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TCS–401

B. Tech. (CS) (Fourth Semester)
Mid Semester EXAMINATION, 2014
COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

Time : Two Hours] [*Maximum Marks : 60*

Note : (i) This question paper contains two Sections : Section A and Section B.

(ii) Answer all questions in Section A by choosing the correct option from multiple choices. Each question carries 2 marks.

(iii) Answer any *four* questions from Section B. Each question carries 12 marks.

Section—A 2 each

1. Attempt all multiple choice questions, choosing the correct option.

(i) If a number is correct to n significant digits, then the relative error is :

(a) $\frac{1}{2}\,10^{n}$

(b) $\frac{1}{2}\,10^{n-1}$

(c) $\leq \frac{1}{2}\,10^{-n}$

(d) $< \frac{1}{2}\,10^{n-1}$

(ii) The iterative formula to find $\sqrt{N}$ is :

(a) $x_{n+1} = x_n (2 - N x_n)$

(b) $x_{n+1} = x_n (2 + N x_n)$

(c) $x_{n+1} = \frac{1}{2}\left(x_n + \frac{N}{x_n}\right)$

(d) None of these

(iii) The equation $x^7 - 3x^4 + 2x^3 - 1 = 0$ has :

(a) Four positive roots

(b) Three positive and four negative roots

(c) Three positive and four imaginary roots

(d) None of these

(iv) The relation between the operator δ and E is :

(a) $\delta = E^{\frac{1}{2}} - E^{-\frac{1}{2}}$

(b) $\delta = E^{\frac{1}{2}} + E^{-\frac{1}{2}}$

(c) $\delta^2 = E^{\frac{1}{2}} - E^{-\frac{1}{2}}$

(d) None of these

(v) The value of $\Delta^2 (ab^x)$ is :

(a) $a(b-1)b^x$

(b) $a^2 (b-1) b^x$

(c) $a (b-1)^2 b^x$

(d) None of these

(vi) The rate of convergence of Newton-Raphson method is :

(a) 2

(b) 1·316

(c) 1·6

(d) None of these

Section—B 12 (6+6) each

Note : Attempt any *four* of the following questions.

2. (a) Using iteration method, find a root of the equation $x^3 + x^2 - 1 = 0$ correct to four decimal places.

   (b) Prove that :

$$\mu^2 = \frac{\delta^2}{4} + 1$$

3. (a) Use Stirling formula to evaluate $f\ (1 \cdot 22)$ given :

x	$f\ (x)$
1·0	8·403
1·1	8·781
1·2	9·129
1·3	9·451

   (b) Find the value of $(48)^{\frac{1}{3}}$, correct to three decimal places by Newton-Raphson method.

4. (a) Use Newton-divided difference formula to calculate $f\ (x)$ from the following table :

x	$f\ (x)$
0	1
1	14
2	15
4	5
5	6
6	19

   (b) Find the missing values in the following table :

x	y
45	3
50	—
55	2
60	—
65	−2 · 4

5. (a) Find the absolute error if the number $X = \cdot 00545828$ is :

   (i) Truncated to three decimal digits

   (ii) Rounded off to three decimal digits

   (b) The function $f(x) = \cos x$ can be expanded as :

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots$$

   Compute the number of terms required to estimate $\cos\left(\frac{\pi}{4}\right)$ so that the result is correct to at least two significant digits.

6. (a) Use Lagrange's formula to evaluate the value of $f(4)$ given :

x	$f(x)$
0	−4
2	2
3	14
6	158

   (b) If $u = \frac{4x^2y^3}{z^4}$ and errors in x, y, z be 0·001, compute the relative maximum error in u when $x = y = z = 1$.

7. (a) From the following table, evaluate $f(3 \cdot 8)$ using Newton backward Interpolartion formula :

x	$f(x)$
0	1·00
1	1·50
2	2·20
3	3·10
4	4·60

   (b) Find the root of the equation $x^3 - 5x - 7 = 0$ which lies between 2 and 3 by the method of false position.