CSC1015F Assignment 3B (70 Marks)

Control (if, for)

Assignment Instructions

This assignment involves constructing Python programs that use input and output statements, `'if'` and `'if-else'` control flow statements, `'for'` statements, and statements that perform numerical manipulation.

NOTE Your solutions to this assignment will be evaluated for correctness. The next assignment and subsequent assignments will also be evaluated for the following qualities:

- Documentation
    - Use of comments at the top of your code to identify program purpose, author and date.
    - Use of comments within your code to explain each non-obvious functional unit of code.
- General style/readability
    - The use of meaningful names for variables and functions.
- Algorithmic qualities
    - Efficiency, simplicity

These criteria will be manually assessed by a tutor and commented upon. In future assignments, up to 10 marks will be deducted for deficiencies.

Question 1 [20 marks]

In Biology, the animal kingdom is separated into nine taxonomic ranks. Below is a very rough sketch of classification tree for animals. Write a program called 'biology.py' to determine the type of an animal based on the following simple classification scheme:

```
The skeleton is:
  internal?
    Fertilisation of eggs occurs:
      within the body?
        Young are produced by:
          waterproof eggs?
            The skin is covered by:
              scales?
                * Reptile
              feathers?
                * Bird
          live birth?
            * Mammal
      outside the body?
        It lives:
          in water?
            * Fish
          near water?
            * Amphibian
  external?
    * Arthropod
```

Your program must ask a series of questions to determine the type of animal. Assume that there are no errors in the input.

This type of program is a simple variant of artificial intelligence known as an **expert system** and the classification tree is known as a **decision tree**.

Sample IO *(The input from the user is shown in **bold** font – do not program this):*

```
Welcome to the Biology Expert
-----------------------------
Answer the following questions by selecting from among the options.
The skeleton is (internal/external)?
internal
The fertilisation of eggs occurs (within the body/outside the body)?
within the body
Young are produced by (waterproof eggs/live birth)?
waterproof eggs
The skin is covered by (scales/feathers)?
scales
Type of animal: Reptile
```

Sample IO *(The input from the user is shown in **bold** font – do not program this):*

```
Welcome to the Biology Expert
-----------------------------
Answer the following questions by selecting from among the options.
The skeleton is (internal/external)?
internal
The fertilisation of eggs occurs (within the body/outside the body)?
within the body
Young are produced by (waterproof eggs/live birth)?
live birth
Type of animal: Mammal
```

Sample IO *(The input from the user is shown in **bold** font – do not program this):*

```
Welcome to the Biology Expert
-----------------------------
Answer the following questions by selecting from among the options.
The skeleton is (internal/external)?
external
Type of animal: Arthropod
```

Question 2 [20 marks]

Write a program called 'perfect.py' to determine if a given number is a perfect number or not. *A perfect number* is a positive integer that is equal to the sum of its proper divisors. For example, 6 is a perfect number because its proper divisors are 1, 2, 3 and 1+2+3=6. However, 12 is not a perfect number because its proper divisors are 1, 2, 3, 4, 6 and their sum is not equal to 12.

Your program should print all the proper divisors of a number followed by a statement that prints whether the number is a perfect number or not.

Sample IO *(The input from the user is shown in **bold** font – do not program this)*:

```
Enter a number:
```
28
```
The proper divisors of 28 are:
1 2 4 7 14

28 is a perfect number.
```

Sample IO *(The input from the user is shown in **bold** font – do not program this)*:

```
Enter a number:
```
63
```
The proper divisors of 63 are:
1 3 7 9 21

63 is not a perfect number.
```

Question 4 [30 marks]

Write a program called 'coordinates.py' to check if a set of six numbers is a pair of geographical/GPS coordinates or not, assuming the degrees/minutes/seconds form:

```
40°20'21" N 79°58'36" W
```

The six numbers represent, in sequence: latitude degrees, latitude minutes, latitude seconds, longitude degrees, longitude minutes and longitude seconds. Your program must use negative number to represent degrees in the southern and western hemispheres.

In professional software, it is never assumed that input from users is valid so you too need to do this in your programs. In this case, you want to check if the latitude degrees is between -90 and 90 (inclusive), the longitude degrees is between -180 and 180 (inclusive), the minutes are between 0 and 59 (inclusive) and the seconds are between 0 and 59 (inclusive).

[Reference: https://www.youtube.com/watch?v=ALN7gXF1thY and/or related YouTube videos]

Sample IO (*The input from the user is shown in **bold** font – do not program this*):

```
Enter first number:
88
Enter second number:
45
Enter third number:
58
Enter fourth number:
-150
Enter fifth number:
59
Enter sixth number:
23
WOW! Looks like geographic coordinates!
```

Sample IO (*The input from the user is shown in **bold** font – do not program this*):

```
Enter first number:
-178
Enter second number:
45
Enter third number:
67
Enter fourth number:
72
Enter fifth number:
90
Enter sixth number:
83
Hmmm ... looks like 6 random numbers.
```

Submission

Create and submit a Zip file called 'ABCXYZ123.zip' (where ABCXYZ123 is YOUR student number) containing biology.py, perfect.py and coordinates.py.

NOTES:

1. FOLDERS ARE NOT ALLOWED IN THE ZIP FILE.
2. As you will submit your assignment to the Automarker, the Assignment tab will still say "Not Complete". THIS IS COMPLETELY NORMAL. IGNORE IT.