Revised

U.S.N.

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

December 2019 / January 2020 Semester End Main Examinations

Programme: B.E. | **Semester: III**
Branch: CSE/ISE | **Duration: 3 hrs.**
Course Code: 19MA3BSSDM | **Max Marks: 100**
Course: STATISTICS & DISCRETE MATHEMATICS | **Date: 17.12.2019**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of Statistical tables is permitted.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT-1

1 a) Draw a diagram of the graph $G=(V,E)$ in each of the following cases: 6

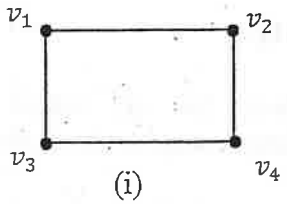
(i) $V=\{A,B,C,D\}$, $E=\{AB,AC,AD,CD\}$

(ii) $V=\{v_1,v_2,v_3,v_4,v_5\}$, $E=\{v_1v_2,v_1v_3,v_2v_3,v_4v_5\}$

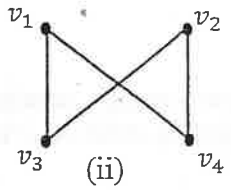
(iii) $V=\{P,Q,R,S,T\}$, $E=\{PS,QR,QS\}$

(iv) $V=\{v_1,v_2,v_3,v_4,v_5,v_6\}$, $E=\{v_1v_4,v_1v_6,v_4v_6,v_3v_2,v_3v_5,v_2v_5\}$

b) Define isomorphism of graphs. Verify that the two graphs shown below are isomorphic or not. 7

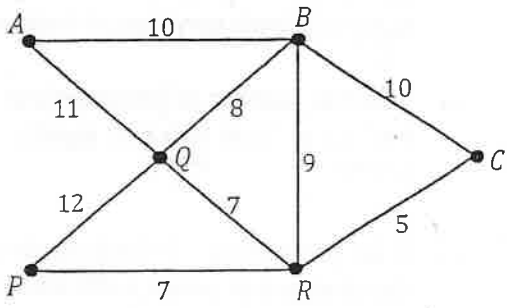


(i)



(ii)

c) Using Kruskal's algorithm, find a minimal spanning tree for the weighted graph shown below: 7

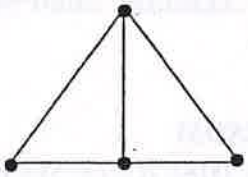


OR

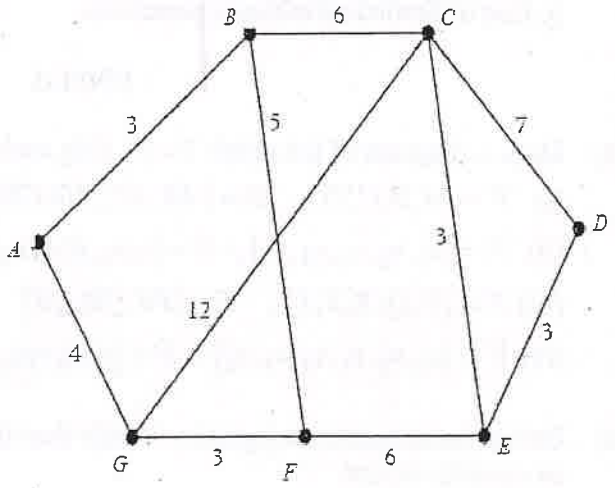
2 a) Let G be a simple graph with n vertices and m edges where m is at least 3. 6

If $m \geq \frac{1}{2}(n-1)(n-2)+2$, then prove that G is a Hamilton graph.

b) Write the adjacency matrix for the given graph and also find all the spanning trees of the graph. 7



c) The diagram below shows roads connecting villages. The numbers on each arc represent the distance, in miles, along each road. Use Dijkstra's algorithm to find the minimum distance from vertex B to vertex D. 7



UNIT-2

3 a) How many arrangements are there for all letters in the word SOCIOLOGICAL? In how many of these arrangements A and G are adjacent? 6

b) A certain question paper contains three parts A, B and C with four questions in part A, five questions in part B and six questions in part C. It is required to answer seven questions selecting at least two questions from each part. In how many different ways can a student select his seven questions for answering? 7

c) Find the number of permutations of the English letters that contain (i) exactly two (ii) at least two (iii) exactly three of the patterns CAR, DOG, PUN and BYTE. 7

