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BCS-054

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

02083

June, 2015

BCS-054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 hours *Maximum Marks : 100*

Note : *Simple (but not scientific) calculator is allowed. Question number 1 is **compulsory**. Attempt any **three** from the next four questions.*

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1. (a) Using an 8-decimal digit floating point representation (4 digits for mantissa, 2 for exponent and one each for sign of exponent and sign for mantissa), represent the following numbers in normalised floating point form (using chopping, if required) : *3*

(i) 87426

(ii) – 94·27

(iii) – 0·000346

(b) For the following two floating point numbers

$x_1 = 0{\cdot}4527 \times 10^4$ and $x_2 = 0{\cdot}5243 \times 10^3$, find $x_1 - x_2$. *2*

(c) Find the product of x_1 and x_2 given in Q. No. 1(b) above. *2*

(d) What is underflow ? Explain it with an example of multiplication in which underflow occurs. *3*

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

$$6x + 8y = 10$$

$$-5x + 3y = 11$$

(f) Solve the system of linear equations given in Q. No. 1 (e) above. *3*

(g) Find an interval in which the following equation has a root : *2*

$$4x^2 - 4x - 3 = 0$$

(h) Give one example of each of (i) algebraic equation (ii) transcendental equation. *2*

(i) Write the expressions, which are obtained by applying each of the operators to f(x), for some h : *4*

(i) ∇

(ii) Δ

(iii) E

(iv) δ

(j) Write Δ and δ in terms of E. *2*

(k) State the following two formulae for (equal interval) interpolation : *3*

(i) Newton's Backward Difference Formula

(ii) Newton's Forward Difference Formula

(l) Construct a difference table for the following data : *2*

x	1	2	3	4
f(x)	2	9	28	65

(m) From the Newton's Forward Difference Formula asked in Q. No. 1(k) (ii) above, derive the formula for finding derivative of a function at x_0. *3*

(n) State Simpson's (1/3) rule for finding the value of the integral $\int_a^b f(x)\,dx$. 3

(o) Explain each of the following concepts with a suitable example : 4

(i) Initial Value Problem

(ii) Degree and order of a differential equation

2. (a) Let min. and max. represent respectively minimum and maximum positive real numbers representable by some floating point number system. Can every real number between max. and min. be representable by such a number system ? Explain the reason for your answer. 4

(b) For each of the following numbers, find the floating point representation, if possible normalized, using chopping, if required. The format is 8-digit as is mentioned in Q. No. 1(a) above :

(i) 3/11

(ii) 74·0365

Further, find the absolute error, if any, in each case. 6

(c) Find a ÷ b (a divided by b) for the floating point numbers : *6*

$a = -0{\cdot}4783 \times 10^4; \; b = 0{\cdot}5237 \times 10^{-5}.$

(d) Find the Taylor's series for x^{-1} at a = 1. *4*

3. (a) Solve the following system of equations, using partial pivoting Gaussian elimination method (compute upto two places of decimal only) : *12*

$$4x_1 - 5x_2 + 6x_3 = 24$$

$$3x_1 - 7x_2 + 2x_3 = 17$$

$$5x_1 + 2x_2 - 4x_3 = -21$$

(b) What are the advantages of Direct methods over Iterative methods for solving a system of linear equations ? *4*

(c) For solving the following system of linear equations

$$a_{11} x_1 + a_{12} x_2 + a_{13} x_3 = b_1,$$

$$a_{21} x_1 + a_{22} x_2 + a_{23} x_3 = b_2 \text{ and}$$

$$a_{31} x_1 + a_{32} x_2 + a_{33} x_3 = b_3$$

with $a_{11} \neq 0 \neq a_{22}$ and $a_{33} \neq 0$, by iterative Gauss-Jacobi Method, with initial approximations as $x_1 = 1 = x_2 = x_3$, find the values of next approximations of x_1, x_2 and x_3. *4*

4. (a) Compute the difference table and mark the forward differences for x = 5. *8*

x	f(x)
1	4
2	7
3	12
4	19
5	28

(b) For the table given above, find Newton's forward differences interpolating polynomial and find the value f(1·7) using the polynomial. *12*

5. Attempt any ***two*** parts out of (a), (b) and (c) given below :

(a) If, in the Table of Q. No. 4(a), f(x) represents the distance covered by a particle in x units of time, estimate the velocity and acceleration of the particle at x = 1·5. *10*

(b) Evaluate the integral

$$\int_0^5 (2x^2 - 5x + 2)\ dx,$$

using trapezoidal rule, with h = 1·0. *10*

(c) Solve the following IVP using Euler's method : *10*

$y' = f(x, y) = x + y$, given $y(0) = 1$.