

B.E FTBE Examination 2017
(2nd Year 2nd Semester)
Numerical Methods and Computer Programming

Time: 3 hours

Full Marks: 100

Answer any *five* questions

1(a) Write a C program to read the lengths of the three sides of a triangle as input and determine whether the triangle is a right angled one.

(b) Write a C program to produce a Centigrade to Fahrenheit temperature conversion table, in which the first column with a heading Centigrade denotes Centigrade temperature values increased in each entry with a fixed step size and the second column with a heading Fahrenheit denotes equivalent Fahrenheit temperature values. The table starts with an initial Centigrade value c_1 , increased with a step size of $delc$ in each entry, and finally ends with a Centigrade value c_2 in the last entry. The values of c_1 , c_2 , and $delc$ are to be read as input at the beginning of the program. Use the following formula for Centigrade (c) to Fahrenheit (f) temperature conversion.

$$f = 1.8c + 32$$

10+10

2(a) Write a C program to read n numbers, denoted by x_1, x_2, \dots, x_n , in an array and find

i) the mean (x_m) of the numbers given as $x_m = \frac{\sum_{i=1}^n x_i}{n}$

ii) the variance (v) given as $v = \frac{\sum_{i=1}^n (x_i - x_m)^2}{n}$

iii) the standard deviation (sd) given as $sd = \sqrt{v}$

The value of n which can be at most 100 is to be read as input at the beginning of the program.

(b) The student strength of a class in some institute can at most be 30. The marks obtained by the students of a class in 10 subjects in some semester examination are tabulated below

Students' scores on 10 subjects
 (Full Mark for each subject is 100)

Student Code	1	2	9	10
1				
2					
....					
30					

Write a C program to read the data from the table shown above and display the percentage of marks obtained by each student with his/her identifying Student code. The output would have two columns. The first column would have a heading 'Student Code' and the second column a heading 'Marks(%)'.

10+10

3(a) Write a C function to compute the following function for a given value of x.

$$f(x) = \begin{cases} 2x^2 + 3x + 4 & \text{for } x < 2 \\ 0 & \text{for } x = 2 \\ -2x^2 + 3x - 4 & \text{for } x > 2 \end{cases}$$

Using the function, write a complete C program to read 10 values of x as input and display the corresponding values of f(x) in a tabular form.

(b) A word, phrase, or sequence that reads the same backwards as forwards, such as “dad”, “radar”, “madam” etc., are called palindromes. Write a C program to read a string of characters as input and determine if the string is a palindrome.

10+10

4. (a) Apply Gaussian Elimination to solve the following:

$$\begin{aligned} x_0 - 3x_1 + x_2 &= 4 \\ 2x_0 - 8x_1 + 8x_2 &= -2 \\ -6x_0 + 3x_1 - 15x_2 &= 9 \end{aligned}$$

(b) How one major disadvantage of Bisection method can be overcome using Regula Falsi or Method of False Position? Apply Regula Falsi to find the root of the following equation.

$$e^x - 3x^2 = 0 \text{ in } [0, 1].$$

The solution needs to be correct up to 2 decimal places.

10+10

5. Derive the formula for Newton-Raphson method. Illustrate the method graphically. Write about its the condition for convergence. Apply Newton-Raphson method to find a root of the following equation.

$$\sin x - e^{-x} = 0$$

Take $x_0 = 3$. The solution needs to be correct up to 2 decimal places.

20

6.(a) Derive the formula for Modified Euler’s method for numerical solution of first order differential equations. Apply the method to find $y(0.2)$ from $\frac{dy}{dx} = \sin(x + y) - e^{-x}$ with $y(0) = 4$. Take $h = 0.1$

(b) Estimate the value of $\int_0^1 e^{\sqrt{x}} dx$ with 4 equally spaced ordinates using Trapezoidal Rule and Simpson’s $1/3^{\text{rd}}$ Rule separately. Compare the results.

10+10