BRAINWARE UNIVERSITY

Term End Examination 2021 - 22
Programme – Master of Science in Mathematics
Course Name – Stochastic Processes
Course Code - MSCME407
(Semester IV)

Time allotted : 1 Hrs.15 Min. **Full Marks : 60**

[The figure in the margin indicates full marks.]

Group-A

(Multiple Choice Type Question) 1 x 60=60

Choose the correct alternative from the following :

(1) The condition for independence of two events A and B is

a) $P(A\cap B)=P(A)P(B)$
b) $P(A+B)=P(A)P(B)$
c) $P(A-B)=P(A)P(B)$
d) $P(A\cap B)=P(A)P(B/A)$

(2) When p=1, for M/M/1/N queuing system, expected number of customers in the system are

a) N/2
b) N/6
c) N
d) None of these.

(3) On a certain day, number of customers in a system are 20,and number of customer in servi ce are 12,the number of customers waiting for service are

a) 10
b) 8
c) 20
d) None of these

(4) In queue description M/M/1, the number of servers are

a) 1
b) M
c) 2
d) None of these

(5) The departure and arrivals in queuing system are normally considered respectively M/M/1 the arrival and departure distribution are

a) Both Markovian
b) Binomial.
c) General.
d) None of these

(6) There are N inventories in the system, one by one all the inventories are consumed with re placing the inventories. This process is stated as

a) The pure birth process.
b) The pure death process.
c) The birth death process.
d) None of these

(7) The variance of a random variable x is

a) $\{E(x)\}^2$

b) $E(x^2)$

c) $E(x^2)-\{E(x)\}^2$

d) None of these

(8) A coin is tossed .The events {H}, {T} are

a) mutually exclusive

b) independent events

c) dependent events

d) None of these

(9) If $P(A)=\frac{1}{3}$, $P(B)=\frac{1}{4}$, $P(A\cup B)=\frac{1}{2}$, then $P(B/A)$ is

a) $\frac{3}{4}$

b) $\frac{4}{3}$

c) $\frac{1}{4}$

d) $\frac{1}{3}$

(10) The probability of any event A satisfies

a) $P(A)\geq 1$

b) $P(A)<0$

c) $0\leq P(A)\leq 1$

d) None of these

(11) A random variable X has the following p.d.f $f(x)=\frac{1}{4}$, $-2<x<2$; $=0$, elsewhere, then $P(2X+3>5)$ is

a) 1

b) $\frac{1}{2}$

c) $\frac{1}{4}$

d) $\frac{3}{4}$

(12) The middle value of an ordered array of numbers is the

a) Mode

b) Mean

c) Median

d) Mid-point

(13) Number of times each value appears is called value's

a) range

b) frequency

c) mode

d) standard deviation

(14) The distribution for which mean and variance are equal is

a) Poisson

b) Normal

c) Binomial

d) Exponential

(15) The withdrawal of items from certain in ventory without refilling in queueing systems can be stated as

a) The pure birth process.

b) The pure death process.

c) The birth death process.

d) None of these .

(16) The arrival of customer (with no departure) in system, in queueing theory can be stated as

a) The pure birth process.

b) The pure death process.

c) The birth death process. d) None of these.

(17) For a process if v_i denotes the rate of transition from one state to another state, then a state is called instantaneous if

a) $v_i = 0$ b) $v_i \to \infty$

c) $v_i = -\infty$ d) none of the above

(18) The birth and death process is a

a) continuous time Markov chain b) discrete time Markov chain

c) discrete state Markov chain d) none of the above

(19) A continuous time Markov chain is said to be regular, if,

a) it's with probability 1, the number of transitions in any finite length of time is finite.

b) it's with probability 0, the number of transitions in any finite length of time is finite.

c) it's with probability 1, the number of transitions in any finite length of time is infinite.

d) none of the above

(20) The number of recurrent classes in the transition matrix

$$\begin{pmatrix} 0.8 & 0 & 0 & 0 & 0.2 \\ 0 & 0.6 & 0 & 0.4 & 0 \\ 0.1 & 0.2 & 0 & 0.3 & 0.4 \\ 0 & 0.5 & 0 & 0.5 & 0 \\ 0.3 & 0 & 0 & 0 & 0.7 \end{pmatrix}$$ are

a) 0 b) 1

c) 2 d) 3

(21) If the coefficients $\{\lambda_j\}$ and $\{\mu_j\}$ are called the birth and death rates respec process is said to be pure birth process if

a) $\mu_j = 0$ b) $\mu_j = 1$

c) $\lambda_j = 0$ d) $\lambda_j = 1$

(22) In the long run, the state probabilities become 0 & 1

a) In no case b) In same cases

c) In all cases d) Cannot say

(23) If a matrix of transition probability is of order nXn, then the number of equilibrium equations

a) n b) n-1

c) n+1 d) n+2

(24) In a matrix of transition probability , the element a_{ij} , where i=j is a

a) Gain b) Loss

c) Retention d) None of the above

(25) In a matrix of transition probability, the probability values should add up to one in each

a) Row
b) Column
c) Diagonal
d) All of the above

(26) Service mechanism in a queuing system is characterized by

a) Server's behaviour
b) Customer behaviour
c) Customers in the system
d) All of the above

