

Complex Engineering Activity

Subject: Computer Programming Lab

Semester: Spring 2025

Instructor: Engr. M. Irfan Minhas

Objective:

The objective of this complex engineering activity is to carry out research, analysis, design, investigation, and implementation of a real-world complex programming project that has the following attributes:

1. The activity requires abstract thinking, originality in analysis to formulate suitable programming models of the activity;
2. The activity involves the creative use of programming principles and research-based knowledge in novel ways;
3. The activity can extend beyond previous experiences by applying principles-based approaches.

Complex Engineering Activity Outcomes (CEAO):

The outcome of this activity is that the students may be able to partially attain some or all the following graduate attributes:

1. GA1: Engineering Knowledge
2. GA2: Problem Analysis
3. GA3: Design/Development of Solutions
4. GA4: Investigation
5. GA5: Modern Tool Usage
6. GA6: The Engineer and Society
7. GA7: Environment and Sustainability
8. GA8: Professional Ethics
9. GA9: Individual and Teamwork
10. GA10: Communication
11. GA11: Project Management
12. GA12: Lifelong Learning

This activity is mapped on CLO2 & CLO3 and your performance in this project will play an important role in their attainment.

CLO's	Statement	PLOs Mapping	Learning Levels
CLO2	Display acquired skills by creating, debugging and running simple C++ programs for specific programming problems.	PLO2	P2
CLO3	Answer concepts related to coding, documenting, testing, & implementing a well-structured robust computer program using C++ programming language both in individual & team work capacity.	PLO9	A2

Task Instructions

TEACHER PORTAL USING C++

- You have been given a sample file named NCA.csv, which contains the marks of students in the Electrical Engineering department (Electronics A) at Air University in NCA. Write a C++ program that reads the data from the file (NCA.csv) and prompts the user on the console to enter the weightage for quizzes, assignments, the mid-term exam, the final exam, and the project. Ensure that the sum of the overall weightage is 100. Then calculate the total marks obtained by each student
- For demonstration purposes, a snapshot from the file NCA.csv is provided below

Student Names	Roll Numbers	Q	Q	Q	Q	Q	Q	A	A	A	M	F	P
	Total Out Of	10	10	10	10	10	10	10	10	10	100	100	40
Muhammad Abdullah Khan	190536	8	3	5	6	8	5	6	4	3	65	64	26
Abdullah Khan	210355	3	7	2	4	3	2	5	3	4	1	17	13
Saram Rehman Qureshi	210764	6	8	0	0	9	10	4	10	1	87	99	22
Hassam Ahsan	211216	1	6	3	10	5	9	2	1	9	7	100	27
Safwan Sami	211243	10	3	10	6	4	5	1	0	8	33	53	3
Huzaifa Munir Janjua	211264	2	3	1	10	0	10	0	4	5	27	62	38
MUHAMMAD ZEESHAN KHAN	212087	10	4	3	0	6	7	8	8	9	19	62	20
Hamza Shoaib	212125	6	8	7	6	2	5	7	2	4	26	76	18
Armaghan Hussain	221119	9	1	1	3	8	8	0	9	7	15	31	36
Hira Nusrat	221123	10	3	3	5	4	8	7	10	6	63	99	15
Areeba Gulzar	221125	4	5	0	8	10	8	6	3	0	97	43	23
Rohma Binte Azeem	221127	10	4	7	6	7	9	6	7	5	59	20	10
Sohail Zafar	221131	0	3	1	2	7	3	9	6	10	93	19	27

- The 'Q' in the first row stands for Quizzes. There are six columns of 'Q,' indicating that the instructor conducted six quizzes.
- The 'A' in the first row stands for Assignments. There are three columns of 'A,' indicating that the instructor assigned three assignments.
- Additionally, 'M' and 'F' stand for the midterm and finalterm exams, respectively, while 'P' stands for Project.
- Suppose the user entered the following weightages on the console: (Quiz 10, Assignment 5, Midterm 30, Final 45, Project 10). The total marks of any student in the file NCA.csv can be calculated using the following formula. (Remember, the formula will change based on the weightages entered by the user on the console and the number of quizzes and assignments taken by the instructor):

$$Total = \left(\frac{Q1+Q2+Q3+Q4+Q5+Q6}{60} \right) * 10 + \left(\frac{A1+A2+A3}{30} \right) * 5 + \left(\frac{M}{100} \right) * 30 + \left(\frac{F}{100} \right) * 45 + \left(\frac{P}{40} \right) * 10$$

- A sample of calculations for student 1 in the file NCA.csv (Muhammad Abdullah Khan 190536) based on the entered weightages is given below

$$Total = \left(\frac{8+3+5+6+8+5}{60} \right) * 10 + \left(\frac{6+4+3}{30} \right) * 5 + \left(\frac{65}{100} \right) * 30 + \left(\frac{64}{100} \right) * 45 + \left(\frac{26}{40} \right) * 10$$

$$Total = 62.8$$

- In a similar way, you will need to calculate the total marks of all the students. However, remember that your code should be generic. For instance, if you are provided with a new file (CP.csv) in which instead of 6 quizzes and 3 assignments, the instructor took 4 quizzes

and 2 assignments, and instead of 42 students as in the (NCA.csv) file, only 39 students registered for the CP lab as in the (CP.csv) file, your code should be able to calculate the result of any provided file having any number of students or any number of quizzes and assignments taken by the instructor. You should be able to achieve this without making any changes to the code, except for replacing the name of the file NCA.csv with the name of the file you are reading.

