Middle East Technical University
Northern Cyprus Campus

CNG242 Programming Language Concepts
Assignment 2 (C++): A University Campus Management System

Date Handed Out: May 1, 2024
Submission Due: May 15, 2024, 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,
```
/* Adam Mohammed - 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.

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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 university campus with several buildings. This assignment aims to create a storage system for a university campus. It will allow the users to generate different types of reports for the campus. 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

University:

For each university, we store:

- Name (data type: char pointer)
- Buildings (an array of buildings): You can assume that there will be a maximum of 20 buildings for each university.
- Number of buildings (data type: int)

For each university, implement the following member functions:

- A default (no-argument) constructor to set the name of the university to "Undefined" and the number of buildings to zero.
- A constructor to set the name of the university to a given name, and the number of buildings to zero.
- Getter and setter functions for the university name, and a getter function for the number of buildings.
- **addBuilding() - A function to add a new building to the university.**
- **printBuildings() - A function to print all the buildings along with their names, sizes in m^2 and the number of rooms.**
- **printRooms()** - A function that prints all the details of each room in each building.
- **printRoomsByType()** - A function to print the details of each room in each building whose type is a given type (1: Classroom or 2: Office).
- **printRoomTypeStatistics()** - A function that prints the total count of each type of room (Classroom or office) in the university.
- **printAvailableOffices() -** A function to print all the details of the offices which are not full in each building.

- **printTotalCapacityOfOffices()** – A function to print the total capacity of all the offices.
- **printSuitableClassrooms()** – A function that takes the number of students and prints the details of the suitable classrooms (based on the capacity of the classrooms) in each building.

Building:
For each building, we store:

- Building name (data type: char pointer)
- Size in m^2 (data type: int)
- Rooms (an array of rooms): You can assume that there will be a maximum of 100 rooms for each building, including offices and classrooms.
- Number of rooms (data type: int)

For each building, implement the following member functions:

- A default (no-argument) constructor to set the building name to "Undefined", size to -1, and the number of rooms to zero.
- A constructor to set the building name to a given name, size to a given size, and the number of rooms to zero.
- Getter and setter functions for building name and size, and a getter function for the number of rooms.
- **addRoom() -** A function to add a new room to the building.
- **printBuilding() -** A function that prints the building with its name, size, and number of rooms.
- **printRooms() -** A function that prints all the details of rooms in the building.
- **printRoomsByType()** - A function to print the details of each room in the building whose type is a given type (1: Classroom or 2: Office).
- **getNumberOfClassrooms**() - A function that returns the number of classrooms in the building.
- **getTotalCapacity() -** A function that returns the total capacity of the offices in the building.
- **getNumberOfOffices**() - A function that returns the number of offices in the building.
- **printAvailableOffices() -** A function to print the details of the offices which are not full in the building.
- **printSuitableClassrooms()** – A function that takes the number of students and prints the details of the suitable classrooms (based on the capacity of the rooms) in the building.

Room:
For each room, we store:

- Room name (data type: char pointer)
- Floor no (data type: int)

For each room, implement the following member functions:

- A default (no-argument) constructor to set room name to "Undefined" and floor no to -1.
- A constructor to initialize all the member variables with given values.

- Getter and setter functions for each of the member variables.
- **printRoom() -** A function to print a room with all its details.

Office:
Each office is a room with an additional following attribute:

- Office type (data type: enum officeType {None, CoordinatorOffice, StandardOffice, SharedOfficeFor2People, SharedOfficeFor3People, SharedOfficeFor10People})
- Number of people in the office (data type: int)

Please note that CoordinatorOffice and StandardOffice are not shared offices.

For each office, implement the following member functions:

- A default (no-argument) constructor to set room name to "Undefined", floor no to -1, office type to None, and number of people in the office to zero.
- A constructor to initialize all the member variables with given values.
- Getter and setter functions for the member variables.
- **isFull()** – A function that returns whether an office is full or not.
- **getCapacity()** – A function that returns the capacity of an office (None: 0, CoordinatorOffice: 1, StandardOffice: 1, SharedOfficeFor2People: 2, SharedOfficeFor3People: 3, SharedOfficeFor10People: 10).
- **printRoom()** - A function to print an office with all its details, including its capacity and availability.

Classroom:
Each classroom is a room with an additional following attribute:

- Capacity (datatype: int)

For each classroom, implement the following member functions:

- A default (no-argument) constructor to set room name to "Undefined", floor no and capacity to -1
- A constructor to initialize all the member variables with given values.
- Getter and setter functions for the member variables.
- **checkSuitability()** - A function that takes a number of students and checks if the capacity of the classroom is suitable for the number of students. If so, it returns true, otherwise it returns false.
- **printRoom() -** A function to print a classroom with its all details.

PART TWO: A UNIVERSITY CAMPUS MANAGEMENT SYSTEM

You need to implement a command-line interface for a campus management system which provides the following menu for the university with the name "METU NCC".

1. Add a new building to the university.
2. Add a new room (classroom or office) to a selected building.

3. Print the buildings in the university.
4. Print the rooms in each building in the university.
5. Print the rooms in each building in the university based on a provided type (1: Classroom or 2: Office)
6. Print the total number of classrooms and offices in the university.
7. Print the available offices in each building in the university.
8. Print the total capacity of all the offices.
9. Print the suitable classroom in the university based on the given number of students.
10. Exit

A sample run is provided in the Appendix.

Grading Policy:

Your submission will be evaluated as follows:

Grading Item	Mark
University Class	**20**
Building Class	**25**
Room Class	**15**
Office Class	**15**
Classroom Class	**15**
Command-line interface for the university campus management system	**10**

APPENDIX

```
[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 1
Please enter name of building: T
Please enter size of building: 100

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
```

```
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 1
Please enter name of building: S
Please enter size of building: 100

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 2
Buildings in METU NCC university:
[1] Building name = T
Building size = 100
Building number of rooms  = 0

[2] Building name = S
Building size = 100
Building number of rooms  = 0

Please enter the number of building to which the room should be added: 1
Please enter the type of room(1: Classroom/ 2: Office): 2
Please enter the name of the new room: TZ-18
Please enter the floor number of the new room: 1
[1] Coordinator Office
[2] Standard Office
[3] Shared Office for 2 people
[4] Shared Office for 3 people
[5] Shared Office for 10 people
Please enter type of office: 5
Please enter number of people in the office: 1

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 2
Buildings in METU NCC university:
[1] Building name = T
Building size = 100
```

```
Building number of rooms  = 1

[2] Building name = S
Building size = 100
Building number of rooms  = 0

Please enter the number of building to which the room should be added: 2
Please enter the type of room(1: Classroom/ 2: Office): 2
Please enter the name of the new room: S-145
Please enter the floor number of the new room: 2
[1] Coordinator Office
[2] Standard Office
[3] Shared Office for 2 people
[4] Shared Office for 3 people
[5] Shared Office for 10 people
Please enter type of office: 2
Please enter number of people in the office: 1

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 2
Buildings in METU NCC university:
[1] Building name = T
Building size = 100
Building number of rooms  = 1

[2] Building name = S
Building size = 100
Building number of rooms  = 1

Please enter the number of building to which the room should be added: 1
Please enter the type of room(1: Classroom/ 2: Office): 1
Please enter the name of the new room: TZ-22
Please enter the floor number of the new room: 1
Please enter capacity of classroom: 43

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
```

```
[0] Exit
Please enter your choice: 2
Buildings in METU NCC university:
[1] Building name = T
Building size = 100
Building number of rooms  = 2

[2] Building name = S
Building size = 100
Building number of rooms  = 1

Please enter the number of building to which the room should be added: 2
Please enter the type of room(1: Classroom/ 2: Office): 1
Please enter the name of the new room: SZ-22
Please enter the floor number of the new room: 1
Please enter capacity of classroom: 20

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 4
Rooms in METU NCC university:
All rooms in T building:
Office name = TZ-18
Office floor number = 1
Office type = Shared office for 10 people
Number of people in office = 1
Office capacity = 10
Office is not full

Classroom name = TZ-22
Classroom floor number = 1
Classroom capacity = 43

All rooms in S building:
Office name = S-145
Office floor number = 2
Office type = Standard Office
Number of people in office = 1
Office capacity = 1
Office is full

Classroom name = SZ-22
Classroom floor number = 1
Classroom capacity = 20

[1] Add a new building to the university
```

```
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 5
Please enter type of room to display:
[1] Classrooms
[2] Offices
1
Classrooms in METU NCC university:
All classrooms  in T building:
Classroom name = TZ-22
Classroom floor number = 1
Classroom capacity = 43

All classrooms  in S building:
Classroom name = SZ-22
Classroom floor number = 1
Classroom capacity = 20

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 5
Please enter type of room to display:
[1] Classrooms
[2] Offices
2
Offices in METU NCC university:
All offices  in T building:
Office name = TZ-18
Office floor number = 1
Office type = Shared office for 10 people
Number of people in office = 1
Office capacity = 10
Office is not full

All offices  in S building:
Office name = S-145
Office floor number = 2
Office type = Standard Office
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```
Number of people in office = 1
Office capacity = 1
Office is full

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 6
Room Type statistics for METU NCC university:
Number of offices = 2
Number of classrooms = 2

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 7
Available offices in METU NCC university:
Available offices in T building:

Office name = TZ-18
Office floor number = 1
Office type = Shared office for 10 people
Number of people in office = 1
Office capacity = 10
Office is not full

Available offices in S building:


[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
```

```
[0] Exit
Please enter your choice: 8
Office capacity in METU NCC university:


Office capacity in T building = 10
Office capacity in S building = 1


[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 9
Please enter number of students: 30
Suitable classes in METU NCC university for 30 students:

Classrooms which are suitable for 30 students in T building:
Classroom name = TZ-22
Classroom floor number = 1
Classroom capacity = 43

Classrooms which are suitable for 30 students in S building:

[1] Add a new building to the university
[2] Add a new room to a selected building
[3] Print the buildings in the university
[4] Print the rooms in each building in the university
[5] Print the rooms in each building in the university based on type
[6] Print the total number of classrooms and offices in the university
[7] Print the available offices in each building in the university
[8] Print the total capacity of all the offices
[9] Print the suitable classrooms in the university based on the given number
of students
[0] Exit
Please enter your choice: 0
Thank you for using the university campus management system
```