UNIT-3

4 a) If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2,000 individuals more than two will get a bad reaction. 6

b) In a test on 2000 electric bulbs, it was found that the life of particular make, was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for 7

(i) more than 2150 hours (ii)more than 1920 hours but less than 2160 hours

c) A joint probability distribution is given by the following table: 7

Y / X	-3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Find $COV(X,Y)$ and $\rho(X,Y)$.

UNIT-4

5 a) A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. 6

b) Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results: 7

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	

Test whether you can discriminate between the two horses based on the average time taken to run a particular race at 5% level of significance.

c) A set of five similar coins is tossed 320 times and the result is 7

No. of Heads	0	1	2	3	4	5
Frequency	6	27	72	113	71	32

Test the hypothesis that the data follows a binomial distribution at 5% level of significance.

OR

6 a) A certain stimulus administered to each of the 12 patients resulted in the following increase of blood pressure : 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will be in general accompanied by an increase in blood pressure at 5% level of significance. 6

b) Can we conclude that the two population variances are equal for the following data of post graduates passed out from a *State* and *Private* university? 7

State:	8350	8260	8130	8340	8070	
Private:	7890	8140	7900	7950	7840	7920

c) A company claims that alloying reduces resistance of electric wire by more than 0.05 ohm. To test this claim samples of standard wire and alloyed wire are tested yielding the following results: 7

Type of wire	Sample Size	Mean resistance (ohms)	Standard deviation (ohms)
Standard	32	0.136	0.004
Alloyed	32	0.083	0.005

Can the claim be substantiated at 0.05 level of significance?

UNIT-5

7 a) A student's study habits are as follows; if he studies one night, he is 70% sure not to study the next night. On the other hand, if he does not study one night, he is 60% sure not to study the next night. In the long run how often does he study? 6

b) The pattern of sunny and rainy days on the planet Rainbow is a homogeneous Markov chain with two states. Every sunny day is followed by another sunny day with probability 0.8. Every rainy day is followed by another rainy day with probability 0.6. i) Today is sunny on Rainbow. What is the chance of rain the day after tomorrow? ii) In the long run, what is the probability that it will be rainy on the planet Rainbow? 7

c) Let us consider a small post office in a village where on the average 70 customers arrive according to a Poisson process during a day. Let us assume that the service times are exponentially distributed with the rate of 10 clients per hour and the office operates 10 hours daily. Find the mean queue length and the probability that the number of waiting customer is greater than 2. What is the mean waiting time and the probability that the waiting time is greater than 20 minutes? 7

******

SEE EXAM

E4

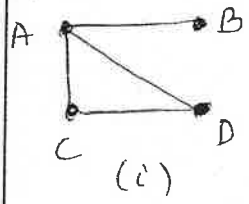
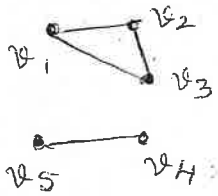
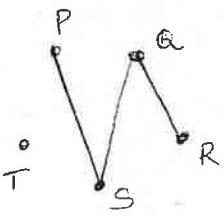
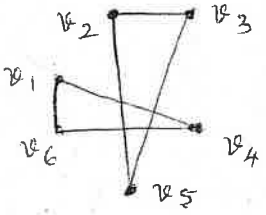
BMS COLLEGE OF ENGINEERING, BANGALORE -19

