No. of Printed Pages : 5

MCSE-004

MCA (Revised)

Term-End Examination

December, 2018

06483

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) Describe the term 'Error'. How are errors generated in the calculation performed by computers ? 5

   (b) Show that $a(b-c) \neq ab - ac$,
   where $a = 0{\cdot}555 \times 10'$, $b = 0{\cdot}4545 \times 10'$
   and $c = 0{\cdot}4535 \times 10'$.
   Use 4-digit precision floating point and significant digit rounding off. 5

   (c) Obtain the positive root of the equation $x^2 - 1 = 0$ by Regula Falsi method. 6

   (d) Use Gauss elimination to solve

   $$10x_1 - 7x_2 = 7$$
   $$-3x_1 + 2{\cdot}099x_2 + 6x_3 = 3{\cdot}901$$
   $$5x_1 - x_2 + 5x_3 = 6.$$ 6

(e) Given $f(x) = \sin x$, $f(0{\cdot}1) = 0{\cdot}09983$ and $f(0{\cdot}2) = 0{\cdot}19867$, use the method of linear interpolation to find $f(0{\cdot}16)$. 6

(f) Evaluate the integral

$$\int_0^6 (x^2 + x + 2)\, dx$$

using Trapezoidal rule, with $h = 1{\cdot}0$. 6

(g) In turning out certain toys in the manufacturing process in a factory, the average number of defectives is 10%. What is the probability of getting exactly 3 defectives in a sample of 10 toys chosen at random, by using Poisson approximation ? (Take $e = 2{\cdot}72$). 6

2. (a) The population of a town in the census was as given below. Estimate the population for the year 1895. 8

Year : x	Population : y (in thousands)
1891	46
1901	66
1911	81
1921	93
1931	101

(b) Solve the equations

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

by LU decomposition method. *8*

(c) Write two pitfalls of Gauss elimination method. *4*

3. (a) Write short notes on any ***four*** of the following : *4×2=8*

   (i) Discrete Random Variable

   (ii) Continuous Random Variable

   (iii) Binomial Distribution

   (iv) Poisson Distribution

   (v) Chi-square Distribution

(b) From the following results, obtain the two regression equations and estimate the yield of crops when the rainfall is 22 cm and the rainfall when the yield is 600 kg :

	y (yield in kg)	x (rainfall in cm)
Mean	508·4	26·7
S.D.	36·8	4·6

Coefficient of correlation between yield and rainfall = 0·52. *8*

(c) Write short note on Acceptance Rejection method of random number generation. *4*

4. (a) Use Runge-Kutta method to solve the IVP, $y' = (t - y)/2$ on $[0, 0, 2]$ with $y(0) = 1$. Compare the solutions when $h = 0{\cdot}2$ and $0{\cdot}1$ respectively. *6*

(b) Evaluate the integral

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

using Gauss-Legendre three-point formula. *8*

(c) Calculate the value of the integral

$$\int_4^{5{\cdot}2} \log x \, dx$$

by Weddle's rule. *6*

5. (a) The length of metallic strips produced by a machine has mean 100 cm and variance 2·25 cm. Only strips with weight between 98 cm and 103 cm are acceptable. What proportion of strips will be acceptable ? You may assume that the length of a strip has a normal distribution. *6*

(b) Fit a straight line to the following data regarding x as the independent variable, using least square approximation.

x	0	1	2	3	4
y	1·0	1·8	3·3	4·5	6·3

Hence, find the difference between the actual value of y and the value of y obtained from the fitted curve when x = 3. *8*

(c) Estimate the missing term in the following data using forward difference : *6*

x	1	2	3	4	5
f(x)	3	7	?	21	31