (250, 250).
point = graphics.Point(250, 250)

# The following code creates a Text object centered at point, and
# displays the string "This is FUN!" to the window
string = graphics.Text(point, "This is FUN!")

string.setSize(15)
string.setFace('arial')
string.setTextColor('red')
string.draw(win)


win.getMouse()
win.close()
```

Exercise 1

Write a program that creates a window (500x500), sets the title to 'Boom!', sets the background to white and displays the text 'Time' (font size 24, font arial, colour black) to the screen.

Scroll to the end of this practical for a sample solution if you are having difficulties with this.

Exercise 2

Modify the program from exercise 1 so that it displays the variable count next to the string 'Time:'. Set variable count to the integer ten.

Scroll to the end of this practical for a sample solution if you are having difficulties with this.

Exercise 3 - more with loops…

Modify the program again so that it uses a while loop to count down from ten to zero. Update the text as it counts down. Hint: you will need to use the setText() method in order to do this.

If your solution is anything like mine, because it all happens so fast, you will only see Time: 0 displayed to the screen (if so, exercise 4 will help with this).

Scroll to the end of this practical for a sample solution if you are having difficulties with this.

Exercise 4

Modify the program so that it uses time.sleep(0.4) that we have used in previous practicals to slow down the loop. You should now be able to see the text changing – counting down from 10 to 0.

Scroll to the end of this practical for a sample solution if you are having difficulties with this.

Exercise 5

Okay, now the fun part… :)

Modify the program so that when it reaches zero (0), it displays the text – 'tick', 'tick', 'BOOM!'. You will need to pause (as you did in exercise 4) between each text change. When the first 'tick' is displayed to the screen, change the background to 'Light Grey', change the colour of the text to yellow and font size to 26, when the second 'tick' is displayed to the screen, change the background to 'Dark Grey', change the colour of the text to orange and font size to 30. When the text 'BOOM!' is displayed, change the background to black, font size to 36 and the font to red.

You may wish to play with the pause times i.e. the parameter passed to method time.sleep() in order to achieve just the right affect!

Scroll to the end of this practical for a sample solution if you are having difficulties with this.

Exercise 6 - a little more with loops…

Modify the program so that instead of using a while loop, it uses a for loop. The program should behave in exactly the same way. Make sure you keep a version of both implementations.

Scroll to the end of this practical for a sample solution if you are having difficulties with this.

Exercise 7:

Download the document titled 'PSP_optional_prac_work.pdf' from the 'Optional Extension Work' tab on the course website. Attempt stages 1 – 7 (inclusive), then attempt stages 8 – 10 (inclusive).

Optional Work: Sample Solutions

Exercise 1
```
import graphics

# create graphics window
win = graphics.GraphWin("Boom!", 500, 500)

win.setBackground("White")


# The following code creates a Point object at coordinates (250, 250).
point = graphics.Point(250, 250)

# The following code creates a Text object centered at point, and
# displays the string "This is FUN!" to the window
string = graphics.Text(point, "Time: ")

string.setSize(24)
string.setFace('arial')
string.setTextColor('black')
string.draw(win)


win.getMouse()
win.close()
```

Exercise 2
```
import graphics

win = graphics.GraphWin("Boom!", 500, 500)
win.setBackground("White")

count = 10

point = graphics.Point(250, 250)
string = graphics.Text(point, "Time: " + str(count))

string.setSize(24)
string.setFace('arial')
string.setTextColor('black')
string.draw(win)


win.getMouse()
win.close()
```

Exercise 3

```
import graphics

win = graphics.GraphWin("Boom!", 500, 500)
win.setBackground("White")

count = 10

point = graphics.Point(250, 250)
string = graphics.Text(point, "Time: " + str(count))

string.setSize(24)
string.setFace('arial')
string.setTextColor('black')
string.draw(win)

while count >= 0:
    string.setText("Time: " + str(count))
    count -= 1

win.getMouse()
win.close()
```


Exercise 4

```
import graphics
import time

win = graphics.GraphWin("Boom!", 500, 500)
win.setBackground("White")

count = 10

point = graphics.Point(250, 250)
string = graphics.Text(point, "Time: " + str(count))

string.setSize(24)
string.setFace('arial')
string.setTextColor('black')
string.draw(win)

while count >= 0:
    string.setText("Time: " + str(count))
    count -= 1

    # slow down movement – i.e. pause for a bit
    time.sleep(0.4)

win.getMouse()
win.close()
```

Exercise 5

```
import graphics
import time

win = graphics.GraphWin("Boom!", 500, 500)
win.setBackground("White")


count = 10

point = graphics.Point(250, 250)
string = graphics.Text(point, "Time: " + str(count))

string.setSize(24)
string.setFace('arial')
string.setTextColor('black')
string.draw(win)

while count >= 0:
    string.setText("Time: " + str(count))
    count -= 1

    # slow down movement
    time.sleep(0.4)

win.setBackground("Light Grey")
string.setText("Tick")
string.setTextColor('Yellow')
string.setSize(26)
time.sleep(0.6)

win.setBackground("Dark Grey")
string.setText("Tick")
string.setTextColor('Orange')
string.setSize(30)
time.sleep(0.6)

win.setBackground("Black")
string.setText("BOOM!")
string.setTextColor('Red')
string.setSize(36)


win.getMouse()
win.close()
```

Exercise 6

```
import graphics
import time

win = graphics.GraphWin("Boom!", 500, 500)
win.setBackground("White")

point = graphics.Point(250, 250)
string = graphics.Text(point, "Time: ")

string.setSize(24)
string.setFace('arial')
string.setTextColor('black')
string.draw(win)

for no in range(10, -1, -1):
    string.setText("Time: " + str(no))

    # slow down movement
    time.sleep(0.4)

win.setBackground("Light Grey")
string.setText("Tick")
string.setTextColor('Yellow')
string.setSize(26)
time.sleep(0.6)

win.setBackground("Dark Grey")
string.setText("Tick")
string.setTextColor('Orange')
string.setSize(30)
time.sleep(0.6)

win.setBackground("Black")
string.setText("BOOM!")
string.setTextColor('Red')
string.setSize(36)


win.getMouse()
win.close()
```

Please make sure you save and keep all of your practical and assignment work. Please ask your supervisor if you are having difficulties doing so.

End of practical 9.