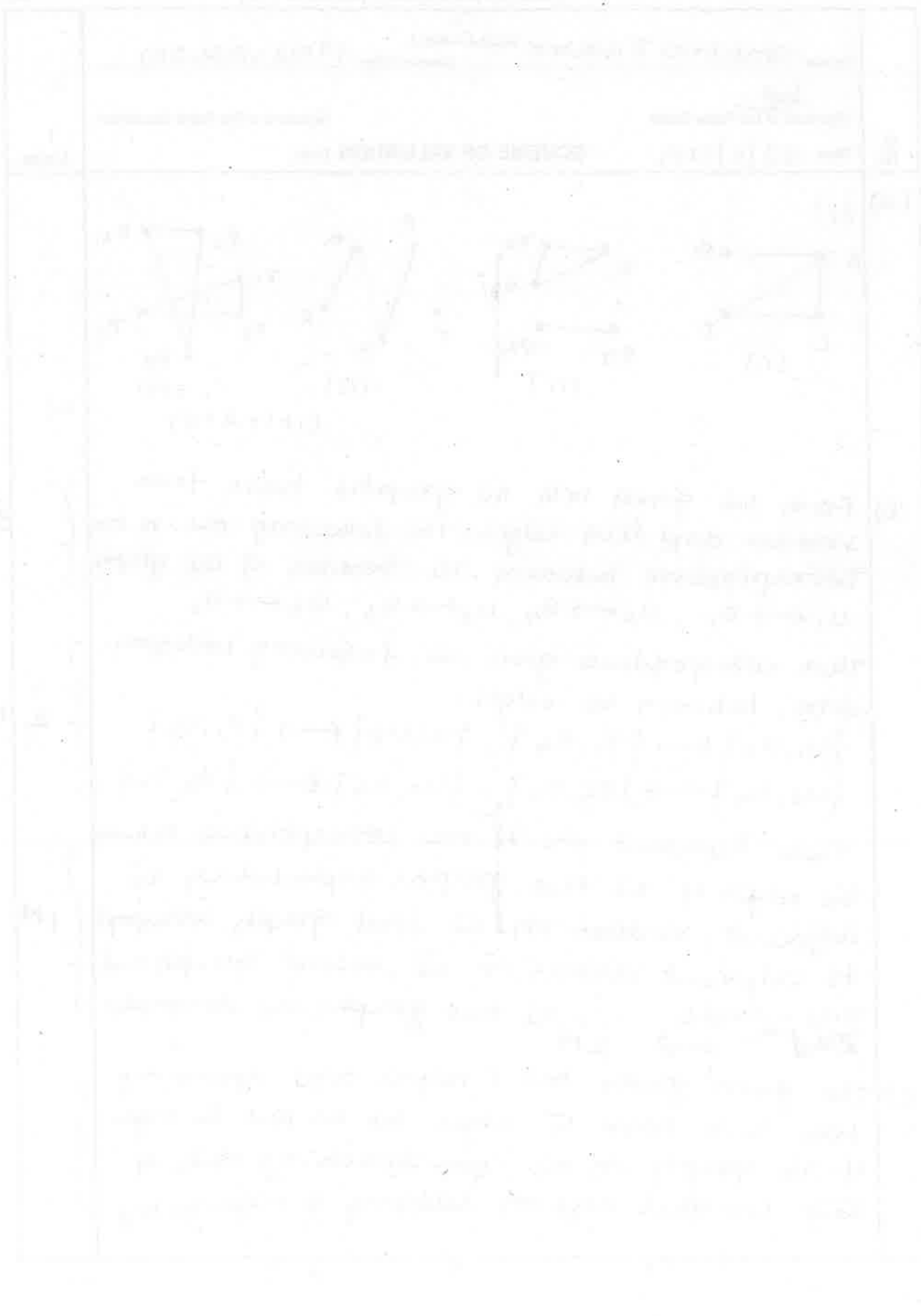
(Autonomous Institute, Affiliated to VTU)

Course : Statistics & Discrete Mathematics Course Code : 19MA3BSSDM

Signature of the Paper Setter | Signature of the Paper Scrutinizer

Date : 22/11/2019 **SCHEME OF VALUATION** Date :

