

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
FIRST SEMESTER 2019/2020 B.Eng. DEGREE SEMESTER EXAMINATION
COURSE: MCE 312 (Computer Programming and Languages)
INSTRUCTION: Answer Question One and Any Other Two Questions.
TIME ALLOWED: 2 Hours.

Question 1 (50 Marks)

- a) The academic office requires a system that helps cluster the graduating students for award ceremonies based on their performance. The operation is such that, the rank of a student in the class is used to cluster them. if a student rank is 1 or 2 then the student should be grouped into the first-class cluster. furthermore, if the rank of a student is 3 or 4 the student should be grouped into the upper-division cluster. However, if the rank is 4, the student should belong to the Second division. In addition, if the rank of the student is 5 the student shall be grouped under the lower division. while any other rank shall be grouped into the pass division. You are required to
- i. Develop a pseudo code for the operation. (5 Marks)
 - ii. Design a flowchart for the Operation. (5Marks)
 - iii. Write a complete C++ code for the operation. (10 Marks)
- b) A discount furniture store sells four types of bedroom sets. The cost (in dollars) of each set can be represented by the array Cs = [199, 268, 500, 670]. The price at which the store sells each set can be represented by the array Ps = [398, 598, 798, 998]. In a particular quarter the number of sets sold of each type can be represented by the array Ns = [35, 25, 20, 10]. Write a C++ program that calculates and reports:
- i. The total number of bedroom sets sold. (5 Marks)
 - ii. The total revenue received by the store from the number of sets sold. (5 Marks)
 - iii. The profit realized by the store from the sale of bedroom sets. (5 Marks)
- c) Using the if-else control structure, write a C++ program that counts the amount of even and odd numbers from 0-100. (7.5 Marks)
- d) Using the function approach, write a C++ program that determines the greatest of 3 integers. (7.5 Marks)

Question 2 (25 Marks)

- a) Objects dropped from a great height fall with increasing speed until the drag force from the air balances the force due to gravity. The terminal velocity in the air (for sufficiently massive bodies like pennies or people) is given by:

$$v_t = \sqrt{\frac{mg}{\rho AC_d}}$$

Where m is the mass of the object, g is the acceleration due to gravity (9.81m/s²), ρ is the density of air (1.18kg/m³), A is the cross-vertical sectional area of the object (m²), and Cd is the dimensionless drag coefficient, which depends on the details of the shape and is about 0.3.

- i. Develop a pseudo code to calculate the Final Velocity. (2.5 Marks)
- ii. Design a flowchart for the operation. (2.5 Marks)

- iii. Write a complete C++ code for the operation. (10 Marks)
- b) Due to the challenges presented by Covid 19, the management of CDQ Inc., has directed the HR department to develop a mechanism to modify the number of vacation days allowable to all staff. The mechanism is such that it deducts 5 days from the original number of initial days allowable to a staff. Using the concepts of functions write a complete C++ code to achieve this task. (10 Marks)

Question 3 (25 Marks)

- a) The Sum-Prod task for any two numbers is described as: Obtain the sum and product of the numbers. However, If the product is greater than the sum, determine and display the modulus of the product, otherwise, add 10 to the sum and display the corresponding result. To solve this task, you are to
 - i. Develop pseudocode for this task (5 Marks)
 - ii. Develop a flowchart for this task (5 Marks)
 - iii. Write a C++ code for the task. (5Marks)
- b) Write a Complete C++ that computes the grade of a student at the end of the semester from the individual score in all 7 courses taken. Note the student cannot score above 100 marks nor below zero (0) marks in any course. (10 Marks)

Question 4 (25 Marks)

- a) Mechatronics Society of Nigeria has decided to pay the tuition fee of any junior school students with the highest number of passes in all subjects. Before the tuition fee can be paid the student must pass at least 50% of the subject been offered. However, if the number of passes is less than 50% the student shall not be entitled to the scholarship. You are required to write a C++ code that accepts the grades, determine whether or not it is a passing grade and thereafter count the number of passes or failures to ascertain if the student is qualified for the sponsorship. Assume there are 50 student and they take 10 subjects.
 - i. Develop an appropriate Pseudo Code for the Operation. (5 Marks)
 - ii. A Complete C++Program for the Scholarship process. (10 Marks)
- b) Write a complete C++ program using the function approach to determine the Quad-square of a number. (10 Marks)
Hint: Quad-square of Number $n = ((n * n * n * n) / 2)^2$