MCA (Revised)
Term-End Examination
07155
June, 2018

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.*

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1. (a) Define relative and percentage error. Find the relative and percentage error when the value of $\pi = \dfrac{22}{7}$ is approximated to 3·14.   *4*

   (b) Find the value of 'e', correct to 3 decimal places.   *4*

   $$e = 1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

   (c) Use the Newton-Raphson method to find the root of the equation $x^3 - 2x - 5 = 0$. Perform two iterations. Use initial approximation $x_0 = 2$.   *4*

(d)   Solve the following system of linear equations using the Gauss Elimination method :   *6*

$$x_1 + x_2 + x_3 = 3$$

$$4x_1 + 3x_2 + 4x_3 = 8$$

$$9x_1 + 3x_2 + 4x_3 = 7$$

(e)   Obtain the forward difference interpolating polynomial from the following set of nodes :   *6*

x	f(x)
0	0
1	7
2	26
3	63
4	124
5	215
6	342
7	511

(f)   Evaluate the integral $\int_0^1 \dfrac{dx}{1+x}$ using Simpson's $\dfrac{3}{8}$th rule with $h = \dfrac{1}{3}$.   *6*

(g) A farmer buys a quantity of cabbage seeds from a company that claims that approximately 90% of the seeds will germinate if planted properly. If four seeds are planted, what is the probability that exactly two will germinate ? **6**

(h) The tangent of the angle between the lines of regression of y on x and x on y is 0·6 and $\sigma_x = \frac{1}{2}\sigma_y$. Find σ_{xy}. **4**

2. (a) Solve the following system of equations by using LU Decomposition method : **6**

$$x + y = 2$$
$$2x + 3y = 5$$

(b) Find the Lagrange interpolating polynomial that fits the following data : **7**

x	0	1	2	5
f(x)	2	3	12	147

(c) Calculate the value of the integral **7**

$$\int_{4}^{5\cdot2} \log x \, dx \quad \text{using Weddle's rule.}$$

3. (a) Show that the moment generating function of a random variable X which is chi-square distributed with v degrees of freedom is

$$M(t) = (1 - 2t)^{-v/2}.$$ **5**

(b) In a partially destroyed laboratory record of an analysis of correlation data, the following results are legible :

Variance of X = 9

Regression equations

$$8x - 10y + 66 = 0$$
$$40x - 18y - 214 = 0$$

Find

(i) the mean values of x and y,

(ii) the correlation coefficient between x and y, and

(iii) the standard deviation of y. *12*

(c) What is the utility of residual plots ? Also give one disadvantage of residual plots. *3*

4. (a) Apply the fourth order Runge-Kutta method to the following differential equation :

$$\frac{dy}{dx} = -2xy^2$$

$$y(0) = 1$$

Obtain y(0·2), taking h = 0·2. *6*

(b) Find the probability that an individual's IQ score is between 91 and 121. Provided : the individual IQ score has normal distribution with mean 100 and variance 225. *6*

(c) Write short notes on any *two* of the following : 4+4=8

    (i) Goodness of Fit

    (ii) Newton-Cotes Formula

    (iii) Non-linear Regression

5. (a) Solve by Jacobi's method, the following system of linear equations : 7

$$2x_1 - x_2 + x_3 = -1$$
$$x_1 + 2x_2 - x_3 = 6$$
$$x_1 - x_2 + 2x_3 = -3$$

(b) Suppose that the amount of time one spends in a bank to withdraw cash from an evening counter is exponentially distributed with mean 10 minutes, that is, $\lambda = \dfrac{1}{10}$. What is the probability that the customer will spend more than 15 minutes at the counter ? 6

(c) What do you mean by pseudo-random number generation ? What is the practical advantage of the concept of random number generation ? 7

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