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INDIAN MARITIME UNIVERSITY

(A Central University, Govt. Of India)

End Semester Examination December 2017

Programme Name: B.Tech (ME) **Semester:** III

Subject Name: Computational Mathematics **Subject Code:** UG11T2301/ UG11T1301

Date: 05.12.2017 **Marks:** 100

Duration: 3 hours **Pass Marks:** 50

Part A

Question No. 1 is compulsory

(10 × 3 marks each = 30 marks)

1.

a) Prove with usual notations that $\Delta^3 y_2 = \nabla^3 y_5$

b) Show that, $\nabla^2 = h^2D^2 - h^3D^3 + \frac{7}{12}h^4D^4 - \cdots \ldots\ldots\ldots$ where ∇ is backward difference operator and h is the unit of differencing.

c) Solve $u_{n+2} - 4u_{n+1} + 4u_n = 2^n$

d) Find the area under the curve $y = \frac{1}{2x+3}$ bounded by X axis and ordinates x = 0 and x = 6.

e) Draw a binary search tree for the following numbers: 3, 7, 2 ,5 ,9 , 1 , 6

f) If the lines of regression of y on x and x on y are $4x - 5y + 33 = 0$ and $20x - 9y = 107$, find mean of variables x and y. Also find the two regression coefficients.

g) The pressure and volume are related by the relation $pv^\gamma = k$. Write the equations required to solve to fit the curve passing through given set of values of p and v.

h) If $f(x) = e^{ax+b}$, show that it's leading differences form a geometric progression.

i) Write the algorithm for multiplication of two matrices.

j) Explain bubble sort method with suitable example.

Part – B

Solve any five questions from remaining seven questions.

(5 × 14 marks each = 70 marks)

2.

a) Solve the difference equation: $y_{n+2} - 4y_n = n^2 + n - 1$ (7 marks)

b) Prove that : $u_0 + \frac{u_1 x}{1!} + \frac{u_2 x^2}{2!} + \frac{u_3 x^3}{3!} + \cdots \ldots = e^x(u_0 + x\,\Delta u_0 + \frac{x^2}{2!}\Delta^2 u_0 + \frac{x^3}{3!}\Delta^3 u_0 + \cdots.)$

(7 marks)

3.

a) From the following table , estimate the number of students who obtained marks between 40 and 45:

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

(7 marks)

b) Using Lagrange's formula, express the function $\frac{3x^2 + x + 1}{(x-1)(x-2)(x-3)}$ as a sum of partial fractions. (7 marks)

4.

a) Predict the radiation dose at an altitude of 3000 feet by fitting an exponential curve $y = ab^x$ Where a and b are constants, by using following data:

Altitude (x)	50	450	780	1200	4400	4800	5300
Dose of radiation (y)	28	30	32	36	51	58	69

(7 marks)

b) Evaluate using Simpson's 1/3 rd rule using 6 sub-intervals $\int_0^{\pi} \sqrt{1 + 3\cos^2\theta}\, d\theta$

(7 marks)

5.

a) Calculate the coefficient of rank correlation between masks assigned to ten students by judges X and Y in a certain competitive test as shown below

Sr.no.	1	2	3	4	5	6	7	8	9	10
Marks by X	52	53	42	60	45	41	37	38	25	27
Marks by Y	65	68	43	38	77	48	35	30	25	50

(7 marks)

b) If θ is the angle between two regression lines , show that

$tan\theta = \frac{1-r^2}{r} . \frac{\sigma_x \sigma_y}{\sigma_x{}^2+\sigma_y{}^2}$ Explain the significance when $r = 0$ *and* $r = \pm 1$

(7 marks)

6.

a) Write an algorithm for finding factorial of positive integer N > 0

(7 marks)

b) $If\ a \vee x = b \vee x\ and\ a \vee x' = b \vee x', then\ prove\ that\ a = b$

(7 marks)

7.

a) Show that : $(x \vee y) \wedge [(x \wedge y') \vee y]' = 0$ (4 marks)

b) Show that : $[x \cdot (x' + y)] + [x' \cdot (x + y)] = y$ (4 marks)

c) Draw the circuit for the Boolean function: $[(p_1 \vee p_2) \vee (p_1 \vee p_3)] \wedge (p_1 \wedge p_2')$, then simplify the function and draw the diagram of simplified resulting circuit. (6 marks)

8.

a) While calculating correlation coefficient between two variables x and y from 25 pairs of observations, the following results were obtained: $n = 25, \sum x = 125$, $\sum x^2 = 650, \sum y = 100, \sum y^2 = 460, \sum(xy) = 508$.

Later it was discovered at the time of checking that the pairs of values

X	Y
8	12
6	8

were copied down as

X	Y
6	14
8	6

Obtain the correct value of correlation coefficient.

(7 marks)

b) If y_x is a polynomial for which the seventh difference is constant , Evaluate y_4 from the following data : $y_0 + y_8 = 1.9243$, $y_1 + y_7 = 1.9590$, $y_2 + y_6 = 1.9823$, $y_3 + y_5 = 1.9956$

(7 marks)

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