# HALDIA INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION UNDER MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL)

**Paper Code: MCS-PC101**

**Paper Name: Mathematical foundations of Computer Science**

*Time Allotted*: 1 Hour 30 Minutes *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 from the followings: 30 x 1 = 30**

(i) One card is selected at random from 50 cards numbered 1 to 50. Find the probability that thenumber on card is divisible by 5
(a) $1/10$ (b) 1/5
(c) $1/2$ (d) $1/7$

(ii) If $f(x)$ is the probability density function of a random variable $X$, then
(a) $\int_{-\infty}^{\infty} f(x)dx = 1$ (b) $\int_{-\infty}^{0} f(x)dx = 1$
(c) $\int_{0}^{\infty} f(x)dx = 1$ (d) $\int_{-\infty}^{\infty} f(x)dx = 1/2$

(iii) If for a random variable $X$, $Var(X) = 1$, then $Var(aX)$ is
(a) $a^3$ (b) $a$
(c) $a^2$ (d) None of these

(iv) The variance for the following probability distribution

| $x_i$: | 2 | 3 | 8 |
|---|---|---|---|
| $p_{i_i}$: | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{1}{4}$is |

(a) 4.4 (b) 2.2
(c) 3.3 (d) 5.5

(v) If $F(x)$ be the distribution function for a random variable $X$, then
(a) $F(-\infty) = 0$ (b) $F(-\infty) = 1$
(c) $F(-\infty) = \infty$ (d) None of these

(vi)The mean for the uniform distribution

$f(x) = \begin{cases} \frac{1}{b-a}, & when\ a \le x \le b \\ 0, & otherwise \end{cases}$ is equal to

(a) $\frac{b-a}{2}$ (b) $\frac{a+b}{2}$

(b) $(b-a)$ (d) None of these

(vii)For a random variables $X, Y$, if $X$ and $Y$ follow standard normal distribution, then

(a) $Cov(X,Y) = \rho(X,Y)$ (b) $Cov(X,Y) = 2\rho(X,Y)$

(c) $2Cov(X,Y) = \rho(X,Y)$ (d) None of these

(viii) For two random variables $X, Y, E(X^2Y^2)$ is

(a) $= E(X^2)E(Y^2)$ (b) $\ge E(X^2)E(Y^2)$

(c) 0 (d) $\le E(X^2)E(Y^2)$

(ix)Let $x_1, x_2, x_3, \dots, x_n$ be $n$ sample values. Then if $\bar{x}$ be the arithmetic mean of the sample, then $\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})$ is

(a) $\bar{x}$ (b) $\frac{\bar{x}}{n}$ (c) 0 (d) 2

(x)For a sample $x_1, x_2, x_3, \dots, x_n$, the $harmonic\ mean\ H$ is given by

(a)$\frac{1}{H} = \frac{1}{n}\sum_{i=1}^{n} x_i$ (b) $H = \frac{1}{n}\sum_{i=1}^{n} x_i$

(c) $H = n\sum_{i=1}^{n} x_i$ (d) None of these

(xi)Coefficient of variation is given by

(a)$\frac{mean}{standard\ \ deviation} \times 100$ (b)$\frac{standard\ \ deviation}{mean} \times 100$

(c)$\frac{mean^2 - (standard\ \ deviation\ )^2}{100}$ (d) $None\ of\ these$

(xii) Pearson's second measure of skewness is given by

(a)$\frac{mean\ - mode}{SD}$ (b) $\frac{mean\ - median}{SD}$

(c) $\frac{mode\ - mode}{SD}$ (d) $3 \times \frac{mean\ - mode}{SD}$

(xiii)If $r$ is the correlation coefficient of a given data of size $n$, then the standard error is given by

(a) $\frac{1-r^2}{n}$ (b) $\frac{1-r^2}{\sqrt{n}}$

(c)$1-r^2$ (d) $\frac{r^2}{n}$

(xiv)If $b_{xy}$ =regression coefficient of $x$ on $y = 0.4$ and
$b_{yx}$ =regression coefficient of $y$ on $x = 0.9$, then the correlation coefficient $r =$

(a) 0.36 (b) 0.6

(c) 0.06 (d) 1.3

(xv)The sample mean is _____ population mean

(a)an unbiased estimate of (b) a biased estimate of

(c)not related to (d) None of these

(xvi)The degree of an undirected complete graph with $n$ vertices is

(a)$\frac{n^2}{2}$ (b)$\frac{n(n-1)}{2}$

(c)$\frac{n(n+1)}{2}$ (d) $\frac{(n+1)^2}{2}$

(xvii)The chromatic number of a Hamiltonian cycle with odd order is

(a) 2 (b) 4

(c) 3 (d) None of these

(xviii)Brooke's Theorem states that if $\chi(G)$ and $\Delta(G)$ be the chromatic number and maximum degrees of vertices, then

