Open Source Practice
Homework #2

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Problem 1

A DNA sequence is a string made up of the letters A, T, G, and C. To find the complement of a DNA sequence, As are replaced by Ts, Ts by As, Gs by Cs, and Cs by Gs. For example, the complement of AATTGCCGT is TTAACGGCA.

1. Write a pseudo code in English of the algorithm that takes a DNA sequence and return its complement.
2. Test your algorithm.
   - `ttcccatcaa gccctagggc tcctcgtggc tgctgggagt tgtagtctga acgcttctat`
   - `cttggcgaga agcgcctacg ctccccctac cgagtcccgc ggtaattctt aaagcacctg`
   - `caccgccccc ccgccgcctg cagagggcgc agcaggtctt gcacctcttc tgcatctcat`
   - `tctccaggct tcagacctgt ctccctcatt caaaaaatat ttattatcga gctcttactt`
3. Write a function named `complement` that takes a DNA sequence and returns the complement of it. Here, we can get some examples from the `https://www.ncbi.nlm.nih.gov`. For example, `p53.rtf` is given.

Problem 2

Develop a function that finds the minimum or maximum value in a list, depending on the caller's request.

1. Write a loop (including initialization) to find both the minimum value in a list and that value's index in one pass through the list.
2. Write a function named `min_index` that takes a list and returns a tuple containing the minimum value in the list and that value's index in the list.
3. Write a function named `max_index` that takes a list and returns a tuple containing the maximum value in the list and that value's index in the list.

Problem 3

Design and implement a class `Country` that stores the information on countries such as nation name, capital city, population, and area. Then write a program that reads in a set of countries and prints

1. the country with the largest area.
2. the country with the largest population.
3. the country with the largest population density.
4. the country with its capital city.

Problem 4

Based on object-oriented programming, design and implement each class for geometry objects on the next page.

1. Implement and test the class on each object
2. Place those classes into a `geometry` module. Then write a program that prints a result for the chosen object depending on a user's values.

Problem 5

Design a class `Msg` that models an e-mail message. A message has a recipient, a sender, and a message text. Support the following methods:

- A constructor that takes the sender and recipient

- A method `append` that appends a line of text to the message body
- A method `__str__` that returns the whole string like this:

```
From G. D. Hong
To: G. I. Dong
Content: Dear friend, I would like to ....
```

Problem 6

Design and implement functions that perform subtraction, multiplication, and element-wise division by extending the Gobhagi project.

Element-wise division is an operation that performs division between values at the same matrix position. Subtraction, multiplication, and element-wise division operations are used only on equally sized matrices.

Test your program by splitting more than 6 files and write a `Makefile` to generate an execution file.

Problem 7

Design and implement a class `Letter` for authoring a simple letter. In the constructor, supply the names of the sender and the recipient:

```
def __init__(self, letterfrom, letterto)
```

Supply a method

```
def addLine(self, line)
```

to add a line of text to the body of the letter. Supply a method

```
def get_text(self)
```

that returns the entire text of the letter. The text has the form:

```
Dear recipient name:
```

```
first line of the body
second line of the body
...
last line of the body

Sincerely,

sender name
```

Problem 8

What is the printed value of the following script? Explain why the results come out.

```
#!/bin/bash

fun(){
    arr=$1
    echo "The size : ${#arr[*]}"
    echo "The array : ${arr[*]}"
}

arr=(1 2 3 4 5 6 7)
fun ${arr[*]}
```

Problem 9

How many lines will be printed on screen from the following script?

```
#!/bin/bash

for(( v1 = 12; v1 < 34; v1++))
do
     echo "$v1"
done > output
```

Problem 10

Write a shell script to output the list of files in the current directory. Only file names are printed one per line.