(27) A calling population is considered to be infinite when

a) all customers arrives at once
b) arrivals are independent of each other
c) arrivals are dependent on each other
d) all of the above

(28) The calling population is assumed to be infinite when

a) Arrivals are independent of each other
b) Capacity of the system is infinite
c) Service rate is faster than arrival rate
d) All of the above

(29) Priority queue discipline may be classified as

a) Finite or infinite
b) Limited or unlimited
c) Pre-emptive or non-pre-emptive
d) All of the above

(30) To compute the steady state distribution π of a continuous-time Marko must solve (in addition to sum of π components equal to 1) the matrix e (where A^t is the transpose of A):

a) $\pi A = 1$
b) $\pi A = 0$
c) $\pi A^t = 1$
d) None of these

(31) Which of the following is not a key operating characteristics apply to queuing system?

a) Utilization factor
b) percent idle time
c) average time spent waiting in the system and q ueue
d) None of the above

(32) Two unbiased coins are tossed. Then the probability of obtaining at least one tail is

a) $\frac{3}{4}$
b) $\frac{1}{2}$
c) $\frac{1}{4}$
d) none of these.

(33) A bag of 45 marbles contains 20 red, 15 blue, and 10 yellow. What is the probability of ra ndomly selecting 12 from the bag and having 3 red, 4 blue, and 5 yellow.

a) 0.0
b) 0.0587
c) 0.0923
d) 0.0136

(34) A set of all possible outcomes of an experiment is called

a) Combination
b) Sample point
c) Sample space
d) Compound event

(35) The probability of getting at least one of the following events, points 'six' or 'one' on the top in rolling of an unbiased die once is

a) $\frac{1}{6}$
b) $\frac{1}{9}$
c) $\frac{1}{3}$
d) none of these

(36) If $P(A)=\frac{1}{2}$, $P(B)=\frac{1}{3}$ and $P(A\cap B)=\frac{1}{4}$, then the value of $P(A\cup B)=$

a) $\frac{6}{7}$

b) $\frac{3}{7}$

c) 1

d) $\frac{7}{12}$

(37) The probability that a leap year selected at random will contain 53 Sundays is

a) $\frac{2}{7}$

b) $\frac{3}{7}$

c) $\frac{4}{7}$

d) $\frac{5}{7}$

(38) If E(x) = 2 and E(z) = 4, then E(z – x) =?

a) 2

b) 6

c) 0

d) Insufficient data

(39) The mean of Binomial distribution $B(n, p)$ (where n and p are the number of trials and probability of success) is

a) $\frac{n}{p}$

b) 0

c) np

d) 1

(40) The mean of a Poisson distribution with parameter μ is

a) μ

b) μ^2

c) $-\mu$

d) $-\mu^2$

(41) Var(2X+3)=?

a) 2Var(X)

b) 4Var(X)

c) 2Var(X)+3

d) None of these

(42) The mean of exponential distribution with parameter λ is given as.................

a) $\frac{1}{\lambda}$

b) $\frac{1}{\lambda^2}$

c) $\frac{1}{\lambda^3}$

d) λ

(43) Normal Distribution is applied for ___________

a) Continuous Random Distribution

b) Discrete Random Variable

c) Irregular Random Variable

d) Uncertain Random Variable

(44) Binomial distribution deals with

a) Continuous random variable

b) Discrete random variable

c) Continuous & Discrete random variable

d) None of the mentioned

(45) In Poisson distribution mean is ______ variance.

a) Greater than

b) Lesser than

c) Equal to

d) Does not depend on

(46) Stochastic processes are

a) Strict sense stationary process

b) Wide sense stationary process

c) All of the mentioned

d) None of the mentioned

(47) Gaussian process is a

a) Wide sense stationary process

b) Strict sense stationary process

c) If Gaussian process is a wide sense stationary process then it will also be strict sense stationa ry process.

d) None of the mentioned

(48) One of the condition for a counting process $\{N(t), t \geq 0\}$, is said to be Poisson process if-

a) N(0)=0

b) N(0)=1

c) N(1)=0

d) N(1)=1

(49) Cov (X, Y) {covariance of (X, Y) is}

a) E(XY)

b) E(XY) - E(X)

c) E(XY) - E (X) E (Y)

d) E(XY) + E(X)E(Y)

