

# The University of Nottingham Ningbo China

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

A LEVEL 1 MODULE, 2021-2022

## **EEEE1044 Introduction to Software Engineering and Programming**

Time allowed: **TWO Hours**

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*Candidates may log in to computers and test CodeBlocks and sign their desk card but must NOT write anything else until the start of the examination period is announced*

### ***Answer ALL questions***

*Only silent, self-contained calculators with a Single-Line Display or Dual-Line Display are permitted in this examination.*

*Dictionaries are not allowed with one exception. Those whose first language is not English may use a standard translation dictionary to translate between that language and English provided that neither language is the subject of this examination. Subject specific translation dictionaries are not permitted.*

*No electronic devices capable of storing and retrieving text, including electronic dictionaries, may be used.*

*At the top of each piece of code you write should be, in addition to any other, a comment statement indicating the question being undertaken and your candidate ID.*

*You are advised to save your work often, as the machines are purged of files each time they are rebooted.*

*Save all the programs on desktop first; before the end of exam copy all programs to "Your Name (folder on desktop with your own name)" -> "My documents". Make sure the programs are the up-to-date ones after copying to "My documents".*

**Q1** Develop a pattern-display program which meets the following requirements:

- Prompt the user to enter **one** integer within the range of **2 ~ 10 (both inclusive)** (*no need to check if the input is integer or not*). Keep prompting if the input is out of this range.
- Display a pattern using the \* symbol with a loop function, e.g. *while*, *for*. An example is given in Figure Q1 when the input is **4**.

```
*
**
***
****
***
**
*
```

*Figure Q1 – Required output for a user entered value of 4*

[20 marks]

**Q2** Develop a program which meets the following requirements:

- a) Prompt the user to enter **an integer with four digits**, e.g. 1202, 2586, 6374 etc., (*no need to check if the input is integer or not*).
- b) If the integer has more or less than four digits, display an appropriate **error message**. Keep prompting until a valid integer is entered by the user.
- c) Display each digit in a single row on the screen. For example, if the user enters an integer of **3564**, the output on the screen should be as shown in Figure Q2:



```
3
5
6
4
```

*Figure Q2 – Required output for an entered value of 3564*

**[15 marks]**

**Q3** Develop a program which meets the following requirements:

- a) In function **main()**, prompt the user to enter the mark of a student. Keep prompting until **the integer of -1** is entered by the user.
- b) Use **a function external to main()** to **determine** and **display** the ranking of the student's mark. The mark ranking is shown in Figure Q3.
- c) If the input mark is out of the range between 0 ~ 100, a proper **error message** should be displayed within the external function.
- d) When -1 is entered by the user, the program should be terminated immediately **without** displaying the error message.

<i>Mark Range</i>	<i>Ranking</i>
<i>70 &lt;= mark &lt;= 100</i>	<i>1st</i>
<i>60 &lt;= mark &lt;70</i>	<i>2:1</i>
<i>50 &lt;= mark &lt;60</i>	<i>2:2</i>
<i>40 &lt;= mark &lt;50</i>	<i>3rd</i>
<i>0 &lt;= make &lt;40</i>	<i>Fail</i>

*Figure Q3 – Mark rankings*

**[15 marks]**

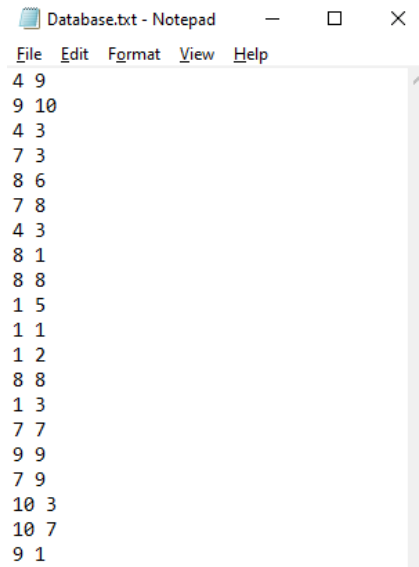
**Q4** Develop a program that meets the following requirement:

- a) Prompt the user to enter **an integer** within the range of **0 ~ 255** (both 0 and 255 are inclusive). If the integer is out of the range, a message indicating the required input should be displayed.
- b) Display on the screen the binary number of the entered integer. For example, the binary number for 0 is 00000000, and the binary number for 255 is 11111111.

**[10 marks]**

**Q5** Develop a program that meets the following requirement:

- a) Use the random function to generate **20 pairs** of random integers within the range of **1 ~ 10**. Save these numbers into a file named **“Database.txt”**. When saving the numbers, each pair occupies one line, as the example shows in Figure Q5a.

