

Name 1 : _____ Name 2 : _____ Date : _____	Assignment 1 SCSJ 1013 (Section 5) Programming Techniques I
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INSTRUCTIONS TO THE STUDENTS

- *Read the instructions carefully*
- *The assignment must be done in pair.*
- *Use the tool Dev C++ for writing your program.*
- *Your program must follow the input and output as required in the text and shown in the examples. You must test the program with (but not limited to) all the input given in the examples.*
- *Please insert your name, matric no, section of your class and date as a comment in your program.*

SUBMISSION PROCEDURE

- *Please submit this assignment no later than **28th October 2018, Sunday (5 pm)**.*
- *Only the two source codes (i.e. the file with the extension .cpp) are required for the submission.*
- *Submit the source codes via the UTM's e-learning system.*

Question 1

Department of Environment (DOE); an agency under Ministry of Natural Resources and Environment (NRE) for Malaysia Government is in the process of finalising the latest Malaysian Air Quality Guidelines to include the new standard limit of PM_{2.5} to replace prior PM₁₀ in the current Air Pollutant Index (API) calculation. The changes in applying the new PM_{2.5} will require the DOE to come up with updated Air Quality Index System and data integration with existing system that will provide comprehensible information about the air pollution level.

API is an indicator for the air quality status at any particular area. API is calculated based on data retrieved from remotely controlled air quality monitoring station throughout the country. Currently, the API value is determined based on 24-hours period measurement of average concentration of air pollutant namely the Particulate Matter (PM₁₀; that is small particles with an "aerodynamic" diameter smaller than 10 µm). The following Table 1 shows the comparison between PM₁₀ and PM_{2.5} readings and their corresponding API value.

Table 1

24-hr PM₁₀ (µg/m³) (Current)	24-hr PM₂₅ (µg/m³) (New)	API Value
0 - 50	0 -12	50
51 -150	13 - 55	100
151 - 350	56 - 150	200
351 - 420	151 - 250	300
421 - 500	251 - 350	400
501 - 600	351 - 500	500

Meantime, using linear interpolation algebra, the accurate API value based on new PM_{2.5} standard can be calculated using the formula below:

$$API = (PM_{2.5} / 2) + 25$$

The API values give an indication of the air quality status, and the corresponding health effects and the advices suggested as shown in Table 2:

Table 2

API Value	Air Quality Status	Health Effect	Health Advise
0 - 50	Good	Low pollution without any bad effect on health	No restricted outdoor activities
51 - 100	Moderate	Moderate pollution that does not pose any bad effect on health	No restricted outdoor activities
101 - 200	Unhealthy	Worsen the health condition of high risk people who is the people with heart and lung complications	Limit outdoor activities
201 - 300	Very unhealthy	Worsen the health condition and low tolerance of physical exercises to people with heart and lung complications. Affect public health.	Stay indoors
Above 300	Hazardous	Hazardous to high-risk people and public health.	Stay indoors

INSTRUCTIONS:

Write a program to calculate the accurate API value and determine the status of the air quality. The program should perform the following steps:

1. Ask the user for location and the pollutant value of PM_{2.5}. Program must be able to notify user if the pollutant value entered is out of range (that is less than zero '0' or more than 500).
2. Calculate the API value using the formula given. Program should round the API value up to the nearest integer.
3. Based on the API value calculated; determine the air quality status, the impact of health effects and the relevant advices.
4. Display the following information as the output of the program:
 - a. The location
 - b. The calculated API value
 - c. The corresponding air quality status
 - d. The impact of health effect
 - e. The suggestion of health advice

The assessment criteria and example runs of the program are shown in **Table 3** and **Figure 1(a)** until (c), respectively.

Table 3

Item	Criteria	Marks
A	The program is able to run	2
	Applying proper styles, <i>e.g.</i> indentation and comments	2
	Using an appropriate structure for the program (<i>e.g.</i> all required header files are included, the function main is properly written,	2
B	Reading the location and pollutant value for PM _{2.5} for the user with proper prompts.	2
C	Calculating the API value	2
D	Determine the status, health effects and advices	5
	Determine the invalid input	1
E	Printing the output	4
Total		20

Note: **Figure 1 (a) until (c): Example Run 1 until 3.** The **bold texts** indicate input from the user.

```
Enter the area of location => Skudai

Enter the air pollutant value of PM2.5 => 122

=== Information Guide of Air Pollutant Index (API) ===
a. Location      : Skudai
b. API value     : 86
c. Status        : Moderate
d. Health effect : Moderate pollution that does not pose any
bad effect on health
e. Health advice : No restricted outdoor activities
```

Figure 1 (a) : Example Run 1

```
Enter the area of location => Port Klang

Enter the air pollutant value of PM2.5 => 653.22

=== Information Guide of Air Pollutant Index (API) ===
a. Location      : Port Klang
b. API value     : 352
c. Status        : Hazardous
d. Health effect : Hazardous to high-risk people and public
health
e. Health advice : Stay indoors
```

Figure 1 (b) : Example Run 2

```
Enter the area of location => Putrajaya

Enter the air pollutant value of PM2.5 => -10

Error Message: You entered invalid value of PM2.5. Please try
again. Thank you.
```

Figure 1 (c) : Example Run 3

Question 2

Write a program that will compute the gross earnings for the employees of a company that produces toys. The company has 2 types of employees: S – salaried worker; and C – contract worker. The initial input to each process will be the employee name, ID (a four digit number) and the employee code: either S or C. Consecutive inputs will depend on the value of any of these codes and its following categories.

A **salaried worker** is paid a **fixed** amount of **earnings** at the end of each working month. A salaried employee can be categorized under M: management or N: non-management. Only employees under the non-management category are allowed to claim for overtime hours worked. For the first 10 hours overtime work, the employee will be paid at a rate of RM15 per hour. Each consecutive hour worked after that will be paid at a rate of RM12 per hour. However in a month an employee is allowed to claim up to 20 hours of overtime pay. Any claim for hours worked beyond that will be rejected. The gross pay is calculated as: **fixed earnings + overtime pay** for this category.

A **contract worker** will be paid according to the total number of hours worked and based on the job category: R – repairs; and M – maintenance. Repair work will be paid a flat rate of RM20 per hour claimable up to 100 hours. Maintenance work will be paid RM10 per hour for the first 50 hours and RM5 per hour for each consecutive hour. The maximum hours worked claimable is also limited to 100 hours.

Calculate (i) the total number of employees in each S and C category, (ii) the total earnings for each S and C category. For each iteration, display the employee name, ID and his earnings for the month. The process will be repeated for the next employee and will terminate when a negative ID (ID less than 0) is read.

At the end of the process, display the (i) total number of employees in each S and C category, (ii) total earnings for each S and C category, and (iii) the total amount of salary that the company has to pay to all workers for a particular month. Hint: use a mixture of selection, case and loop structures.

The assessment criteria of the program are shown in **Table 4**.

Table 4

Item	Criteria	Marks
A	The program is able to run	2
	Applying proper styles, <i>e.g.</i> indentation and comments	2
	Using an appropriate structure for the program (<i>e.g.</i> all required header files are included, the function main is properly written,	2
B	Reading the employee name, ID and employee code with proper prompts.	3
C	Calculating the salary	3
	Calculating the total number of employees in each S and	3
	Calculating the total earnings for each S and C category.	3
D	Determine the salaried worker and contract worker	2
	Determine management/non-management & repair/maintenance	4
	Determine the invalid input	2
E	Printing the output	4
Total		30