Q. No.		Marks
1.a)	(i)  (i)  (ii)  (iii)  (iv) (1+1+2+2)	06
b)	From the given both the graphs have four vertices and four edges. The following one-to-one correspondence between the vertices of the graphs $u_1 \longleftrightarrow v_1$, $u_2 \longleftrightarrow v_4$, $u_3 \longleftrightarrow v_3$, $u_4 \longleftrightarrow v_2$	2M
	This correspondence gives the following correspondence between the edges: $\{u_1,u_2\} \longleftrightarrow \{v_1,v_4\}$, $\{u_1,u_3\} \longleftrightarrow \{v_1,v_3\}$ $\{u_2,u_4\} \longleftrightarrow \{v_4,v_2\}$, $\{u_3,u_4\} \longleftrightarrow \{v_3,v_2\}$	2M
	These represent one-to-one correspondence between the edges of the two graphs under which the adjacent vertices in the first graph correspond to adjacent vertices in the second graph and vice-versa. ∴ the two graphs are isomorphic Def^n ⟶ 2M	1M
c)	The given graph has 6 vertices and spanning tree will have 5 edges. Let us put the edges of the graph in the non-decreasing order of their weights and on selecting 5 edges one by	



BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course Statistics & Discrete Mathematics Course Code : 19MA3BSSDM

Signature of the Paper Setter | Signature of the Paper Scrutinizer

Date : 22/11/2019 **SCHEME OF VALUATION** Date :

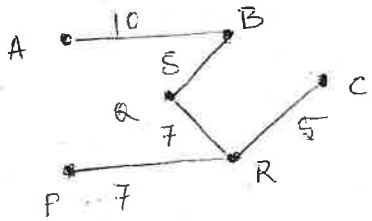
Q. No. | Marks

One is such a way that no cycle is created. The scheme is summarised below.

Edge	CR	PR	QR	BQ	BR	AB	BC	AQ	PQ
Weight	5	7	7	8	9	10	10	11	12
Select	Yes	Yes	Yes	Yes	No	Yes			

3M

Thus, a minimal spanning tree of the given graph contains the five edges CR, PR, QR, BQ, AB. This tree is shown in the following figure The weight of the tree is 37 units.



4M

(3+4)

2.a) Let u and v be any two non-adjacent vertices in G. Let x and y be their respective degrees. If we delete u, v from G, we get a subgraph with (n-2) vertices. If this subgraph has q edges, then $q \le \frac{1}{2}(n-2)(n-3)$.

Since u and v are nonadjacent, $n = q + x + y$

Thus, $x + y = n - q \ge \left\{\frac{1}{2}(n-1)(n-2)+2\right\} - \left\{\frac{1}{2}(n-2)(n-3)\right\}$

$= n$

(3+3)M

Therefore, the given graph is a Hamiltonian graph

~~The converse of the result proved is not~~

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course: Statistics & Discrete Mathematics Course Code: 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Q. No. Date: 22/11/2019 **SCHEME OF VALUATION** Date: Marks

always true. Because, a 2-regular graph with five vertices is Hamiltonian but the inequality does not hold

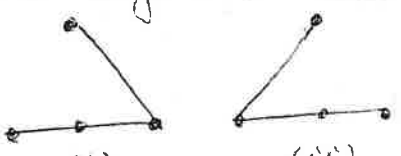
Ex.

2M

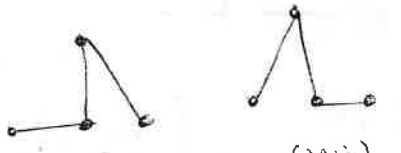
(4+2)

2.b) In the given graph, there are four vertices. Its spanning tree must include all these four vertices and three of the edges. Each such tree is got by deleting two edges from the graph. There are eight such trees are shown below:

	A	B	C	D
A	0	1	1	1
B	1	0	1	0
C	1	1	0	1
D	1	0	1	0



(i) (ii) (iii) (iv)



(v) (vi) (vii) (viii)

3M

1M

Adjacency matrix

c) Step 1: Given a connected, weighted graph G with n vertices, assign n names (say: $v_1, v_2 \cdots$ or A, B, C & so on) to these vertices and prepare a $n \times n$ Table in which the weights of all edges are shown. The entries in the table will be symmetric w.r.t. diagonal and the entries appear on the diagonal. Indicate the weights of the non existing edges as ∞

3M

2 c)

	A	B	C	D	E	F	G	
B	∞	0	∞	∞	∞	∞	∞	
A	3	0	6	∞	∞	5	∞	A: Min(∞, 5) C: Min(∞, 6) F: Min(∞, 5)
F	3	0	6	∞	∞	5	7	G: Min(∞, 7)
C	3	0	6	∞	11	5	7	G: Min(7, 8) E: Min(∞, 11)
G	3	0	6	13	9	5	7	G: Min(7, 8) D: Min(∞, 13) E: Min(11, 9)
E	3	0	6	13	9	5	7	F: Min(
D	3	0	6	12	9	5	7	D: Min(13, 12)

Shortest path:

B → C → E → D.