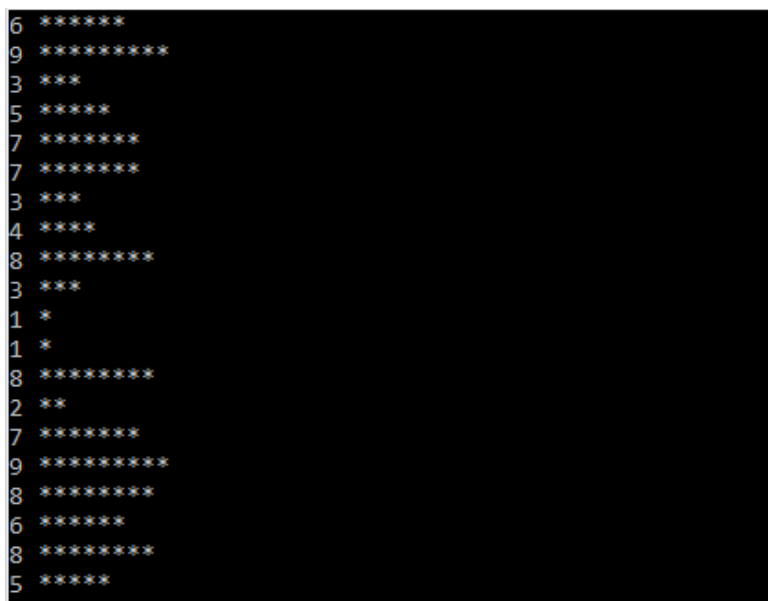


```
Database.txt - Notepad
File Edit Format View Help
4 9
9 10
4 3
7 3
8 6
7 8
4 3
8 1
8 8
1 5
1 1
1 2
8 8
1 3
7 7
9 9
7 9
10 3
10 7
9 1
```

*Figure Q5a Example of the txt document saved with 20 pairs of random numbers*

- b) Read from this file **“Database.txt”** in your program. Calculate and display to the screen the average value of each pair of numbers as histogram as shown in Figure Q5b, i.e. calculate the result of  $(n1+n2)/2$  using the data type of integer for the result.

*Note: the example below is the output generated based on the random numbers in Figure Q5a, and the random numbers generated by your program should be of **different** combination of numbers from this example.*



```
6 *****
9 *****
3 ***
5 *****
7 *****
7 *****
3 ***
4 *****
8 *****
3 ***
1 *
1 *
8 *****
2 **
7 *****
9 *****
8 *****
6 *****
8 *****
5 *****
```

*Figure Q5b The histogram display for the average result of each pair in Figure Q5a*

**[10 marks]**

**Q6** Develop a program to calculate the volume of a cylinder. The radius **R** of the circular face and the height of the cylinder **H** will be entered by the user; the area of the circular face **A** can be calculated using Eq. 1. The volume of the cylinder **V** can be calculated using Eq. 2.

$$A = \pi \cdot R^2 \quad \text{Eq. 1}$$

$$V = H \cdot A \quad \text{Eq. 2}$$

Input **R** and **H** with both value and unit. For example, the input of **R** can be **5 mm** or **0.5 cm**, and the height **H** can be **0.8 m** or **80 cm**. The input units of **m**, **cm** and **mm** should be accepted by the program and all the units should be converted to meters in the calculation; the unit of area **A** and volume **V** should be **m<sup>2</sup>** and **m<sup>3</sup>**, respectively.

You are required to develop the program that meets the following requirements:

- Prompt the user to enter the value and the unit for **R**, the radius of the circular face. You should ensure **R > 0**. Otherwise, prompt the user to enter again until a valid **R** is entered. *No need to check if the input unit is one of m, cm and mm, it is assumed that the unit entered by the user meets the requirement of this question.*
- Prompt the user to enter the value and the unit for **H**, the height of the cylinder. You should ensure **H > 0**. Otherwise, prompt the user to enter again until a valid **H** is entered. *No need to check if the input unit is one of m, cm and mm, it is assumed that the unit entered by the user meets the requirement of this question.*
- Use a **function external to main()** to convert the units of **R** and **H** to **meters (m)**.
- Use a **second function external to main()** which accepts the value of **R** in meters and returns the area **A** in **square meters (m<sup>2</sup>)**.
- Given the values from the user and the value of **A** obtained from (d), use a **third function external to main()** which returns the volume of the cylinder **V** in **cubic meters (m<sup>3</sup>)**.
- Display the area **A** and the volume **V** to two decimal places of accuracy in function **main()**.

*Hint: For a value of R of 120 cm, H of 3000 mm, you should obtain via calculation the following values.*

$$R = 120 \text{ cm} = 1.2 \text{ m}$$

$$H = 3000 \text{ mm} = 3 \text{ m}$$

$$A = \pi r^2 = 3.14 \times (1.2)^2 = 4.52 \text{ m}^2$$

$$V = AH = 4.52 \times 3 = 13.56 \text{ m}^3$$

[30 marks]

**END**