Middle East Technical University
Northern Cyprus Campus

CNG242 Programming Language Concepts
Assignment 2 (C++): A Transportation Company Management System

Date Handed Out: May 9, 2023
Submission Due: May 23, 2023, 23:59

Please Read This Page Carefully

Submission Rules:

- **With your name, surname, and ID, you need to write a comment on the first line of your files**, stating that you read the rules specified here and the submission is your own work. **Submissions without this statement will not be graded.** For example,
```
/* Javid Babayev – 1234567
I read and accept the submission rules and the extra rules specified in
each question. This is my own work that is done by myself only */
```
- Please refer to the syllabus[1] provided for CNG 242 for the measures in place in case of any academic dishonesty[2,3].
- The instructors or TAs may ask for demo sessions for any of the submissions.
- You cannot share this worksheet with any third parties. Upon doing so, any detected action will directly be sent to the disciplinary committee.
- You need to compress your .cpp and .h files and submit a single rar or zip file **named with your student id** only. Your compressed file should not contain any .exe or any project related 3rd extensions. Only .cpp and .h files will be evaluated. For example, **1234567.rar or 1234567.zip**
- Class/function names must be the same if it is provided in the questions.
- Header files should only contain class definitions with prototypes only, no function implementation.
- Apart from your own header files, you can only use <string.h>, <cstring> and <iostream>. You cannot import any other libraries or namespaces. You are not allowed to use vectors, strings (you need to use char * for strings).
- You should read the questions fully and follow the directions listed in there. **Only the functions, classes and/or structures with the same name will be graded.**
- The assignment should not be shared publicly in any manner, at any time. The assignment cannot be disclosed or disseminated to anyone before, during, or after the submission.
- You cannot use following keywords: allignas, allignof, asm, auto, char8_t, concept, consteval, constexpr, constinit, const_cast, co_await, co_return, co_yield, dynamic_cast, elifdef, elifndef, export, extern, explicit, goto, import, inline, module, mutable, reflexpr, register, reinterpret_cast, requires, static_assert, static_cast, synchronized, thread_local, unsigned, volatile, typeid.

[1] Page 3&4 (Course rules, #1,2,3)
[2] Taking unfair advantage in assessment is considered a serious offence by the university, which will take action against any student who contravenes the regulation through negligence or deliberate intent.
[3] For a comprehensive cheating definition, please refer to: https://ncc.metu.edu.tr/res/academic-code-of-ethics . When a breach of the code of ethics occurs (cheating, plagiarism, deception, etc.), the student will be added to the BLACKLIST.

Learning Outcomes: On successful completion of this assignment, a student will:

- Write a C++ program that utilizes multiple classes
- Appreciate the usefulness of reusing code
- Develop a class based on the use of an array as a means of storing a collection of objects

In this assignment, you implement several C++ classes for a transportation company with several branches in different cities. This assignment aims to create a storage system for this company. It will allow the users to generate different types of reports related to the branches and vehicles of the transportation company. Put each of the class declarations in a separate header file and implement the member methods in separate .cpp files.

Implementation Details:

To implement this system, you will need to implement at least the following classes as specified below. **You also need to implement copy constructors, assignment operators, and destructors if the class has heap members.** Please note that you may need to implement more functions and add extra attributes. Additionally, you need to decide where to use access specifier keywords (public, protected, private) yourself.

PART ONE: C++ Classes

Company:
For each company, we store:

- Name (data type: char pointer)
- Branches (an array of branches): You can assume that there will be maximum of 10 branches for each company.
- Number of branches (data type: int)

For each company, implement the following member functions:

- A default (no-argument) constructor to set the name of the company to “Undefined” and the number of branches to zero.
- A constructor to set the name of the company to a given name, and the number of branches to zero.
- Getter and setter functions for each of the member variables.
- **addBranch() -** A function to add a new branch to the company.
- **printBranches() -** A function to print all the branches along with their cities and the number of vehicles.
- **printVehicles()** - A function to print the vehicles in each branch.
- **printVehiclesByType()** - A function to print the vehicles in each branch whose type is a given type (Bus or Car).
- **printTypeStatistics()** - function to print the number of each type (Bus or Car) of vehicle in each branch.

- **printVehiclesBySeat()** - A function to print vehicles that can carry a given number of people in each branch.
- **printAnnualCost()** - A function to calculate the total annual cost for the company.

