

NEW

2018

Part-III 3-Tier

MATHEMATICS

PAPER—IV

(General)

Full Marks : 90

Time : 3 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

Group—A

(Compulsory)

(Elements of Computer Science)

[Marks : 45]

1. Answer any one question : 15×1

- (a) (i) What are the main components of a computer system? Draw a block diagram of a computer with its main components showing the transfer of data amongst themselves. 1+2

(Turn Over)

2. Answer any two questions :

8×2

- (a) (i) Express the following algebraic expression into its equivalent FORTRAN expression :

$$a = \frac{x^3 \sqrt{\sin(x + \sqrt{x})}}{1 + \pi x^3 \log x} \quad 2$$

- (ii) Find the value of $I = A/B^{**3}*(X/K)^{**2}*Y$, in FORTRAN, where $A = 4.2$, $B = 0.7$, $X = 6.0$, $Y = 0.5$, $K = 3$. 2

- (iii) Write a program in FORTRAN to find the roots of a quadratic equation $ax^2 + bx + c = 0$. 4

- (b) (i) What are differences between DO and implied DO statements ? 4

- (ii) Find the following :

(a) $(110011.11)_2 \times (1101.011)_2$

(b) Binary equivalent of $(57.625)_{10}$. 2+2

- (c) Assume that at the beginning of each of the following program segment $M = 5$ and $N = 15$. What will be the final values of N and M after the execution of each segment ?

- (i)

```
IF (2*M . EQ.N) GOTO 50
N = N + 1
GOTO 20
50 N = M
20 N = N + 5
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(ii) IF ((M - N) * 3.EQ.N) THEN

M = N - M

N = M - N

ELSE

M = 1

N = 2

ENDIF

4+4

3. Answer any *three* questions :

4×3

(a) Write a FORTRAN program to find the value of

$$\int_a^b \frac{e^x}{1+x^2} dx \text{ using Simpson's } \frac{1}{3} \text{ rule.} \quad 4$$

(b) Indicate the printed form of the output for the following statement :

PRINT 9, I, M, A, B

9 FORMAT (5X, I2, 2X, I4 // F6.2, 5X, E15.5)

where I = -4, M = 2, A = -4.1, B = -0.00142. 4

(c) The values A = 1324.256, B = 3.621×10^{41} , I = -141, J = 35 are to be read by the computer. Write a READ statement and the necessary FORMAT statement to do this. 2+2

(d) Simplify the following Boolean expression $ABC + A'BC + AB'C + ABC' + AB'C' + A'BC'$ and draw a block diagram of the circuit for simplified expression using NAND and OR gates. Assume the inputs are from flip-flop.

(e) Identify the errors, if any, in the following programs :

```

READ*, A
B = A*2
PRINT *, A, B, C
END

```

4. Answer any one question : 1×2

(a) Write a short note on DIMENSION statement. 2

(b) What do you mean by input and output devices? 2

Group—B

(Probability and Statistics)

[Marks : 45]

5. Answer any one question : 15×1

(a) (i) State and prove Binomial law. 5

(ii) From the numbers 1, 2, ..., $2n + 1$, three are chosen at random. What is the probability that these numbers are in A.P.? 5

(iii) State and prove Boole's inequality. 5

- (b) (i) The probability density function of a random variable X given by

$$f(x) = Kx^2(1-x), \quad 0 \leq x \leq 1$$

$$= 0, \quad \text{otherwise}$$

Determine K and find mean of X . 2+3

- (ii) In a factory, machines M_1, M_2, M_3 produce 15%, 35% and 50% respectively of the total output and they produce 3%, 5% and 6% defective items respectively. If a randomly chosen item is found to be defective, what is the probability that it comes from machine M_2 ? 5

- (iii) Find the mean and variance of the poisson distribution. 2+3

6. Answer any *three* questions : 8×3

- (a) If X and Y are standardized random variables and

$$r(aX + bY, aY + bX) = \frac{1+2ab}{a^2+b^2}, \text{ find the correlation}$$

coefficient $r(X, Y)$ between X and Y . 8

- (b) Compute quartile deviation graphically for the following data :

Marks :	20-30	30-40	40-50	50-60	60-70	70 & over
No. of students :	5	20	14	10	8	5

- (c) (i) Define Kurtosis. What does Kurtosis indicate? Explain with diagram.

- (ii) Do you consider these two lines : $2x + y = 3$ and $3y - x = 2$ as the regression line? Give reasons.
5+3

- (d) Define likelihood function. What do you mean by interval estimation? A sample of size n is drawn from the binomial distribution $f(x, p) = p^x q^{1-x}$; $x = 0, 1$. Find the likelihood estimate of p .
2+2+4

- (d) The joint density function of random variables X and Y is given by

$$f(x, y) = \begin{cases} k(x+y), & 0 < x < 1, 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

Find the

- (i) value of k ,
 (ii) marginal density functions $f_X(x)$ and $f_Y(y)$.
 (iii) conditional density functions $f_{Y|X}(y/x)$ and $f_{X|Y}(x/y)$.
 (iv) Are X and Y independent? 2+3+2+1

7. Answer any *two* questions :

3×2

(a) Show that the probability that exactly one of the events A and B occurs is $P(A) + P(B) - 2P(AB)$.

3

(b) Show that the distribution function of a random variable is discontinuous at left, that is to show $P(X = a) = F(a) - F(a - 0)$.

3

(c) Prove that standard deviation is independent of the change of origin but depends on the change of scale.

3
