MCSE-004

MASTER OF COMPUTER APPLICATIONS (MCA) (REVISED)
Term-End Examination
June, 2020

MCSE-004 : NUMERICAL AND STATISTICAL COMPUTING

Time : 3 Hours   *Maximum Marks : 100*

Note : *Question No. 1 is compulsory. Attempt any* **three** *questions from the rest. Use of calculator is allowed.*

1. (a) Evaluate the sum :   5

$$S = \sqrt{3} + \sqrt{5} + \sqrt{7}$$

to four significant digits and determine absolute and relative errors.

(b) Use Newton-Raphson method to determine the root of the equation :   5

$$X^3 - 2X - 5 = 0$$

Perform two iterations.

(c) Use Lagrange's interpolation formula to find the value of $\sin\left(\dfrac{\pi}{6}\right)$, given $y = \sin x$: 5

x	$y = \sin x$
0	0
$\dfrac{\pi}{4}$	0.70711
$\dfrac{\pi}{2}$	1.0

(d) Evaluate the integral :   5

$$I = \int_0^1 \frac{dx}{1 + x}$$

by using trapezoidal rule with $n = 2$ and 4.

(e) Use Secant method to find the root of the equation :   5

$$f(x) = \frac{e^x}{2} + 5x + 2$$

Perform two iterations.

(f) A car rental firm has two cars which it rents out day by day. The number of demands for a car on each day is

distributed as Poisson variate with mean
1.5. Calculate the proportion of days on
which :   5

(i)   neither car is used.

(ii) some demand is refused.

(g) An irregular six-faced die is thrown
10 times and the expectation of getting five
even numbers is twice of the expectation
that it will give four even numbers. How
many times in 10000 sets of 10 throws
would you expect it to give no even
number ?   5

(h) What are the two pitfalls of Gauss-
Elimination method ? Give suitable
example for each.   5

2. (a) The tangent of the angle between the lines of regression y on x and x on y is 0.6 and $\sigma_x = \frac{1}{2}\sigma_y$. Find r_{xy}.   5

   (b) Evaluate the integral :   8

   $$I = \int_0^{\frac{\pi}{2}} \sin x \, dx$$

   using Gauss-Legendre formula. Compare the results with exact solutions obtained by Simpson's rule. The exact value of $I = 1$.

   (c) Solve the system of linear equations, by using Jacobi's method. Perform two iterations :   7

   $$2x_1 - x_2 + x_3 = -1$$

   $$x_1 + 2x_2 - x_3 = 6$$

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

3. (a) Solve the initial value problem $u' = -2tu^2$ with $u(0) = 1$ and $h = 0.2$ on the interval $[0, 1]$. Use the fourth order classical Runge-Kutta method.   10

(b) Calculate the correlation coefficient for the following data : 10

X	Y
65	67
66	68
67	65
67	68
68	72
69	72
70	69
72	71

Obtain the equations of lines of regression. Also estimate the value of X for Y = 70.

4. (a) Compute R and R^2 for the data given below : 7

Sample size (i)	12	21	15	1	24
x_i	0.96	1.28	1.65	1.84	2.35
y_i	138	160	178	190	210
$\hat{y}_i$	138	—	—	—	—
$\hat{e}_i$	0	—	—	—	—

Regression equation $\hat{y} = 90 + 50x$ is used to fill the table, where $\hat{e}_i = y_i - \hat{y}_i$.

(b) Solve the following system of equations by using LU decomposition method :   7

$$x + y = 2$$

$$2x + 3y = 5$$

(c) Write short notes on the following :   6

(i) Binomial Distribution

(ii) Poisson Distribution

(iii) Normal Distribution

5. (a) What is error ? How are errors generated in computers ? Briefly discuss the sources of error.   5

(b) Evaluate the integral $\int_1^4 x^2 \, dx$ using Weddle's rule, with $h = 0.5$.   5

(c) Write short notes on any *two* the

following :   10

(i) Euler's method

(ii) Explicit Runge-Kutta method

(iii) Random variables and its types