ASSIGNMENT 3

PROGRAMMING TECHNIQUE 1 (SECJ1013)

SECTION 04, SEM 1 (2024/2025)

INSTRUCTIONS TO THE STUDENTS

- *This assignment must be done **in pairs**, except for students explicitly instructed to complete it individually.*
- *Please check your name in the **Assignment 2 & 3 Groups List**:*

- ***Program Requirements:***
  - ✓ *Your program must strictly follow the input and output formats as specified in the question and examples. Test your program thoroughly using the given input examples and other possible test cases.*
  - ✓ *Plagiarism is strictly prohibited. Students who copy or share their work will receive ZERO marks (both the one who copies and the one who shares).*
  - ✓ *Programs detected as being 100% generated by AI tools will also receive ZERO marks.*
  - ✓ *Include the following details in the comments section of your program:*
    - *Your name and your partner's name (if applicable)*
    - *Matric number(s)*
    - *Date of completion of the assignment.*

SUBMISSION PROCEDURE

- *Submit the assignment **before Thursday, January 23, 2025, at 12:00 AM**.*
- *Only one submission per group is required, which includes two type of files: the source code (the file with the extension .cpp) and the input files (the files with the extension .txt).*
- *Submit your assignment via the UTM e-learning system.*
- *Your submission will be evaluated based on correctness, clarity, formatting, and adherence to the requirements.*

QUESTION

The Ministry of Transportation monitors revenue data for transportation hubs across Malaysia. Each hub is identified by a unique hub code (e.g., KLS101 for KL Sentral, PS202 for Penang Sentral). Quarterly revenue data for each hub is recorded in separate files. A centralized system is required to calculate, analyze, and generate detailed revenue reports. This assignment assesses your understanding of arrays, functions, control structures, file operations, output formatting, and structured data. You are required to write a complete C++ program to address the problem. The program must perform the following tasks:

Task 1: Define a Structured Data Type

Define a structure to store the following information for each transportation hub:

(a) Hub code.
(b) Hub name.
(c) Hub location.
(d) Quarterly revenues (Q1, Q2, Q3, Q4).

(e) Annual revenue (calculated later).
(f) Revenue contribution percentage (calculated later).

Task 2: Read and Validate Input Files

Write a function that:

(a) Checks if the following input files exist:
- hubs.txt: Contains hub codes (one per line).
- q1.txt, q2.txt, q3.txt, q4.txt: Contain quarterly revenue data corresponding to the hub codes in hubs.txt.

(b) Check that all files have the same number of lines to ensure consistency across datasets.
(c) Display an error message and terminate the program if any file is missing or inconsistent.
(d) Read data from the input files and store it in an array of Hub structures.
(e) Each hub should include:
- Its code from hubs.txt.
- Its quarterly revenues from q1.txt, q2.txt, q3.txt, and q4.txt.

(f) Dynamically determine the number of hubs based on the number of lines in the files.
(g) Figure 1 shows an example of data in the input files.

KLS101	90000	95000	92000	130000
PNS202	185000	187000	89000	97000
JBS303	78000	80000	181000	90000
IPS404	120000	72000	75000	185000
MKS505	70000	125000	85000	178000
KKS606	180000	83000	170000	87000
KTS707	65000	168000	128000	175000
hubs.txt	**q1.txt**	**q2.txt**	**q3.txt**	**q4.txt**

Figure 1: Sample data in the input files

Task 3: Determine Hub Details

Write a function that:

(a) Takes the array of Hub structures and determines each hub's name and location based on the reference table below:

Hub Code Prefix	Hub Name	Location
KLS	KL Sentral	Kuala Lumpur
PNS	Penang Sentral	Penang
JBS	JB Sentral	Johor Bahru
IPS	Ipoh Sentral	Ipoh
MKS	Melaka Sentral	Melaka
KKS	KK Sentral	Kota Kinabalu
KTS	Kuantan Sentral	Kuantan

(b) Uses the hub code prefix to map each hub to its corresponding name and location.

Task 4: Perform Revenue Analysis

Write a function that:

(a) Calculate the total revenue for each hub across all four quarters.
(b) Calculate the total annual revenue for all hubs combined.
(c) Compute the percentage contribution of each hub to the total annual revenue using the following formulas:

Revenue Contribution (%) = (Annual Revenue / Grand Total Revenue) × 100

(d) Determine the hub with the highest and lowest annual revenue.
(e) Compute the average revenue for each quarter across all hubs, the average for annual revenue and the average for revenue contribution.

Task 5: Generate Revenue Report

Write a function that:

(a) Displays the following data in a formatted table: Hub code, name, location, quarterly revenues, annual revenue, and revenue contribution percentage.
(b) Displays the following summary statistics:
- The total annual revenue for all hubs combined.
- The hub with the highest annual revenue and its value.
- The hub with the lowest annual revenue and its value.
- The quarter with the highest total revenue and its value.
- The quarter with the lowest total revenue and its value

(c) Figure 2 provides an example of the output displayed on the screen, based on the data from the input files illustrated in Figure 1.
(d) Ensure the output is neatly formatted and easy to read.

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HUB CODE    HUB NAME           LOCATION           Q1        Q2        Q3        Q4     ANNUAL REV    CONTRIBUTION
-------------------------------------------------------------------------------------------------------------------
KLS101      KL Sentral         Kuala Lumpur       90000     95000     92000     130000     407000         12.11%
PNS202      Penang Sentral     Penang            185000    187000     89000      97000     558000         16.61%
JBS303      JB Sentral         Johor Bahru        78000     80000    181000      90000     429000         12.77%
IPS404      Ipoh Sentral       Ipoh              120000     72000     75000     185000     452000         13.45%
MKS505      Melaka Sentral     Melaka             70000    125000     85000     178000     458000         13.63%
KKS606      KK Sentral         Kota Kinabalu     180000     83000    170000      87000     520000         15.48%
KTS707      Kuantan Sentral    Kuantan            65000    168000    128000     175000     536000         15.95%
-------------------------------------------------------------------------------------------------------------------
                      AVERAGE                 112571.43  115714.29  117142.86  134571.43  480000.00         14.29%
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OVERALL REPORT
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GRAND TOTAL REVENUE    = 3360000
HIGHEST ANNUAL REVENUE = 558000 (Penang Sentral, Penang)
LOWEST ANNUAL REVENUE  = 407000 (KL Sentral, Kuala Lumpur)
QUARTER WITH HIGHEST TOTAL REVENUE: Quarter 4 (942000)
QUARTER WITH LOWEST TOTAL REVENUE : Quarter 1 (788000)
```

Figure 2: Example of output

Additional Notes: Please include meaningful comments in your code for clarity.