- After calculating the total marks of all the students, find the grades based on the following grading policy.
- Suppose the class average is 61, then the following grading scheme should be applied (noting that 61 is the central point of the B- grade range. The other grades have a range of 5 marks above and below the B- grade, except for the A grade and F grade).

0-38 F

39-43 D

44-48 C-

49-53 C

54-58 C+

59-63 B-

64-68 B

69-73 B+

74-78 A-

79-100 A

- This is just an example. The grading scheme should change according to the class average.
- Now, after calculating grades, provide 3 options on the console:
 1. Display Class Result on the console.
 2. Generate Class Result in a new CSV file.
 3. Search Result of an individual student by roll number on console.
 4. Exit.
- A sample of the class result generated in a new NCA_result.csv file for an NCA.csv file is shown below. (The class average was approximately 49.55, rounded to 50, so grades are allotted according to that):

Student Names	Roll Numbers	Quiz	Assignment	Mid	Final	Project	Total	Grades
	Weightage (out of)	10	5	30	45	10	100	
Muhammad Abdullah Khan	190536	5.83	2.17	19.5	28.8	6.5	62.80	B+
Abdullah Khan	210355	3.50	2.00	0.3	7.65	3.25	16.70	F
Saram Rehman Qureshi	210764	5.50	2.50	26.1	44.55	5.5	84.15	A
Hassam Ahsan	211216	5.67	2.00	2.1	45	6.75	61.52	B+
Safwan Sami	211243	6.33	1.50	9.9	23.85	0.75	42.33	C
Huzaifa Munir Janjua	211264	4.33	1.50	8.1	27.9	9.5	51.33	B-
MUHAMMAD ZEESHAN KHAN	212087	5.00	4.17	5.7	27.9	5	47.77	C+
Hamza Shoaib	212125	5.67	2.17	7.8	34.2	4.5	54.33	B
Armaghan Hussain	221119	5.00	2.67	4.5	13.95	9	35.12	C-
Hira Nusrat	221123	5.50	3.83	18.9	44.55	3.75	76.53	A
Areeba Gulzar	221125	5.83	1.50	29.1	19.35	5.75	61.53	B+
Rohma Binte Azeem	221127	7.17	3.00	17.7	9	2.5	39.37	C
Sohail Zafar	221131	2.67	4.17	27.9	8.55	6.75	50.03	B-

Additional Bonus

1. Name the .cpp file you have created as "subject_results.cpp". Run it six times, each time providing a different subject file as input. For example, run it with "calculus.csv", "eca.csv", "nca.csv", "islamiat.csv", "cp.csv", and "fluids.csv" respectively. (I have already provided CP.csv and NCA.csv. If you need others, you can generate them randomly or come to my office and ask me. I will provide them.)
2. After running "subject_results.cpp" for each subject file, you will have generated six separate CSV files containing the results for each subject through the code.
3. Create a new .cpp file, let's call it "overall_results.cpp". In this file, write the logic to read the results from all six CSV files and calculate the GPA for each student.
4. Compile and run "overall_results.cpp" to generate the overall GPA for each student based on the results from all six subject files.

Policy on Professional Ethics & Plagiarism

- The project carries a weightage of 20 absolute marks in the lab and 10 absolute marks in the theory, so this policy will be strictly implemented.
- You are allowed to consult books and online resources during the design and analysis phase of your project.
- However, it is strictly prohibited to copy any material or code directly from the web or any other source.
- Your design and implementation must be original and your own effort.
- If anyone is found to have copied code from the Internet or another individual, severe penalties will be imposed.
- Violating this policy or submitting work that is not your own will result in severe consequences.
- Project marks may be adjusted after conducting viva of all the students to detect code or report sharing.
- Both groups involved in code or report sharing will receive the minimum penalty of 0 marks or an F grade.

Deliverables

1. The project code is to be submitted on GCR before **Thursday 5th June, 11:59 pm.**
2. The project report is to be submitted on GCR before **Thursday 5th June, 11:59 pm.**
3. Late submitted projects will not be acceptable.
4. Project viva on **Friday 6th June.** Timings will be shared later.

Project Report Guidelines

The report should contain the following contents:

- Title (Complex Engineering Activity)
- Project name (Teacher Portal using C++)
- Introduction
- Implementation (Include code snippets/screenshots of your main logics and explain them)
- Program outputs
- Learning outcomes
- References
- C++ program code (Include it after **References** as an **appendix**, If the code is very lengthy, upload it on **Google Drive** and add the link of the uploaded file in the **appendix**)