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BCS-054

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

December, 2019

BCS-054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 Hours *Maximum Marks : 100*

Note : *Question No. 1 is compulsory. Attempt any* ***three*** *more questions from the questions no. 2 to 5. Use of any calculator is permitted.*

1. (a) Find the absolute error and relative error in the numbers 432.8 and 0.12584 if four digit mantissa is used and chopping is used for approximation. 4

   (b) Round the following numbers to two decimal places : 2

   38.21416, 4.3742, 82.375, 2.4869

(c) For the following two floating point numbers : 3

$$x_1 = 0.5527 \times 10^4$$

and $$x_2 = 0.6243 \times 10^3$$

find $x_1 - x_2$. The result should be rounded to four decimal digits.

(d) Find the product of x_1 and x_2 given in Q. No. 1 (c) above. The result should be chopped to four decimal digits. 3

(e) Find the Newton's forward difference interpolating polynomial for the following data. Hence obtain the value of $f(x)$ at $x = 1.5$: 6

x	$f(x)$
1	34
2	60
3	90
4	124
5	162
6	204

(f) Write the following system of linear equations in matrix form : 2

$$x + 2y + 3z = 14$$

$$x - y = -1$$

$$y + 3z = 11$$

(g) Solve the following system of linear equations using Gauss-Seidel iterative method : 5

$$x + 6y = 13$$

$$4x - y = 2$$

Perform two iterations, taking $x = 0$ and $y = 0$ as the initial values.

(h) Find an interval in which the following equation has a positive root : 2

$$2x^3 + x^2 - 20x + 12 = 0$$

(i) Find Δf for the following functions for some $h > 0$: 3

(i) $f(x) = 3x^2$

(ii) $f(x) = 2x$

(j) Find the approximate value of $I = \int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule dividing the interval into five equal parts. 10

2. (a) Using an 8-decimal digit floating point representation (4 digits for mantissa, 2 for exponent and 1 each for sign for exponent and sign for mantissa) represent the following numbers in normalised floating point from (using chopping if required) : 6

(i) 92752

(ii) –93.231

(iii) –0.0012345

(b) Solve the following system of linear equations by using Gaussian elimination method : 8

$$x_1 - x_2 - x_3 = -3$$

$$2x_1 + 3x_2 + 5x_3 = 7$$

$$x_1 - 2x_3 + 3x_3 = -11$$

(c) Give *one* example each of the following : 6

(i) Ill conditional problem

(ii) Ordinary differential equation (ODE) of degree 3 and order 2

(iii) A system of inconsistent linear equations in two variables.

3. (a) Consider the initial-value problem : 6

$$y' = 0.2xy,\ y(1) = 1$$

Use Euler's method to obtain an approximation to $y(1.2)$ using $h = 0.1$.

(b) Using Lagrange's interpolation formula, find the form of the function $y(x)$ from the following table. Also compute $f(3)$: 7

x	y
0	6
2	20
5	56

(c) Write the expressions, one for each, which is obtained by applying each of the following operators to $f(x)$ for some $h > 0$: 4

(i) ∇

(ii) δ

(iii) μ

(iv) E

(d) Derive the relation between δ and E. 3

4. (a) Solve the following system of linear equations using partial pivoting : 10

$$x + y - 5z = 0$$

$$5x + 2y - z = 18$$

$$2x - 2y + z = 3$$

(b) Find a real root for the equation $x^3 + x - 5 = 0$.

Using Regula-Falsi method, taking x co-ordinates of initial points as $x = 0$ and $x = 2$. Perform only two iterations of the method. 7

(c) Make the Newton's divided difference table for the following data : 3

x	$f(x)$
1	10
2	20
4	40
8	80

5. (a) Explain the concept of overflow and underflow in the context of decimal floating point number with the help of ***one*** example of each. 6

(b) Find by Newton-Raphson's method, the real root of the equation $x^2 - 3x + 1 = 0$ taking $x = 2$ as the starting value. Show three iterations. 7

(c) Apply Newton's backward difference formula to the data below to obtain a polynomial of degree 4 in x: 7

x	y
1	1
2	−1
3	1
4	−1
5	1