Computational Thinking and Problem Solving (COMP1002)

Assignment 1

(Due on **30 September 2022 (Fri) at 12:00 noon**)

1. [15 marks] Convert the octal number, 10323646520, to hexadecimal number. Interpret the number in terms of ASCII code. What is the resulting text message? Show all your steps.

2. [20 marks] Suppose you are given a *m* * *n* matrix, named, *M*, which represents a 2D greyscale image. Each value in the matrix presents a dot (or pixel) of the image. Assume the range of each value lies between 0 and 255 (i.e., [0, 255]). 0 represents black (no light) and 255 represents white (maximum light intensity level). The values lying between represent light intensity levels:

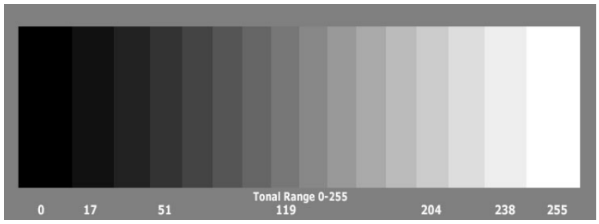

Image source: https://www.baeldung.com/cs/convert-rgb-to-grayscale

Given *M*, you are required to find out the intensity value that occurs most frequently. For example, if M =

$$\begin{bmatrix} 22 & 23 & 125 \\ 125 & 137 & 23 \\ 23 & 158 & 200 \end{bmatrix}$$

23 is the result. If there are more than two intensity values occurring most frequently, we only use the first found value.

Write down the pseudocode to solve this problem. It should be detailed enough to illustrate the steps of traversing M, comparing and counting the pixels, in order to obtain the result. Also write down the *input* and *output* specifications.

3. [15 marks] In Lecture 2, the difference between function and procedure is mentioned. Suppose you are a software developer. You are given a document of technical specifications for developing a business application software package. Before your implementation of the software, you have to set up a software development tool (e.g., IDLE) to write programs. After months of development (with numerous cups of coffee intake), the software is created.

Do you act like a function or a procedure? What is/are the input(s) and output(s), if any? Justify your claim.

4. [25 marks] Write a Python program that a user enters a valid positive integer in base 10. The program will display the corresponding octal number (base 8) in string data type. You are required to provide TWO test cases, which include the input and expected output, which is typed as *comments* at the beginning of your program. Your program should behave as below: [The input is 200 and the lines that follow are the outputs]

```
Please enter a decimal number(an integer number in base 10). >> 200
quotient 25
remainder 0
quotient 3
remainder 1
quotient 0
remainder 3

The octal number is: 310
```

5. [25 marks] Write a Python program to calculate the root(s) of the quadratic equation, $ax^2 + bx + c = 0$. The program flow is shown as below:

    a. A user is asked to provide *a*, *b*, *c* values;
    b. The program will calculate and check the discriminant value;
    c. Based on b., the program, will calculate and print the number of root(s) and root value(s).

    You may assume the user always input decimal values and no input validation is required.

    (Hints: You may refer to https://en.wikipedia.org/wiki/Quadratic_equation or other sources for more information about quadratic equation.)

    Your program should behave like below:

    Case 1

```
The programme is to calculate the root(s) of the quadratic equation, ax^2+bx+c=0.
Please enter the value a. >> 3
Please enter the value b. >> 4
Please enter the value c. >> 5
Invalid input.
```

    Case 2

```
The programme is to calculate the root(s) of the quadratic equation, ax^2+bx+c=0.
Please enter the value a. >> 2
Please enter the value b. >> 4
Please enter the value c. >> 2
There is only one root: -1.0
```

    Case 3

```
The programme is to calculate the root(s) of the quadratic equation, ax^2+bx+c=0.
Please enter the value a. >> 1
Please enter the value b. >> -3
Please enter the value c. >> -4
There are two roots:(4.0,-1.0)
```

Submission Instructions

Follow the steps below:

1. Create a folder and name it as <student no>_<your name>,
   e.g., **`12345678d_CHANTaiMan`**
2. For Q1, Q2, and Q3, type your answers in a word document and save it as a **`.pdf`** file. Name the single **`.pdf`** file as A1_<student no>_<your name>**`.pdf`**,
   e.g., **`A1_12345678d_CHANTaiMan.pdf`**
3. For Q4 and Q5, submit the source file (**`.py`**). Name the **`.py`** files as A1_Q<question no>_<student no>_<your name>**`.py`**,
   e.g., **`A1_Q4_12345678d_CHANTaiMan.py`**
4. Put all the **`.pdf`** and **`.py`** files into the folder created in Step 1.
5. Compress the folder (**`.zip`**, **`.7z`**, or **`.rar`**).
6. Submit the file to Blackboard.

A maximum of **3 attempts** for submission are allowed. **Only the last attempt will be graded**. A late penalty of 5% per hour will be imposed.

Any wrong file naming and submission will be given ZERO mark. It is your obligation to check carefully the files in your submission.

If you are using Windows, the file extension may be hidden by the operating system. Follow the steps of below links to make sure the file extension is not hidden:

https://www.howtohaven.com/system/show-file-extensions-in-windows-explorer.shtml

If your program cannot be run successfully (i.e., having any syntax error(s)) when it is triggered, ZERO mark will be awarded for that program, regardless of how much you have coded.

This assignment is an individual work. All work must be done on your own. Plagiarism is serious offence. You are not allowed to consult any external channels, e.g., discussion forums, and copy code from any web resources, to assist your completion of your assignments. The Moss (https://theory.stanford.edu/~aiken/moss/) system will be adopted for plagiarism checking for program code. Submissions with high similarity, in terms of code patterns and structures, in addition to direct-copy-and-paste, will be extracted and reviewed. Any plagiarism cases (both copier and copiee) will be given ZERO mark plus a deduction of the maximum mark of this assignment. Serious cases would be submitted to the Student Discipline Task Group (SDTG) of the department for further disciplinary actions.