2017

MATHEMATICS

[General]

PAPER – IV

Full Marks : 90

Time : 3 hours

The figures in the right hand margin indicate marks

[OLD SYLLABUS]

GROUP – A

(*Elements of Computer Science*)

[*Marks* : 45]

1. Answer any *one* question : 15 × 1

(*a*) (*i*) What do you mean by assembler, compiler and interpreter ? 3

(*ii*) Write FORTRAN program to find maximum among three numbers. 4

(*iii*) Using truth table, find the full conjunctive normal form of the following Boolean expression

$f = a'b'c + ab'c' + ab'c + abc' + abc$. 4

(*iv*) Perform the operation in binary system $111011 - 10011 \cdot 11$ and verify the results by converting them to decimal numbers. 4

(*b*) (*i*) Explain different types of constants used in FORTRAN. 3

(*ii*) Write a FORTRAN program to find the sum of the series

$(0 \cdot 1)^2 + (0 \cdot 2)^2 + (0 \cdot 3)^2 + ... + (1 \cdot 0)^2$. 4

(*iii*) Write an algorithm to check if three given points (x_1, y_1), (x_2, y_2) and (x_3, y_3) are collinear. 4

(*iv*) Construct the circuit diagram, using AND and NOR gates, for the function $A + (B \cdot C)$. 4

(*Continued*)

2. Answer any *two* questions : 8 × 2

(*a*) (*i*) State the rules of using Do Statement in FORTRAN 77. 4

(*ii*) Write a FORTRAN program to evaluate the function $f(x)$ defined by : 4

$f(x) = x + \log_{10}(1 + x)$ for $x = 0{\cdot}0\ (0{\cdot}5)\ 4{\cdot}0$.

(*b*) (*i*) Explain the term with suitable examples :

Runtime error, Syntax error. 4

(*ii*) Write the following expressions in FORTRAN equivalent : 4

(*I*) $x^{2/3} + y^{2/3} = e^{|x|}$

(*II*) $y = \log_3 (\tan^{-1} |x + y|^{2/3})$.

(*c*) (*i*) Write short notes on DIMENSION Statement. 3

(*ii*) Find the values of A and M after the completion of the following program segment 3

```
      A = 1·5
Do 10 I = 1, 5
      A = A + I
Do 10 J = 1, 5
      M = I + J

10 CONTINUE
```

(*iii*) Write the syntax of Assigned GoTO Statement and give an example. 2

3. Answer any *three* questions : 4 × 3

(*a*) A Boolean function $f(x, y, z)$ is such that

$$f(0,0,0) = f(1, 0, 0) = f(0, 0, 1) = f(1, 0, 1) = 1 \text{ and } f(x, y, z) = 0$$

in all other cases. Write down the expression for $f(x, y, z)$ in a simple form as possible. 4

(*b*) Use Block diagram of logic gates to prove the commutative and associative laws in Boolean algebra. 4

(*c*) Write down a FORTRAN program to find a real root of the equation

$$x^3 - x - 1 = 0$$

by iteration method. 4

(*d*) Find the value of $A1$ where

$$A1 = I**K/2 + K/8 + I * K/2 - I/4 * K$$

where $I = 2$, $K = 4$. 4

(*e*) Write short notes on READ and WRITE Statements. 4

4. Answer any *one* question : 2 × 1

(*a*) What is binary number ? Why do we need such numbers ? 2

(*b*) Write down the differences between high level and low level languages. 2

GROUP – B

(Optional Paper– I)

(*Probability and Statistics*)

[*Marks* : 45]

5. Answer any *one* question : 15 × 1

(*a*) (*i*) State and prove Baye's theorem on probability. 5

(*ii*) Show that Poisson distribution is a limit of the Binomial distribution under certain condition to be stated by you. 5

(*iii*) An integer is chosen at random from the first 100 positive integers. What is the probability that the integer is divisible by 6 or 8 ? 5