Branch:
For each branch, we store:

- Branch id (data type: int)
- City (data type: char pointer)
- Vehicles (an array of vehicles): You can assume that there will be maximum 30 vehicles for each branch.
- Number of vehicles (data type: int)

For each branch, implement the following member functions:

- A default (no-argument) constructor to set the branch id to -1, city to "Undefined", and the number of vehicles to zero.
- A constructor to set the branch id to a given id, city to a given city, and the number of vehicles to zero.
- Getter and setter functions for each of the member variables
- **addVehicle()** - A function to add a new vehicle to the company.
- **printBranch()** - A function to print the branch with its city and the number of vehicles.
- **printVehicles()** - A function to print the vehicles in the branch.
- **printVehiclesByType()** - A function to print the vehicles whose type is a given type (Bus or Car).
- **printTypeStatistics()** - A function to print the number of each type (Bus or Car) of vehicle in the branch.
- **printVehiclesBySeat()** - A function to print the vehicles in the branch that can carry a given number of people.
- **printAnnualCost()** - A function to calculate and return the total annual cost for the branch.

Vehicle:
For each vehicle, we store:

- Vehicle id (data type: int)
- Brand (data type: char pointer)
- Model (data type: char pointer)
- Plate No (data type: char pointer)

For each vehicle implement the following member functions:

- A default (no-argument) constructor to set vehicle id to -1, and brand, model and plate no to "Undefined".
- A constructor to initialize all the member variables with given values.
- Getter and setter functions for each of the member variables.
- **printVehicle()** - A function to print a vehicle with its all details.

Car:
Each car is a vehicle with an additional following attribute:

- Car type (data type: enum carType {None, Sedan, Hatchback, Limousine})

For each car implement the following member functions:

- A default (no-argument) constructor to set vehicle id to -1, the brand, model and plate no to "Undefined", and the car type to None.
- A constructor to initialize all the member variables with given values.
- **getSeats()** - A function to return the number of seats based on the car type.
  Note: the number of seats Sedan and Hatchback are 5, and the number of seats of Limousine is 6.
- **checkSuitability()** - A function to check if a car can carry a given number of people.
- A function called **annualCost()** takes the kilometres (float) made using the car as an input **inside** of function and returns the cost of the car to the company. The cost is 10$ per kilometre.
- **printVehicle()** - A function to print a car with its all details (see Sample run).

Bus:
Each bus is a vehicle with an additional following attribute:

- Number of seats (datatype: int)

For each bus implement the following member functions:

- A default (no-argument) constructor to set the vehicle id to -1, the brand, model and plate no to "Undefined", and the number of seats to zero.
- A constructor to initialize all the member variables.
- **checkSuitability()** - A function (same as the car class) to check if a bus can carry a given number of people.
- A function called **annualCost()** (same as the car class) takes the maintenance cost (float) and number of times serviced as input **inside** of function and returns the cost of the bus to the company. Total cost is the maintenance cost times the number of times serviced.
- **printVehicle()** - A function to print a bus with its all details (see Sample run).

PART TWO: A TRANSPORTATION COMPANY MANAGEMENT SYSTEM

You need to implement a command-line interface for a transportation management system which provides the following menu for the agency with the name "Quick Transport".

1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch whose type is a given type.
6. Print the number of each type of vehicle in each branch.

7. Print the details stored as member variables for the vehicles that can carry a given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit

A sample run is provided in Appendix.

Grading Policy:

Your submission will be evaluated as follows:

Grading Item	**Mark**
Company Class	15
Branch Class	20
Vehicle Class	20
Bus Class	15
Car Class	15
Command-line interface for the transportation company management system	15

