	Utech
Name:	
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Invigilator's Signature :	

STATISTICS AND NUMERICAL TECHNIQUES

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

 $10 \times 1 = 10$

- i) E^{-1} is equivalent to
 - a) 1∇

b) $1 + \Delta$

c) $1 - \nabla$

- d) none of these.
- ii) if $Var(aX + bY) = a^2 Var(X) + b^2 Var(Y)$, the X and Y are
 - a) mutually exclusive
- b) uncorrelated
- c) impossible events
- d) none of these.

3020 [Turn over



iii) If E^{c} is the complement of the event E then



b)
$$P(E^{c}) = P(E)$$

c)
$$P(E^{c}) = 1 + P(E)$$

- d) none of these.
- iv) For a binomial distribution
 - a) Mean > Variance b) Mean = Variance
 - c) Mean < Variance d) none of these.
- v) If f(x) is a polynomial of degree n, then $\Delta^n f(x)$ is
 - a) 0

b) constant

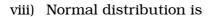
c) 1

- d) none of these.
- vi) Romberg's method is based on the error in
 - a) Trapezoidal rule
 - b) Simpson's 1/3rd rule
 - c) Weddle's rule
 - d) none of these.
- vii) Order of convergence of Newton-Raphson method is
 - a) 0

b) 2

c) 1

d) none of these.



- a) unimodal
- b) bimodal
- c) trimodal
- d) none of these.
- ix) Order of error in Simpson's 1/3rd rule is
 - a) h^2

b) h^4

c) 1

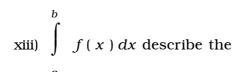
- d) none of these.
- x) Condition for convergence of Fixed-point iteration method to solve the equation f(x) = 0 in [a, b] is that
 - a) $\phi'(x) < 1$
- b) $\phi'(x) > 1$
 - c) $\phi'(x) = 1$
- d) $\phi'(x) \leq 1$

in [a, b] where f(x) = 0 can be written as $\phi(x) = x$.

- xi) The formula of the area of a trapezium whose length of the parallel sides are a, b and the distance between them is h is
 - a) $\frac{h}{2}(a+b)$
- b) $\frac{h}{2} + a + b$
- c) h(a+b)
- d) h + a + b.
- xii) The method of bisection for solving equation f(x) = 0in [a, b] is based on
 - a) Intermediate value theorem
 - b) MVT of integral calculus
 - c) MVT of differential calculus
 - d) Fundamental theorem of Algebra.

3020 3 [Turn over





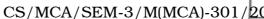
- a) area
- b) volume
- c) surface area
- d) volume and surface area both under the curve y = f(x) in [a, b].
- xiv) In Newton's forward and backward interpolation formula the points are
 - a) equally spaced
 - b) unequally spaced
 - c) both of the previous
 - d) none of the previous.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- 2. Prove that $P(A \cup B) = P(A) + P(B)$, if A and B are disjoint events.
- 3. The probabilities of X, Y and Z being managers are in the ratio 4:2:3 respectively. The probabilities that the bonus scheme will be introduced if X, Y, Z become managers are $\frac{3}{10}$, $\frac{1}{2}$, $\frac{4}{5}$ respectively.
 - i) What is the probability that bonus scheme will be introduced?
 - ii) If the bonus scheme has been introduced, what is the probability that the manager appointed was Y?





- 4. Evaluate $\int_{0}^{1} x/(1+x) dx$ using Trapezoidal rule using 5 intervals.
- 5. Evaluate $\int_{1}^{2} \log x \, dx$ using Simpson's 1/3rd rule using 5 intervals.
- 6. Distinguish between absolute error and relative error with example.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

- 7. a) Use Newton-Raphson method to find a positive root of $e^{x} = 3x$ correct to four decimal places.
 - b) What are the advantages and disadvantages of Newton-Raphson method?
 - c) State and prove Bayes' theorem. 6 + 4 +
- 8. a) Find $\Delta^2 f(x)$ where $f(x) = 3x^4 + 8x^2 + 5x + 7$ by taking h = 1.
 - b) Apply Simpson's 1/3rd rule to find $\int_{0}^{\pi/2} \cos x dx$ by

dividing the range on integration into 6 subintervals.

c) Prove that if E_1 and E_2 are statistically independent, then $P(E_1 \cap E_2) = P(E_1)P(E_2)$. 6+6+3

3020 5 [Turn over



- 9. a) Discuss the convergence of fixed point iteration
 - b) Prove that if ρ_{xy} is the Pearson correlation coefficient between the random variables X and Y, then $-1 \le \rho_{xy} \le 1$.
 - c) Apply Newton's forward interpolation to find f(x) at x = 2.5 from the following table :

х	2	3	4	5	6
f(x)	1.456	1.689	1.992	2.010	2.225

5 + 5 + 5

- 10. a) Find $\sqrt{45}$ using Newton-Raphson method.
 - b) Use Gauss-Jordan method to solve

$$p + 2q + r - s = -2$$

$$2p + 3q - r + 2s = 7$$

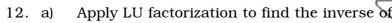
$$p + q + 3r - 2s = -6$$

$$p+q+r+x=2.$$

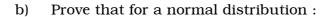
c) Prove that if $X \sim \text{Binomial}(n, p)$ then E(X) = np.

$$5 + 5 + 5$$

- 11. a) Derive the expression of error in the composite trapezoidal rule.
 - b) Apply Runge-Kutta method of order 4 to solve $\frac{dy}{dx} = x + y$, where y(0) = 1 at x = 0.1 and 0.2. 7 + 8



$$\left[\begin{array}{ccc} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{array}\right]$$



$$Mean = Median = Mode$$

c) Fit an approximating polynomial to the following data :

X	0	3	4
f(x)	2.12	4.34	3.19

$$8 + 3 + 4$$