FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
FIRST SEMESTER 2018/2019 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) A company requires to computerize its payment system. The company pays "straight time" for the first 40 hours worked by each employee and pays "time-and-a-half" for all hours worked in excess of 40 hours. You are given a list of the employees of the company, the number of hours each employee worked last week and the hourly rate of each employee. Your program should input this information for each employee and should determine and display the employee's gross pay.
You are required to
   i. Develop a pseudo code for the operation. (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) Write a single sum function that returns the sum of two integers using C++. (5 Marks)

c) Write the equivalent function for taking the sum of two doubles using C++.
(5 Marks)

d) Explain why, given your functions from (b) and (c), sum (1, 10.0) is a syntax error. (5 Marks)

e) Write a Complete Matlab program using a function approach to determine the Quad-square of a number. (Hint: Quad-square of Number n= (n*n*n*n)/2). (10 Marks)

f) 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 Python program that calculates and reports: a. The total number of bedroom sets sold. b. The total revenue received by the store from the number of sets sold. c. The profit realized by the store from the sale of bedroom sets. (10 Marks)

Question 2 (25 Marks)

a) When two objects collide in such a way that the sum of their kinetic energies before the collision is the same as the sum of their kinetic energies after the collision, they are said to collide elastically. The final velocities of the two objects can be obtained by using the following equations.

$$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_{1i} + \left(\frac{2m_2}{m_1 + m_2}\right) v_{2i}$$

$$v_{2f} = \left(\frac{2m_1}{m_1 + m_2}\right) v_{1i} + \left(\frac{m_2 - m_1}{m_1 + m_2}\right) v_{2i}$$

It is required to calculate the final velocities of two objects in an elastic collision, given their masses and initial velocities. Use m1 =5 kg, m2 =3 kg, v1i =2 m/s, and v2i =−4 m/s as a test case.

i. Develop a pseudo code to calculate the Final Velocities. (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) A college has a list of test results (1=PASS,2=FAIL) for ten (10) students. If more than eight (8) students pass, then the program will print "RAISE TUTION".

i. Develop a flowchart for this task (4 Marks)
ii. Write a python code for the task. (4 Marks)

c) Discuss the meaning of std::cin and std::cout in a standard C++ program (2 Marks)

Question 3 (25 Marks)

a) The HOD of Mechatronics is in need of a C++ code to help control a newly designed home automation system. The operation is such that if the status code of the device is 15, the temperature is too hot, and the device should be turned off; if the status code is 12, the operator should check the temperature every 5 minutes; if the status is 13, the operator should turn on the circulating fan; for all other status codes, the equipment is operating in a normal mode. You are required to

i. Develop a suitable Pseudo Code for the operation. (2.5 Marks)
ii. Develop a flowchart for the operation. (2.5Marks)
iii. write a complete C++ code for the operation, using the Switch-Case control structure. (10 Marks)

b) 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 product, otherwise add 10 to the sum and display the corresponding result. To solve this task, you are to

i. Develop a flowchart for this task (4 Marks)
ii. Write a Matlab code for the task. (4 Marks)

c) Explain the term Algorithm as it relates to program development (2 Marks)

Question 4 (25 Marks)

a) Twenty three (23) of the one hundred (100) persons arrested in connection to the newly discovered fraud case in Waka-now (a newly liberated country in the west African Region of Africa) are to be charged to court and the prosecuting counsels requires a C++ based program code to quantify the amount stolen in Naira based on the value in the bank accounts of the arrested suspects. If a suspect has over 3000WD (WD Waka-now Dollar currency of waka-now) in his account, the total amount stolen in Naira is equivalent to 20 times the Account Value otherwise it is 15 times the Account Value. To this end you are required to

   i. Develop an appropriate Pseudo Code for the Operation. (2.5 Marks)
   ii. A suitable Flowchart to represent the problem. (2.5 Marks)
   iii. A Complete Python Program for the conversion process. (10 Marks)

b) It is required to obtain the product of all even numbers between 0 to 100. Hence, you to.

   i. Develop a Flowchart for this operation. (4 Marks)
   ii. Write a complete C++ program code for this task. (4 Marks)

c) Compare and Contrast between a Flowchart and Pseudo-Code (2 Marks)