(*b*) (*i*) If A and B be any two events corresponding to a random experiment E, then $P(\bar{A} + B) = 1 - P(A) + P(AB)$, where $\bar{A}$ denotes the complement of A. 5

(*Continued*)

(*ii*) What is the probability of getting an odd sum when two dice are thrown ? 5

(*iii*) A speaks the truth in 75% cases and B in 80% cases. In what percentage of cases are they likely to contradict each other in stating the same fact ? 5

(*c*) (*i*) Prove that the correlation coefficient between two variables lies between -1 and 1. 5

(*ii*) Prove that for any two random variables X and Y

$$[E(XY)]^2 \leq E(X^2) \cdot E(Y^2).$$ 5

(*iii*) Prove that arithmetic mean depends on both change of origin and change of scale. 5

6. Answer any *three* questions : 8×3

(*a*) If X be a normal (m, σ) variate, then prove that

$$\mu_{2r+2} = \sigma^2 \mu_{2r} + \sigma^3 \frac{d\mu_{2r}}{dr}.$$

Hence find the coefficient of Kurtosis β_2 of this distribution. 8

(*b*) Show that the mean deviation about the mean of a normal (m, σ) distribution is

$$\sigma \cdot \sqrt{\frac{2}{\pi}}.$$ 8

(*c*) The expenditure of 1000 families is given below :

Expenditure (Rs) :	40-59	60-79	80-99	100-119	120-139
Frequency :	50	?	500	?	50

The mean and median for the distribution are both 87·50. Calculate the missing frequencies. 8

(*d*) A random variable X has the probability density function
$f(x) = ax(2-x), 0 \leq x \leq 2$. Find $E(X)$ and Var $(2-3X)$. 8

(e) If θ be the angle between the two regration lines, then show that

$$\tan\theta = \pm\frac{1-r^2}{r}\cdot\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2},$$

where r is the correlation coefficient of the variables x and y. 8

(f) Draw a rough sketch of the cumulative frequency distribution of the following data :

x :	1	2	3	4	5	6	7
f :	5	9	12	17	14	10	6

How would you find the median of the distribution from the graph ? 8

7. Answer any *two* questions : 3×2

(a) Prove that

$$P(X=a) = F(a) - F(a-0),$$

where X is a random variable. 3

(*b*) A point P is chosen at random on a line segment AB of length $2a$. Find the probability that the area of the rectangle $AP \cdot PB$ will exceed $\frac{a^2}{2}$? 3

(*c*) If X be a normal (m, σ) variate, find the probability density function of $\frac{1}{2}\left(\frac{X-m}{\sigma}\right)^2$. 3

(*d*) Briefly explain the meaning of 'Interval estimation'. 3

(Optional Paper– II)

[*Marks* : 45]

5. Answer any *one* question : 15×1

(*a*) (*i*) Write down the difference between risk and uncertainty. Define different types of risks. How do you measure the risk factors ? $5 + 3 + 4$

(*ii*) Briefly explain the concept of "Time value of money." 3

(*b*) (*i*) What are the objectives of Cash Flow Statement ? What are its limitations ? 4 + 4

(*ii*) State the basic finance functions. 4

(*iii*) What is the importance of life insurance in human life ? 3

6. Answer any *two* questions : 8 × 2

(*a*) Derive briefly Sharpe's single Index systematic and unsystematic model. 8

(*b*) What does the duration mean to bond investor and how does the duration of a bond differ from maturity ? 8

(*c*) Derive the measurement of the returns under uncertainty situations, with examples. 8

7. Answer any *two* questions : 4 × 2

(*a*) Mention the three broad areas of financial decision making. 4

(*b*) What do you mean by return ? State its different components of a corporate security. 4

(*c*) Derive briefly the applications of mathematics in finance. 4

8. Answer any *two* questions : 3×2

(*a*) Write a note on 'Call Option'. 2

(*b*) What do you mean by 'Internal Rate Return' ? 2

(*c*) What is proximate cause in insurance ? 2