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MCSE-004

MCA (Revised)
Term-End Examination
December, 2014

11654

MCSE-004 : NUMERICAL AND STATISTICAL COMPUTING

Time : 3 hours *Maximum Marks : 100*

Note : *Question number **1** is **compulsory**. Attempt any **three** questions from the rest. Use of calculator is allowed.*

1. (a) Find the value of 'e', correct to 3 decimal places. $e = 1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \ldots$ *5*

(b) If 0·333 is the approximate value of $\frac{1}{3}$, find absolute, relative and percentage error. Explain how these errors measure accuracy. *5*

(c) If a bank receives on an average six bad cheques per day, then what is the probability that it will receive four bad cheques on any given day ? *5*

(d) Use the Newton-Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$. *5*

(e) Find the value of $\sin(\pi/6)$ by using Lagrange's interpolation, the related data is given below : 5

x	:	0	$\pi/4$	$\pi/2$
$y = \sin(x)$	:	0	0·70711	1·0

(f) Find the roots of the equation $f(x) = \frac{e^x}{2} - 5x + 2$, by using Secant method. 5

(g) 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

(h) Evaluate $\int_0^1 \frac{dx}{1+x}$,

using Composite Trapezoidal rule with n = 2 and 4. 5

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

$$M(t) = (1 - 2t)^{-\upsilon/2}$$ 10

(b) An irregular six faced die is thrown and the expectation that in 10 throws it will give five even numbers is twice the expectation that it will give four even numbers. How many times in 10,000 sets of 10 throws would you expect it to give no even number ? 6

(c) Write short notes on the following : 4

(i) Acceptance-Rejection method

(ii) Non-Linear Regression

3. (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) Evaluate the integral $I = \int_0^{\pi/2} \sin x \, dx$ using Gauss-Legendre formula. Compare the results with exact solution obtained by Simpson rule. The exact value of I = 1. 10

(c) What are the pitfalls of Gauss-Elimination method ? 3

4. (a) Write short notes on the following Probability Distributions : 6

(i) Binomial Distribution

(ii) Poisson Distribution

(iii) Normal Distribution

(b) A polynomial passes through the following set of points :

x	1	2	3	4
y	– 1	– 1	1	5

Find the polynomial, using Newton's forward interpolation. 6

(c) Prove that $x(y - z) \neq xy - xz$, where $x = 0{\cdot}5555$ E1, $y = 0{\cdot}4545$ E1 and $z = 0{\cdot}4535$ E1. *3*

(d) Solve the quadratic equation $x^2 + 9{\cdot}9x - 1 = 0$, using two decimal digit arithmetic with rounding. *5*

5. (a) Consider the following data and perform the "Goodness of fit test" over it :

x	100	110	120	130	140	150	160	170	180	190
y	45	51	54	61	66	70	74	78	85	89

Now comment, whether the data is fitted well or not. *6*

(b) Use Runge-Kutta method to solve the initial value problem $y' = (t - y)/2$ on $[0, 0{\cdot}2]$ with $y(0) = 1$. Compare the solution with $h = 0{\cdot}2$ and $h = 0{\cdot}1$. *8*

(c) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$ by using Simpson's $\frac{1}{3}$ rule with $h = 0{\cdot}25$ (or 5 points, viz. 0·0, 0·25, 0·50, 0·75 and 1·00). *6*
