BDAT 1004 Computer Studies

Problem Set 1

This problem set is based on lectures 1,2 and 3. For a complete list of topics please consult page 2 of the course syllabus. Please consult the "Instructions for Problem Set Submissions" document under course information before submitting your assignment.

Question 1

What data type is each of the following (evaluate where necessary)?

```
5
5.0
5 > 1
'5'
5 * 2
'5' * 2
'5' + '2'
5 / 2
5 % 2
{5, 2, 1}
5 == 3
Pi (the number)
```

Question 2

Write (and evaluate) python expressions that answer these questions:
   a. How many letters are there in 'Supercalifragilisticexpialidocious'?
   b. Does 'Supercalifragilisticexpialidocious' contain 'ice' as a substring?

c. Which of the following words is the longest: Supercalifragilisticexpialidocious, Honorificabilitudinitatibus, or Bababadalgharaghtakamminarronnkonn?
d. Which composer comes first in the dictionary: 'Berlioz', 'Borodin', 'Brian', 'Bartok', 'Bellini', 'Buxtehude', 'Bernstein'. Which one comes last?

Question 3

Implement function `triangleArea(a,b,c)` that takes as input the lengths of the 3 sides of a triangle and returns the area of the triangle. By Heron's formula, the area of a triangle with side lengths a, b, and c is $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = (a+b+c)/2$.

```
>>> triangleArea(2,2,2)
1.7320508075688772
```

Question 4

Write a program in python to separate odd and even integers in separate arrays. Go to the editor
Test Data :
Input the number of elements to be stored in the array :5
Input 5 elements in the array :
element - 0 : 25
element - 1 : 47
element - 2 : 42
element - 3 : 56
element - 4 : 32
Expected Output:
The Even elements are:
42 56 32
The Odd elements are :
25 47

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Question 5

a. Write a function `inside(x,y,x1,y1,x2,y2)` that **returns** True or False depending on whether the point `(x,y)` lies in the rectangle with lower left corner `(x1,y1)` and upper right corner `(x2,y2)`.

```
>>> inside(1,1,0,0,2,3)
True
>>> inside(-1,-1,0,0,2,3)
False
```

b. Use function `inside()` from part a. to write an expression that tests whether the point (1,1) lies in both of the following rectangles: one with lower left corner (0.3, 0.5) and upper right corner (1.1, 0.7) and the other with lower left corner (0.5, 0.2) and upper right corner (1.1, 2).

Question 6

16. You can turn a word into pig-Latin using the following two rules (simplified):
   - If the word starts with a consonant, move that letter to the end and append 'ay'. For example, 'happy' becomes 'appyhay' and 'pencil' becomes 'encilpay'.
   - If the word starts with a vowel, simply append 'way' to the end of the word. For example, 'enter' becomes 'enterway' and 'other' becomes 'otherway' . For our purposes, there are 5 vowels: a, e, i, o, u (so we count y as a consonant).

Write a function `pig()` that takes a word (i.e., a string) as input and returns its pig-Latin form. Your function should still work if the input word contains upper case characters. Your output should always be lower case however.

```
>>> pig('happy')
'appyhay'
>>> pig('Enter')
'enterway'
```

Question 7

File bloodtype1.txt records blood-types of patients (A, B, AB, O or OO) at a clinic. Write a function `bldcount()` that reads the file with name *name* and reports (i.e., prints) how many patients there are in each bloodtype.

```
>>> bldcount('bloodtype.txt')
There are 10 patients of blood type A.
There is one patient of blood type B.
There are 10 patients of blood type AB.
There are 12 patients of blood type O.
There are no patients of blood type OO.
```

Question 8

Write a function `curconv()` that takes as input:

1. a currency represented using a string (e.g., 'JPY' for the Japanese Yen or 'EUR' for the Euro)
2. an amount

and then converts and returns the amount in US dollars.

```
>>> curconv('EUR', 100)

122.96544

>>> curconv('JPY', 100)

1.241401
```

The currency rates you will need are stored in file currencies.txt:

```
AUD   1.0345157   Australian Dollar
CHF   1.0237414   Swiss Franc
CNY   0.1550176   Chinese Yuan
```

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```
DKK   0.1651442   Danish Krone
EUR   1.2296544   Euro
GBP   1.5550989   British Pound
HKD   0.1270207   Hong Kong Dollar
INR   0.0177643   Indian Rupee
JPY   0.01241401  Japanese Yen
MXN   0.0751848   Mexican Peso
MYR   0.3145411   Malaysian Ringgit
NOK   0.1677063   Norwegian Krone
NZD   0.8003591   New Zealand Dollar
PHP   0.0233234   Philippine Peso
SEK   0.148269    Swedish Krona
SGD   0.788871    Singapore Dollar
THB   0.0313789   Thai Baht
```

Question 9

Each of the following will cause an exception (an error). Identify what type of exception each will cause.

Trying to add incompatible variables, as in adding `6 + 'a'`

Referring to the 12th item of a list that has only 10 items

Using a value that is out of range for a function's input, such as calling `math.sqrt(-1.0)`

Using an undeclared variable, such as `print(x)` when `x` has not been defined

Trying to open a file that does not exist, such as mistyping the file name or looking in the wrong directory.

Question 10

Encryption is the process of hiding the meaning of a text by substituting letters in the message with other letters, according to some system. If the process is successful, no one but the intended recipient can understand the encrypted message. *Cryptanalysis* refers to attempts to undo the encryption, even if some details of the encryption are unknown (for example, if an encrypted message has been intercepted). The first step of cryptanalysis is often to build up a table of letter frequencies in the encrypted text. Assume that the string `letters` is already defined as `'abcdefghijklmnopqrstuvwxyz'`. Write a function called `frequencies()` that takes a string as its only parameter, and returns a list of integers, showing the number of times each character appears in the text. Your function may ignore any characters that are not in letters.

```
>>> frequencies('The quick red fox got bored and went home.')
[1, 1, 1, 3, 5, 1, 1, 2, 1, 0, 1, 0, 1, 2, 4, 0, 1, 2, 0, 2,
1, 0, 1, 1, 0, 0]
>>> frequencies('apple')
```