ITICT102A Introduction to Programming Group Assignment–25%

Work in a group of 2 or 3. Due end of week 11

Your brief

The Department of Health has asked you to create a program to assist in the modelling of data for the rolling out of the COVID-19 vaccine, as more General Practitioners (GPs) become accredited to deliver the vaccine, and more vaccination centres become available. (All the numbers and equations are hypothetical and are provided just for this question.)

You have been asked to read data from a text file and predict the required time to cover all the nation based on a number of parameters, including:

- each state's population,
- the growth rate of vaccination centres,
- the growth rate of accredited GPs for vaccinating, and
- vaccine refusal rate due to possible side effects.

You have been asked to provide summary reports based on several scenarios and write updated files to disk.

Details

You will be provided with a file, *data.txt*, which will contain data in the following form (figures represent the number of GPs who are participating in vaccine rollout and are indicative only):

NSW
185
ACT
45
QLD
178
VIC
126
SA
42
WA
51
TAS
13
NT
5

Your program will read the file *data.txt*, and predict the number of required days for complete vaccination of each State and Australia as a whole, considering the in-need

population for the vaccine within each State as below (The numbers are not real and are assumed just for this question).

State	NSW	ACT	QLD	VIC	SA	WA	TAS	NT
Population	6000000	300000	4500000	5800000	1000000	2000000	400000	200000

Inputs

The user will be asked for:

- The rate of vaccination (v).
- The growth rate of vaccination centres (g_c).
- The growth rate of accredited GPs for vaccinating (g_v).
- The vaccine refusal rate due to possible side effects (r).
- The number of days to calculate into the future (d).

Outputs

The program will list vaccination numbers in each state and for the country as a whole in the following form:

COVID-19 VACCINATION NUMBERS – 5 DAY PREDICTIONS
VACCINATION RATE: 10
CENTRE GROWTH: 5%
ACCREDITED GP GROWTH: 10%
REFUSAL RATE: 2%

DAY	NSW	QLD	VIC	TAS	WA	SA	NT	ACT	TOTAL
1	……	……	……	……	……	……	……	…….	……..
2	……	……	……	……	……	……	……	…….	……..
3	……	……	……	……	……	……	……	…….	……..
4	……	……	……	……	……	……	……	…….	……..
5	……	……	……	……	……	……	……	…….	……..

*The blank area must be filled by correct numbers of vaccination after each day.

Once the modelling has been run, the user should have the option to run it again. Each time it is run, the output should be saved to disk with the following filename: *report_s.txt* where *s* is a number returned by **int(time.time())** (*time.time()* is a function from the *time* module which you will need to import).
This returns the number of seconds since 1/1/70 so that each value of s will be a unique timestamp. For example, the file may look like this: *report_1586386072.txt*.

Calculations

Use the following information for your calculations:

- **p**=initial number of GPs (read from *data.txt*)
- **d**=number of days being calculated

• **v**=vaccination rate (how many people are vaccinated by each doctor every day)
• $\mathbf{g_C}$=growth rate of vaccination centres (percentage of increasing the vaccination centre numbers)
• $\mathbf{g_V}$=growth rate of accredited GPs for vaccination (percentage of increasing the accredited GPs for vaccination)
• **r**= vaccine refusal rate due to possible side effects (what percentage of the population refuses to take the vaccine.)
For any given day **d**, the number of vaccinations is calculated by the following (simplified) formulae:

1) To scale the vaccination rate, we take into account effective parameters:

$$\boldsymbol{v = v \times (1 + \frac{10g_c + g_v - r}{100})}$$

2) We then use this figure in the formula:

$$\boldsymbol{vaccination\ number = p \times v \times d}$$

For example, if there were:
45 initial number of GPs, a vaccination rate of 10 and you wanted to know the number of vaccinated people after 14 days, with:

- growth rate of vaccination centre =5%
- verified GP for vaccination =10%, and
- vaccine refusal = 5%,

this would be:

$$\boldsymbol{v = 10 \times \left(1 + \frac{10 \times 5 + 10 - 5}{100}\right) = 15.5}$$
$$\boldsymbol{vaccination\ number = 45 \times 15.5 \times 14 = 9765}$$

• Import the *math* module so you can implement the formula.
• Break the problem down and use functions where possible to make your program modular.
• Test your program with a range of values for vaccination rate, the growth rate of vaccination centre, the growth rate of verified GP for vaccination, and vaccine refusal.
• Validate all data input for correct data type and range.
Note that the group's solution should be documented in a **formal report**. **Each student must identify their particular role** in the report by which they will be assessed.

Your report should:
• Indicate the role of each team member
• Provide the results of several runs of your program with different values for vaccination rate, the growth rate of vaccination centres, the growth rate of accredited GPs for vaccination, and vaccine refusal, for 5, 14, and 30 days.

• For a given vaccination rate, indicate the vaccine refusal that would result in reductions of national immunity and make recommendations.

The approximate word length is 600 words.

Note that each student must upload the following saved as a zip file:

1. Python program
2. Formal Report

Marking Criteria

Program uses functions	2	Program should make generous use of functions (at least 2)
Data is correct based on input	2	Gives correct output
Several runs using different data provided as requested	2	0.5 for each run (at least 4 runs)
Comments used to explain program operation	2	
Table of data displayed as required	1	See above
Data displayed in correct format (including no decimal places)	2	
Output file written using correct filename (including timestamp)	2	
Exceptions for file I/O handled correctly	2	Should not crash
Data input validation done properly for the following: • Growth rate • Social distancing compliance • Number of days	3	Data types and ranges tested for each
Opportunity to run program again	2	User-driven
Formal report: • Work distribution between students documented properly • Recommendations	3	1 mark for student roles, 2 marks for recommendations
TOTAL	25	