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MCSE-004

MCA (Revised)

Term-End Examination

09603

June, 2015

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 calculators is allowed.*

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1. (a) Show that $a(b - c) \neq ab - ac$, where $a = 0{\cdot}5555 \times 10^1$, $b = 0{\cdot}4545 \times 10^1$ and $c = 0{\cdot}4535 \times 10^1$.

Use 4-digit precision floating point and significant digit rounded off. *4*

(b) Solve the following linear system of equations using Gauss Elimination method with partial pivoting : *6*

$$x_1 + x_2 + x_3 = 3$$

$$4x_1 + 3x_2 + 4x_3 = 11$$

$$9x_1 + 3x_2 + 4x_3 = 16$$

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

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

(d) Evaluate the integral $\int_{1}^{4} x^2 \, dx$ using Simpson's 1/3 rule with h = 0·5. *4*

(e) A filling machine is set to pour 952 ml of oil into bottles. The amount to fill is normally distributed with a mean of 952 ml and a standard deviation of 4 ml. Use the standard normal table to find the probability that the bottle contains oil between 952 and 956 ml. *4*

(f) What is the utility of residual plots ? What is the disadvantage of residual plots ? *4*

(g) If $\pi = 3 \cdot 14159265$, then find out to how many decimal places the approximate value of $22/7$ is accurate. *4*

(h) Three bags of same type have the following balls :

Bag 1 : 2 black 1 white

Bag 2 : 1 black 2 white

Bag 3 : 2 black 2 white

One of the bags is selected and one ball is drawn. It turns out to be white. What is the probability of drawing a white ball again, the first one not having been returned ? *6*

(i) Define Poisson Distribution. *2*

2. (a) Find the smallest positive root of the quadratic equation

$$x^2 - 8x + 15 = 0,$$

using Newton-Raphson method. *8*

(b) Find the Lagrange interpolating polynomial of degree 2 approximating the function y = *ln* x. Hence determine the value of *ln* 2·7. Also find the error. *8*

x	2	2·5	3·0
y = *ln* x	0·69315	0·91629	1·09861

(c) What are the sources of errors in numerical data and processing ? How does error measure accuracy ? *4*

3. (a) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$ using Gauss-Legendre three-point formula. *6*

(b) Solve the initial value problem $u' = -2t\,u^2$ with $u(0) = 1$ and $h = 0{\cdot}2$ on the interval $[0, 1]$. Use the fourth order classical Runge-Kutta method. *8*

(c) Evaluate

$$\int_1^6 \left[2 + \sin\left(2\sqrt{x}\right)\right] dx$$

using Composite Simpson's rule with 5 points. *6*

4. (a) Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) :

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

Obtain the equations of lines of regression. Also estimate the value of X for Y = 70. *10*

(b) A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the approximate probability that a box will fail to meet the guaranteed quality ? *10*

5. (a) What do you mean by pseudo-random number generation ? What is the practical advantage of the concept of random number generation ? 5

(b) For the data given in the table, compute R and R^2, where R denotes $S_{xy} / \sqrt{S_{xx} S_{yy}}$. 10

Sample No (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				

Note : $\hat{y}_i = 90 + 50 X_i$ and $\hat{e}_i = Y_i - \hat{y}_i$, for calculating $\hat{y}_i$ and $\hat{e}_i$.

(c) If a bank receives on an average $\lambda = 6$ bad cheques per day, what is the probability that it will receive 4 bad cheques on any given day, where λ denotes the average arrival rate per day ? 5