(a) $\chi(G) \leq \Delta(G)$ (b) $\chi(G) \geq \Delta(G)$

(c) $\chi(G) = \Delta(G)$ (d) $\chi(G) > \Delta(G)$

(xix)If $G$ is a perfect graph with chromatic number $\chi(G) = 4$, then the clique number $\omega(G)$ is

(a) 2 (b) 6

(c) 7 (d) 4

(xx)$Dijkstra's\ Algorithm$is used to solve

(a) $Degree\ of\ a\ cycle$ (b)$Transportation\ Problem$

(c)$The\ shortest\ path\ problem$ (d) None of these

(xxi)Which one of these is not a data mining algorithm?

(a)Kruskal's Algorithm (b) CART Algorithm

(c) $k$-mean Algorithm (d) Support Vector Machines

(xxii)Which one of these transfers files one to another machine?

(a) HTTPS (b) POP3

(c) FTP (d) TCP

(xxiii)In Operating Systems, which of the following is/are CPU scheduling algorithms?

(a) First Come First Serve scheduling (b) Shortest Job First scheduling
(c) Round Robin scheduling (d) All of these

(xxiv)The first computer virus is
(a) The famous (b) HARLIE
(c) Creeper (d) PARAM

(xxv)What does RAD stand for?
(a) Rapid Application Development (b) Rapid Application Document
(c) Relative Application Development (d) None of these

(xxvi)The process of finding the relative location of genes on a chromosome is called
(a) Gene tracking (b) Genome mapping
(c) Genome walking (d) Chromosome walking

(xxvii) The Hardy-Weinberg equilibrium does not satisfy the following assumption
(a) The population-size is infinite
(b) The population-size is finite
(c) Mating between individuals occur completely at random
(d) There are no natural selection pressures on the population

(xxviii) What does OS X has?
(a)monolithic kernel with modules (b) microkernel
(c) hybrid kernel (d) monolithic kernel

(xxix)When was the first operating system developed?

(a) 1949 (b) 1950

(c) 1951 (d) 1952

(xxx)Which of the following computer bus connects the CPU to a memory on the system board?
(a) Expansion bus (b) Width bus
(c) System bus (d) None of these

## Group – B
## (Multiple Choice Type Questions)

**2. Choose the correct alternatives from the followings: 20 x 2 = 40**

(i)$X$and$Y$ are two independent normal variables with means 50 and 80 respectively and variances 4 and 3 respectively. Then the distribution of $X + Y$ is
(a) $N(130,3)$ (b) $N(130,7)$
(c) $N(130,4)$ (d) $N(130,5)$

(ii)What percentage of scores falls within three standard deviations from the mean of $N(0,1)$?
(a) 67.8% (b) 50%

(c)95% (d) 99.7%

(iii)If $X$ is a Poisson variate with $P(X = 0) = 0.6$, then the variance of $X$ is

(a) $\log_e 5$ (b) $\log_e \frac{5}{3}$ (c)0 (d) $\log_e 10$

(iv) Patients arrive at the clinic following the Poission process, with the mean rate of 10 customers per hour. The inter-arrival time of a customer follows:

(a) Geometric Distribution (b) Poission Distribution

(c) Gamma Distribution (d) Exponential Distribution

(v)Let $X$ be a standard normal distribution. Then $E(X^3)$ is

(a) $e^{t^2/2}$ (b) 1 (c)0 (d) $(t^3 + 3t)e^{t^2/2}$

(vi)A random variable $X$ has pdf $12x^2(1-x); 0 < x < 1$. Then $P(|X - m| \geq 2\sigma)$ is equal to

(a) $\frac{19}{625}$ (b) $\frac{1}{5}$

(c) $\frac{1}{4}$ (d) $\frac{17}{625}$

(vii) The pdf of a random variable $X$ is given by $f(x) = e^{-x}, x \geq 0$. Then the actual value of $P(|X - 1| \geq 2)$ is

(a) $e^3$ (b) $e^{-5}$

(c)$e^{-3}$ (d) 5

(viii)The degree of all the vertices of a graph G are 10, 12, 4, 8 and 9 then

(a) $\chi(G) = 12$ (b) $\chi(G) \leq 7$ (c)$\chi(G) \leq 13$ (d) None of these

(ix)If the relation between two variables $x$ and $y$ is given by $5x - 7y = 11$ and range of $x$ is 5. Then the range of $y$ is

(a) $\frac{5}{7}$ (b) $\frac{4}{7}$

(c) $\frac{25}{7}$ (d) $\frac{55}{7}$

(x)Root Mean Square deviation is minimum when deviations are taken about

(a) Mean (b) Median

(c) Mode (d) Square of mean

(xi) For two correlated variables $x$and $y$, if the correlation coefficient $r(x, y) = 0.8014$, variances of $x$ and $y$ are 16 and 25 respectively, then covariance $Cov(x, y)$ is

(a) Mean (b) Median

(c) 16.028 (d) Square of mean

(xii) The regression coefficients of $x$ on $y$ and $y$ on $x$ are $-\frac{1}{4}$ and $-\frac{1}{9}$ respectively. What is the correlation coefficient between $x$and $y$?

(a) $-\frac{1}{4}$ (b) $-\frac{1}{6}$

(c) $\frac{1}{4}$ (d) $\frac{1}{6}$

(xiii) Distribution of sample mean $\bar{x}$ from a normal $N(m, \sigma)$ population a normal distribution given by

(a) $N(0,1)$ (b) $N(m, \sigma)$

(c) $N(m, \frac{\sigma}{2})$ (d) $N(m, \sigma/\sqrt{n})$

(xiv) The variance of Student's $t$-distriution with $n$ degrees of freedom is given by

(a) $\sqrt{n/n-2}$ , $n > 2$, (b) $\sqrt{n/n-3}$ , $n > 3$,

(c) $\sqrt{n/n-1}$ , $n > 1$, (d) $\sqrt{n/n-4}$ , $n > 4$,

(xv) The chromatic polynomial of a complete graph $K_n$ is

(a) $x(x-1)^n$ (b) $x(x-1)(x-2) \ldots (x-n+1)$

(c) $x(x-1)^{n-1}$ (d) $x^n$

(xvi) Let $G$ be a planar graph with 7 vertices. Then its chromatic number $\chi(G)$ is

(a) $> 7$ (b) 3

(c) $\leq 4$ (d) $\leq 7$

(xvii) Let $C_4$ denote the cycle of order 4. The ways $x$ colors can be used to color $C_4$ is

(a) 27 (b) 84

(c) 86 (d) 12

(xviii) The probability density function of a Markov process is

(a) $p(x_1, x_2, x_3, \ldots\ldots, x_n) = p(x_1)p(x_2|x_1)p(x_3|x_2)\ldots\ldots p(x_n|x_{n-1})$

(b) $p(x_1, x_2, x_3, \ldots\ldots, x_n) = p(x_1)p(x_1|x_2)p(x_2|x_3)\ldots\ldots p(x_{n-1}|x_n)$

(c) $p(x_1, x_2, x_3, \ldots\ldots, x_n) = p(x_1)p(x_2)p(x_3)\ldots\ldots p(x_n)$

(d) $p(x_1, x_2, x_3, \ldots\ldots, x_n) = p(x_1)p(x_2)p(x_3)\ldots\ldots p(x_n)$

(xix) Which vectors are probability vectors?

(a) $(\frac{1}{2}\frac{1}{3} \quad 0 \quad -\frac{1}{5})$ (b) $(3 \quad 4 \quad 5 \quad 0)$

(c) $(\frac{1}{2}\frac{1}{2} \quad 0 \quad 0)$ (d) $(1 \quad 0 \quad 2 \quad -1)$

(xx) $v = [b \quad a]$is fixed point of the stochastic matrix

(a) $\begin{bmatrix} a & a \\ b & b \end{bmatrix}$ (b) $\begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix}$

(c) $\begin{bmatrix} a^2 & a \\ b & b^2 \end{bmatrix}$ (d) None of these

**Answer Key:**

**Group – A**

| | | | | | |
|---|---|---|---|---|---|
| **1.** (i) b | (ii) a | (iii) c | (iv) d | (v) a | (vi) b |
| (vii) a | (viii) d | (ix) c | (x) a | (xi) b | (xii) d |
| (xiii) b | (xiv) b | (xv) a | (xvi) b | (xvii) c | (xviii) a |
| (xix) d | (xx) c | (xxi) a | (xxii) c | (xxiii) d | (xxiv) c |
| (xxv) a | (xxvi) b | (xxvii) a | (xxviii)c | (xxix) b | (xxx) c |

**Group – B**

| | | | | | |
|---|---|---|---|---|---|
| **2.** (i) d | (ii) d | (iii) b | (iv ) d | (v) c | (vi) d |
| (vii) c | (viii) c | (ix) c | (x) a | (xi) c | (xii) b |
| (xiii) d | (xiv) a | (xv) b | (xvi) d | (xvii) c | (xviii)a |
| (xix) c | (xx) b | | | | |