APPENDIX

```
Welcome to Quick Transports

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 1
Please enter branch's ID: 1
Please enter the city, where branch is located: Nicosia

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 1
Please enter branch's ID: 2
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Please enter the city, where branch is located: Kyrenia

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 1
Please enter branch's ID: 3
Please enter the city, where branch is located: Morphou

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 3

City: Nicosia, Number of vehicles: 0
City: Kyrenia, Number of vehicles: 0
City: Morphou, Number of vehicles: 0

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 4
There is no branch with ID 4 at Quick Transport

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
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5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 1
What kind of vehicle would You like to add?
Possible options: (0) Bus, (1) Sedan, (2) Hatchback, (3) Limousine
Your choice: 0
Please enter the ID of the vehicle: 10
Please enter the brand of the vehicle: Skoda
Please enter the model of the vehicle: Irisbus
Please enter the plate number of the vehicle: LA100
Please enter the number of seats on the Bus: 24
Vehicle is successfully added!

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 1
What kind of vehicle would You like to add?
Possible options: (0) Bus, (1) Sedan, (2) Hatchback, (3) Limousine
Your choice: 3
Please enter the ID of the vehicle: 11
Please enter the brand of the vehicle: Hummer
Please enter the model of the vehicle: H2 Limo
Please enter the plate number of the vehicle: LA101
Vehicle is successfully added!

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 2
What kind of vehicle would You like to add?
Possible options: (0) Bus, (1) Sedan, (2) Hatchback, (3) Limousine
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Your choice: 1
Please enter the ID of the vehicle: 20
Please enter the brand of the vehicle: BMW
Please enter the model of the vehicle: 8 Series
Please enter the plate number of the vehicle: KY200
Vehicle is successfully added!

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 3
What kind of vehicle would You like to add?
Possible options: (0) Bus, (1) Sedan, (2) Hatchback, (3) Limousine
Your choice: 2
Please enter the ID of the vehicle: 30
Please enter the brand of the vehicle: Mercedes
Please enter the model of the vehicle: A45
Please enter the plate number of the vehicle: GY300
Vehicle is successfully added!

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 3
What kind of vehicle would You like to add?
Possible options: (0) Bus, (1) Sedan, (2) Hatchback, (3) Limousine
Your choice: 1
Please enter the ID of the vehicle: 31
Please enter the brand of the vehicle: Porsche
Please enter the model of the vehicle: Panamera
Please enter the plate number of the vehicle: GY301
Vehicle is successfully added!

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
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5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 2
Please enter the ID of the Branch: 3
What kind of vehicle would You like to add?
Possible options: (0) Bus, (1) Sedan, (2) Hatchback, (3) Limousine
Your choice: 2
Please enter the ID of the vehicle: 32
Please enter the brand of the vehicle: Honda
Please enter the model of the vehicle: Civic
Please enter the plate number of the vehicle: GY302
Vehicle is successfully added!

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 4

Vehicles at Branch with ID 1:
Vehicle ID: 10, Brand: Irisbus, Model: Skoda, Plate Number: LA100, Car Type: Bus,
Number of Seats: 24
Vehicle ID: 11, Brand: H2Limo, Model: Hummer, Plate Number: LA101, Car Type:
Limousine
Vehicles at Branch with ID 2:
Vehicle ID: 20, Brand: 8Series, Model: BMW, Plate Number: KY200, Car Type: Sedan
Vehicles at Branch with ID 3:
Vehicle ID: 30, Brand: A45, Model: Mercedes, Plate Number: GY300, Car Type:
Hatchback
Vehicle ID: 31, Brand: Panamera, Model: Porsche, Plate Number: GY301, Car Type:
Sedan
Vehicle ID: 32, Brand: Civic, Model: Honda, Plate Number: GY302, Car Type:
Hatchback

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
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9. Exit
Your selection: 5
Please select the type of the vehicles, You want to see: (0) Bus, (1) Car
Your choice: 0

Vehicle at Branch with ID: 1
Vehicle ID: 10, Brand: Irisbus, Model: Skoda, Plate Number: LA100, Car Type: Bus,
Number of Seats: 24

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 6

At Branch with ID: 1 there are:
   1 bus(es)
   1 car(s)
At Branch with ID: 2 there are:
   0 bus(es)
   1 car(s)
At Branch with ID: 3 there are:
   0 bus(es)
   3 car(s)

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 7
Please enter the number of passengers vehicle should be able to carry: 6
Vehicle at Branch with ID: 1
Vehicle ID: 10, Brand: Irisbus, Model: Skoda, Plate Number: LA100, Car Type: Bus,
Number of Seats: 24
Vehicle at Branch with ID: 1
Vehicle ID: 11, Brand: H2Limo, Model: Hummer, Plate Number: LA101, Car Type:
Limousine

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
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```
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 8
Vehicles at Branch with ID 1:
Vehicle 1:
Enter the maintenance cost: 1000
Enter the number of times bus has been serviced: 3
Vehicle 2:
Enter the kilometres driven: 2000
Total Annual Cost for Branch with ID: 1 is 23000

Vehicles at Branch with ID 2:
Vehicle 1:
Enter the kilometres driven: 4000
Total Annual Cost for Branch with ID: 2 is 40000

Vehicles at Branch with ID 2:
Vehicle 1:
Enter the kilometres driven: 4500
Vehicle 2:
Enter the kilometres driven: 2500
Vehicle 3:
Enter the kilometres driven: 6500
Total Annual Cost for Branch with ID: 3 is 135000
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Total Annual Cost for Quick Transport is 198000

Options:
1. Add a new branch to the company.
2. Add a new vehicle (car or bus) to a branch.
3. Print all the branches along with their cities and the number of vehicles.
4. Print the details stored as member variables for the vehicles in each branch.
5. Print the details stored as member variables for the vehicles in each branch
whose type is a given type.
6. Print the number of each type of vehicle in each branch.
7. Print the details stored as member variables for the vehicles that can carry a
given number of people in each branch.
8. Calculate the total annual cost for the company.
9. Exit
Your selection: 9
Good Bye!
```