(50) If $R_{XY} = 0$ then X and Y are

a) independent

b) orthogonal

c) independent & orthogonal

d) Statistically independent

(51) The collection of all the sample functions is referred to a as

a) Ensemble

b) Assemble

c) Average

d) Set

(52) The random process X(t) and Y(t) are said to be independent, if $f_{XY}(x_1, y_1 : t_1, t_1)$ is =

a) $f_X(x_1 : t_1)$

b) $f_Y(y_1 : t_2)$

c) $f_X(x_1 : t_1)\, f_Y(y_1 : t_2)$

d) 0

(53) A stationary continuous process X(t) with auto-correlation function $R_{XX}(\tau)$ is called autocorrelation-ergodic or ergodic in the autocorrelation if, and only if, for all τ

a) $\frac{1}{2T}\int_{-T}^{T} X(t)X(t+\tau)dt = R_{xx}(\tau)$

b) $\lim_{T\to\infty} \frac{1}{2T}\int_{-T}^{I} X(t)X(t+\tau)dt = R_{xx}(\tau)$

c) $\frac{1}{2T}\int_{-\infty}^{\infty} X(t)X(t+\tau)dt = R_{xx}(\tau)$

d) $\int_{-T}^{T} X(t)dt = 0$

(54) Two processes X(t) and Y(t) are statistically independent if

a) $F_{x,y}(x_1, x_2, \ldots\ldots, x_N, y_1, y_2, \ldots.. y_M) = F_x(x_1, x_2, \ldots\ldots, x_N) F_y(y_1, y_2, \ldots.. y_M)$

b) $f_{x,y}(x_1, x_2, \ldots\ldots, x_N, y_1, y_2, \ldots.. y_M) = f_x(x_1, x_2, \ldots\ldots, x_N) f_y(y_1, y_2, \ldots.. y_M)$

c)

d)

$F_{x,y}(x_1,\dots\dots,x_N,y_1,\dots\dots y_M,t_1,\dots t_N,t_1,$ $f_{x,y}(x_1,\dots\dots,x_N,y_1,\dots\dots y_M,t_1,\dots t_N,t_1,.$

$f_x(x_1,\dots\dots,x_N,t_1,\dots t_N)f_y(y_1,\dots y_M,t_1',$ $f_x(x_1,\dots\dots,x_N,t_1,\dots t_N)f_y(y_1,\dots y_M,t_1',$

(55) A process stationary to all orders N = 1, 2, ---- &. For $X_i = X(t_i)$ where i = 1, 2, -------N is called

a) Strict-sense stationary
b) wide-sense stationary
c) Strictly stationary
d) independent

(56) Consider a random process X(t) defined as X(t) = A coswt + B sinwt, where w is a Constant and A and B are random variables which of the following it's a condition for its stationary.

a) E (A) = 0, E(B) = 0
b) E (AB) ≠ 0
c) E(A) ≠ 0; E(B) ≠ 0
d) A and B should be independent

(57) X(t) is a wide source stationary process with E[X(t)] = 2 and $R_{XX}(\tau) = 2$ and $R_{xx}(\tau) = y + e^{-0.1|x|}$. Find the mean and variance of $\int_0^1 X(t)dt$

a) 2, 20 [$10e^{-0.1}$ - 9]
b) 1, 10 [10e-0.1 + 9]
c) 0, 5 [20e-0.1- 9]
d) 0, 10 [10e-0.1 + 9]

(58) Let X(t) and Y(t) be two random processes with respective auto correlation functions $R_{xx}(\tau)$ and $R_{yy}(\tau)$. Then $|R_{xy}(\tau)| =$

a) $= \sqrt{R_{xx}(0)R_{yy}(0)}$
b) $\geq \sqrt{R_{xx}(0)R_{yy}(0)}$
c) $\leq \sqrt{R_{xx}(0)R_{yy}(0)}$
d) $> \sqrt{R_{xx}(0)R_{yy}(0)}$

(59) $R_{xx}(\tau) = ?$

a) $E[X^2(t)]$
b) $\int_{-\infty}^{\infty} X(t)dt$
c) $\int_{-\infty}^{\infty} X^2(t)dt$
d) $E[X(t)X(t+\tau)]$

(60) If $X_1, X_2, \dots$ are independent and identically distributed with mean m, then $P\left\{\lim_{n\to\infty}(X_1 + X_2 + \dots + X_n)/n = \mu\right\} = ?$

a) 0
b) 1
c) 2
d) None of these