Shortest distance = 12 (6 + 1) Marks

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course : Statistics & Discrete Mathematics Course Code : 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Date : 22/11/2019 **SCHEME OF VALUATION** Date :

Q. No.		Marks
	Step-2: Start from the vertex v_1 (or A) and connect it to its nearest neighbour in the v_1-row say v_K now, consider the edge $\{v_1, v_K\}$ and connect it to its closet neighbour. Let this vertex be v_m.	2M
	Step-3: Start from the vertex v_m and repeat the process of Step2. Stop the process when all the n vertices have been connected by $(n-1)$ edges. These $(n-1)$ edges constitute a maximal spanning tree. (3+2+2)	2M
	Unit-2	
3 a)	The given word has 12 letters of which 3 are C, 2 are C, I, L and 1 each are S, A, G. ∴ the no of arrangements of these letters is $\frac{12!}{3!\,2!\,2!\,2!\,1!\,1!\,1!} = 99,79,200$.	2M
	If, in an arrangements A and G are to be adjacent, we treat A & G together as a single letter say X so that we have 3 number of C's, 2 each of C, I, L and one each of S & X. These can be arranged in $\frac{11!}{3!\,2!\,2!\,2!\,1!}$ ways. In the letters A & G can be arranged among themselves in two ways. ∴ the total no of arrangements is $\frac{11!}{3!\,2!\,2!\,2!\,1!} \times 2 = 16,63,200$ ways (2+2)	4M

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course : Statistics & Discrete Mathematics Course Code : 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Date : 22/11/19 **SCHEME OF VALUATION** Date :

Q. No.		Marks
3.b)	The different possible ways in which a student can make a selection are (i) 2 questions from part A, 2 from B and 3 from C (ii) 2 questions from A, 3 from B and 2 from C (iii) 3 questions from A, 2 from B and 2 from C	1M
	Selection (i) can be made in $C(4,2) \times C(5,2) \times C(6,3) = 6 \times 10 \times 20 = 1200$ ways Selection (ii) can be made in $C(4,2) \times C(5,3) \times C(6,2) = 6 \times 10 \times 15 = 900$ ways Selection (iii) can be made in $C(4,3) \times C(5,2) \times C(6,2) = 4 \times 10 \times 15 = 600$ ways	4M
	$\therefore$ the total no of possible selection is $1200 + 900 + 600 =$ (2,700) ways (1+4+1)	1M
c)	Let S denote the set of all permutations of the 26 letters. Then $\lvert S \rvert = 26!$ Let A_1 be the set of all permutations in which CAR appears in which CAR consists of three letters to form single block. $\therefore \lvert A_1 \rvert = 24!$ Similarly $\lvert A_2 \rvert = \lvert A_3 \rvert = \lvert A_4 \rvert = 24!$ where A_2, A_3 & A_4 are denotes the words DOG, PUN & BYTE respectively. $\lvert A_1 \cap A_2 \rvert = \lvert A_1 \cap A_3 \rvert = \lvert A_2 \cap A_3 \rvert = 22!$ $\lvert A_1 \cap A_4 \rvert = \lvert A_2 \cap A_4 \rvert = \lvert A_3 \cap A_4 \rvert = 21!$; $\lvert A_1 \cap A_2 \cap A_3 \rvert = 20!$ $\lvert A_1 \cap A_2 \cap A_4 \rvert = \lvert A_1 \cap A_3 \cap A_4 \rvert = \lvert A_2 \cap A_3 \cap A_4 \rvert = 19!$ $\lvert A_1 \cap A_2 \cap A_3 \cap A_4 \rvert = 17!$	2M

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course: Statistic and Discrete Mathematics Course Code: 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Date 22/11/2019 **SCHEME OF VALUATION** