

# FPP1 — FPP1 TASK 1: CLASS ROSTER

SCRIPTING AND PROGRAMMING APPLICATIONS — C867

PRFA — FPP1

## COMPETENCIES

### 4048.2.1 : Introduction to Programming

The graduate applies fundamental programming concepts in a specific programming environment.

### 4048.2.2 : Variables and Data Types

The graduate prepares code which declares, initializes, and assigns values to variables of appropriate types as part of the application development process.

### 4048.2.3 : Control Structures

The graduate writes code that implements decision and loop constructs to control the flow of a program.

### 4048.2.4 : Arrays

The graduate creates arrays in order to solve complex problems.

### 4048.2.5 : Pointers and Memory

The graduate applies pointers to solve complex problems.

### 4048.2.6 : Functions

The graduate writes code that creates and manipulates functions and files.

### 4048.2.7 : Object-Oriented Paradigm

The graduate applies object-oriented programming concepts in order to create a basic application.

## INTRODUCTION

Throughout your career in software development, you will develop and maintain new and existing applications. You will be expected to fix issues as well as add new enhancements or migrate existing applications to new platforms or different programming languages. As a software developer, your role will be to create a design of an application based on given business requirements. After the design is completed, you must implement the application based on the design document and provided requirements.

In this assessment, you will create a C++ application based on the scenario below. The skills you demonstrate in your completed application will be useful in responding to technical interview questions for future employment. This application may also be added to your portfolio to show to future employers.

**This project will require an integrated development environment (IDE). Before attempting this assignment, it is recommended that you use one of the following IDEs: Visual Studio or Eclipse. Directions for accessing these IDEs can be found in the attached "IDE Instructions."**

**Your submission should include a zip file with all the necessary code files to compile, support, and run your application. The zip file submission must also keep the project file and folder structure intact for the Visual Studio IDE or Eclipse IDE.**

## SCENARIO

You are hired as a contractor to help a university migrate an existing student system to a new platform using C++ language. Since the application already exists, its requirements exist as well, and they are outlined in the next section.

You are responsible for implementing the part of the system based on these requirements. A list of data is provided as part of these requirements. This part of the system is responsible for reading and manipulating the provided data.

You must write a program containing five classes

(i.e., `Student`, `SecurityStudent`, `NetworkStudent`, `SoftwareStudent`, and `Roster`). The program will maintain a current roster of students within a given course. Student data for the program includes student ID, first name, last name, email address, age, an array of the number of days to complete each course, and degree. This information can be found in the `studentData` table below. The program will read a list of five students and use function calls to manipulate data (see part F4 in the requirements below). While parsing the list of data, the program should create student objects using the appropriate subclasses indicated by the degree program. The entire student list will be stored in one array of students called `classRosterArray`. Specific data-related output will be directed to the console.

### STUDENT DATA TABLE

Student ID	First Name	Last Name	Email	Age	Days in Course	Degree
A1	John	Smith	John1989@gmail.com	20	30, 35, 40	SECURITY
A2	Suzan	Erickson	Erickson_1990@gmail.com	19	50, 30, 40	NETWORK
A3	Jack	Napoli	The_lawyer99yahoo.com	19	20, 40, 33	SOFTWARE
A4	Erin	Black	Erin.black@comcast.net	22	50, 58, 40	SECURITY
A5	Your first name	Your last name	Your valid email address	Your age	Number of days to complete 3 courses	SOFTWARE

The data should be input as follows:

```
const string studentData[] =
{ "A1, John, Smith, John1989@gmail.com, 20, 30, 35, 40, SECURITY",
  "A2, Suzan, Erickson, Erickson_1990@gmail.com, 19, 50, 30, 40, NETWORK",
  "A3, Jack, Napoli, The_lawyer99yahoo.com, 19, 20, 40, 33, SOFTWARE",
  "A4, Erin, Black, Erin.black@comcast.net, 22, 50, 58, 40, SECURITY",
  "A5, [firstname], [lastname], [emailaddress], [age],
  [numberofdaystocomplete3courses], SOFTWARE"
```

You may not include third party libraries. Your submission should include one zip file with all the necessary code files to compile, support, and run your application. You must also provide evidence of the program's required functionality by taking a screen capture of the console run, saved as an image file or PDF.

*Note: This assessment requires you to submit pictures, graphics, and/or diagrams. Each file must be an attachment no larger than 30 MB in size. Diagrams must be original and may be hand-drawn or drawn using a graphics program. Do not use CAD programs because attachments will be too large.*

## REQUIREMENTS

*Your submission must be your original work. No more than a combined total of 30% of the submission and no more than a 10% match to any one individual source can be directly quoted or closely paraphrased from sources, even if cited correctly. An originality report is provided when you submit your task that can be used as a guide.*

*You must use the rubric to direct the creation of your submission because it provides detailed criteria that will be used to evaluate your work. Each requirement below may be evaluated by more than one rubric aspect. The rubric aspect titles may contain hyperlinks to relevant portions of the course.*

Create a program that converts the array of strings found in the `studentData` table to an array of student objects by doing the following:

- A. Modify the `studentData` table to include your personal information as the last item.
- B. Create a C++ project in your integrated development environment (IDE) with the following files:
  - `degree.h`
  - `student.h` and `student.cpp`
  - `networkStudent.h` and `networkStudent.cpp`
  - `securityStudent.h` and `securityStudent.cpp`
  - `softwareStudent.h` and `softwareStudent.cpp`
  - `roster.h` and `roster.cpp`

*Note: There must be a total of 11 source code files.*

- C. Define an enumerated data type *Degree* for the degree programs containing the following data elements *SECURITY*, *NETWORKING* and *SOFTWARE*.

*Note: This information should be included in the `degree.h` file.*

- D. For the `Student` class, do the following:

1. Create the base class `Student` in the files `student.h` and `student.cpp`, which includes *each* of the following variables:
  - student ID
  - first name
  - last name
  - email address
  - age
  - array of number of days to complete each course
  - degree types

*Note: Degree type should be populated in subclasses only.*

2. Create *each* of the following functions in the `Student` class:
  - a. an accessor (i.e., getter) for *each* instance variable from part D1
  - b. a mutator (i.e., setter) for *each* instance variable from part D1

*Note: All access and changes to the instance variables of the `Student` class should be done through the accessor and mutator functions.*

- c. constructor using *all* of the input parameters provided in the table
- d. virtual `print()` to print specific student data
- e. destructor
- f. virtual `getDegreeProgram()`

*Note: Leave the implementation of the `getDegreeProgram()` function empty.*

3. Create the **three** following classes as subclasses of `Student`, using the files created in part B:
  - `SecurityStudent`
  - `NetworkStudent`

- `SoftwareStudent`

*Each* subclass should override the `getDegreeProgram()` function. *Each* subclass should have a data member to hold the enumerated type for the degree program using the types defined in part C.

E. Create a `Roster` class (`roster.cpp`) by doing the following:

1. Create an array of pointers, `classRosterArray`, to hold the data provided in the `studentData` table.
2. Create a student object for *each* student in the data table by using the subclasses `NetworkStudent`, `SecurityStudent`, and `SoftwareStudent`, and populate `classRosterArray`.
  - a. Apply pointer operations when parsing *each* set of data identified in the `studentData` table.
  - b. Add *each* student object to `classRosterArray`.
3. Define the following functions:
  - a. `public void add(string studentID, string firstName, string lastName, string emailAddress, int age, int daysInCourse1, int daysInCourse2, int daysInCourse3, < degree program >)` that sets the instance variables from part D1 and updates the roster.
  - b. `public void remove(string studentID)` that removes students from the roster by student ID. If the student ID does not exist, the function prints an error message indicating that the student was not found.
  - c. `public void printAll()` that prints a complete tab-separated list of student data using accessor functions with the provided format: 1 [tab] First Name: John [tab] Last Name: Smith [tab] Age: 20 [tab] daysInCourse: {35, 40, 55} Degree Program: Security. The `printAll()` function should loop through *all* the students in `classRosterArray` and call the `print()` function for *each* student.
  - d. `public void printDaysInCourse(string studentID)` that correctly prints a student's average number of days in the three courses. The student is identified by the `studentID` parameter.
  - e. `public void printInvalidEmails()` that verifies student email addresses and displays all invalid email addresses to the user

*Note: A valid email should include an at sign ('@') and period (".") and should not include a space (" ").*

- f. `public void printByDegreeProgram(int degreeProgram)` that prints out student information for a degree program specified by an enumerated type

F. Demonstrate the program's required functionality by adding a `void main()` function to `roster.cpp`, which will contain the required function calls to achieve the following results:

1. Print out to the screen, via your application, the course title, the programming language used, your student ID, and your name.
2. Create an instance of the `Roster` class called `classRoster`.
3. Add *each* student to `classRoster`.
4. Convert the following pseudo code to complete the rest of the `main()` function:
 

```
classRoster.printAll();
classRoster.printInvalidEmails();
//loop through classRosterArray and for each element:
classRoster.printAverageDaysInCourse(/*current_object's student id*/);
classRoster.printByDegreeProgram(SOFTWARE);
classRoster.remove("A3");
classRoster.remove("A3");
//expected: the above line should print a message saying such a student with
this ID was not found.
```
5. Call the destructor to release the `Roster` memory.

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## File Restrictions

File name may contain only letters, numbers, spaces, and these symbols: ! - \_ . \* ' ( )

File size limit: 200 MB

File types allowed: doc, docx, rtf, xls, xlsx, ppt, pptx, odt, pdf, txt, qt, mov, mpg, avi, mp3, wav, mp4, wma, flv, asf, mpeg, wmv, m4v, svg, tif, tiff, jpeg, jpg, gif, png, zip, rar, tar, 7z

## RUBRIC

### A: PERSONAL INFORMATION

#### NOT EVIDENT

Personal information in the last item of the studentData table is not provided.

#### APPROACHING COMPETENCE

Personal information in the last item of the studentData table is incomplete.

#### COMPETENT

Personal information in the last item of the studentData table is complete.

### B: C++ PROJECT

#### NOT EVIDENT

A C++ project in the IDE is not provided.

#### APPROACHING COMPETENCE

The C++ project is incorrectly created in the IDE or incorrectly uses the given files.

#### COMPETENT

The C++ project is correctly created in the IDE and correctly uses the given files.

### C: ENUMERATED DATA TYPES

#### NOT EVIDENT

The enumerated data types for the degree programs are not provided.

#### APPROACHING COMPETENCE

The enumerated data types for the degree programs are incorrectly defined.

#### COMPETENT

The enumerated data types for the degree programs are correctly defined.

### D1: BASE CLASS STUDENT

#### NOT EVIDENT

The base class Student is not provided.

#### APPROACHING COMPETENCE

The base class Student is incorrectly created or incorrectly uses one or more given variables.

#### COMPETENT

The base class Student is correctly created by correctly including each of the given variables.

## D2A:ACCESSOR

**NOT EVIDENT**

An accessor function in the Student class for each instance variable from part D1 is not provided.

**APPROACHING COMPETENCE**

The accessor function in the Student class for each instance variable from part D1 is not functional or incomplete.

**COMPETENT**

The accessor function in the Student class for each instance variable from part D1 is functional and complete.

## D2B:MUTATOR

**NOT EVIDENT**

A mutator function in the Student class for each instance variable from part D1 is not provided.

**APPROACHING COMPETENCE**

The mutator function in the Student class for each instance variable from part D1 is not functional or incomplete.

**COMPETENT**

The mutator function in the Student class for each instance variable from part D1 is functional or complete.

## D2C:CONSTRUCTOR

**NOT EVIDENT**

A constructor in the Student class is not provided or does not use any of the input parameters from the data table.

**APPROACHING COMPETENCE**

The constructor function in the Student class inaccurately uses one or more of the input parameters from the data table.

**COMPETENT**

The constructor function in the Student class accurately uses all of the input parameters from the data table.

## D2D:PRINTING SPECIFIC DATA

**NOT EVIDENT**

A virtual print() function in the Student class is not provided.

**APPROACHING COMPETENCE**

The virtual print() function in the Student class inaccurately prints specific student data.

**COMPETENT**

The virtual print() function in the Student class accurately prints specific student data.

## D2E:DESTRUCTOR

**NOT EVIDENT**

A destructor function is not provided.

**APPROACHING COMPETENCE**

The destructor function is provided but does not release memory.

**COMPETENT**

The destructor function is implemented to release memory.

## D2F:VIRTUAL GETDEGREEPROGRAM

**NOT EVIDENT**

A  
virtual getDegreeProgram()function  
is not provided.

**APPROACHING COMPETENCE**

The  
virtual getDegreeProgram()function  
is provided but not empty.

**COMPETENT**

The  
virtual getDegreeProgram()function  
is provided with empty  
implementation.

## D3:THREE CLASSES

**NOT EVIDENT**

3 classes are not provided.

**APPROACHING COMPETENCE**

All 3 classes are provided, but one  
or more are not subclasses of  
the Student class or do not use the  
files created in part B. Each  
subclass does not override  
the getDegreeProgram() function.  
Each subclass does not have a data  
member to hold the enumerated  
types, using the types defined in  
part C.

**COMPETENT**

All 3 classes are a subclass of  
the Student class using the files  
created in part B. Each subclass  
overrides  
the getDegreeProgram() function. E  
ach subclass has a data member to  
hold the enumerated type, using the  
types defined in part C.

## E1:ONE ARRAY

**NOT EVIDENT**

An array is not provided.

**APPROACHING COMPETENCE**

The array of pointers created to  
hold the data provided in the  
studentData table is incomplete or  
incorrect.

**COMPETENT**

The array of pointers created to hold  
the data in the studentData table is  
complete and correct.

## E2:STUDENT OBJECT

**NOT EVIDENT**

A student object for each student in  
the data table is not provided.

**APPROACHING COMPETENCE**

The student object for each student  
in the data table is incorrectly  
created or does not use each of the  
given subclasses.  
Or classRosterArray is incorrectly  
populated.

**COMPETENT**

The student object for each student  
in the data table is correctly created  
and uses each of the given  
subclasses. classRosterArray is  
correctly populated.

## E2A:APPLYING POINTER OPERATIONS

**NOT EVIDENT**

Pointer operations are not  
populated.

**APPROACHING COMPETENCE**

The pointer operations are  
incorrectly applied when

**COMPETENT**

The pointer operations are correctly  
applied when parsing each set of

parsing each set of data listed in the studentData table.

data listed in the studentData table.

#### E2B:ADDING STUDENT OBJECTS TO ARRAY

##### NOT EVIDENT

Each student object is not added to the classRosterArray.

##### APPROACHING COMPETENCE

One or more student objects are incorrectly added to the classRosterArray.

##### COMPETENT

Each student object is correctly added to the classRosterArray.

#### E3A:ADD FUNCTION

##### NOT EVIDENT

A public void add(string studentID, string firstName, string lastName, string emailAddress, int age, int daysInCourse1, int daysInCourse2, int daysInCourse3, ) function is not defined.

##### APPROACHING COMPETENCE

The public void add(string studentID, string firstName, string lastName, string emailAddress, int age, int daysInCourse1, int daysInCourse2, int daysInCourse3, ) function is incorrectly defined to set the instance variables from part D1 and update the roster.

##### COMPETENT

The public void add(string studentID, string firstName, string lastName, string emailAddress, int age, int grade1, int grade2, int grade3, ) function is correctly defined to set the instance variables from part D1 and update the roster.

#### E3B:REMOVE FUNCTION

##### NOT EVIDENT

A public void remove(string studentID) that removes students from the roster by student ID is not defined.

##### APPROACHING COMPETENCE

The public void remove(string studentID) that removes students from the roster by student ID is incorrectly defined.

##### COMPETENT

The public void remove(string studentID) that removes students from the roster by student ID is correctly defined.

#### E3C:PRINT ALL FUNCTION

##### NOT EVIDENT

A public void printAll() is not defined.

##### APPROACHING COMPETENCE

The public void printAll() that prints a complete tab-separated list of student data uses incorrect accessor functions. Or the printAll() incorrectly loops through one or more of the students in the student list or incorrectly calls the print() function for one or more students.

##### COMPETENT

The public void printAll() that prints a complete tab-separated list of student data uses correct accessor functions appropriately. The printAll() correctly loops through all the students in the student list and correctly calls the print() function for each student.



## E3D:PRINT AVERAGE FUNCTION

**NOT EVIDENT**

A public void  
`printAverageDaysInCourse(string studentID)` that prints a student's average number of days in the 3 courses is not defined.  
 Identification of the student by the student-ID parameter is not provided.

**APPROACHING COMPETENCE**

A public void  
`printAverageDaysInCourse(string studentID)` incorrectly prints a student's average number of days in the 3 courses by student ID. The student is not correctly identified by the student-ID parameter.

**COMPETENT**

A public void  
`printAverageDaysInCourse(string studentID)` correctly prints a student's average number of days in the 3 courses by student ID. The student is correctly identified by the student-ID parameter.

## E3E:PRINT INVALID EMAILS FUNCTION

**NOT EVIDENT**

A public void `printInvalidEmails()` is not defined.

**APPROACHING COMPETENCE**

A public void  
`printInvalidEmails()` incorrectly verifies student email addresses or displays one or more invalid email addresses to the user.

**COMPETENT**

A public void  
`printInvalidEmails()` correctly verifies student email addresses and displays all invalid email addresses to the user.

## E3F:PRINT DEGREE PROGRAM FUNCTION

**NOT EVIDENT**

A public void  
`printByDegreeProgram(int degreeProgram)` is not provided.

**APPROACHING COMPETENCE**

A public void  
`printByDegreeProgram(int degreeProgram)` incorrectly prints out students for a degree program specified by an enumerated type.

**COMPETENT**

A public void  
`printByDegreeProgram (int degreeProgram)` correctly prints out student information for a degree program specified by an enumerated type.

## F1:SCREEN PRINT OUT

**NOT EVIDENT**

The course title, programming language used, student ID, and student name are not all provided.

**APPROACHING COMPETENCE**

The course title, programming language used, student ID, or student name is incorrectly printed at the top.

**COMPETENT**

The course title, programming language used, student ID, and student name are all correctly printed at the top.

## F2:ROSTER CLASS INSTANCE

**NOT EVIDENT**

An instance of the Roster class called `classRoster` is not provided.

**APPROACHING COMPETENCE**

The instance of the Roster class called `classRoster` is incorrectly created.

**COMPETENT**

The instance of the Roster class called `classRoster` is correctly created.

## F3:ADD STUDENTS

**NOT EVIDENT**

Students are not added to classRoster.

**APPROACHING COMPETENCE**

One or more students are missing from classRoster.

**COMPETENT**

All students are added to classRoster.

## F4:PSEUDO CODE CONVERSION

**NOT EVIDENT**

Evidence of converting the pseudo code to complete the rest of the main() function is not provided.

**APPROACHING COMPETENCE**

Some of the pseudo code is incorrectly converted to complete the rest of the main() function or is out of order.

**COMPETENT**

All pseudo code is correctly converted to complete the rest of the main() function and is in order.

## F5:DECONSTRUCTOR CALL

**NOT EVIDENT**

Evidence of calling the destructor to release the Roster memory is not provided.

**APPROACHING COMPETENCE**

Evidence of calling the destructor to release the Roster memory is provided, but the destructor was incorrectly called.

**COMPETENT**

The Roster memory is released by calling the destructor.

## SUPPORTING DOCUMENTS

[IDE Instructions.docx](#)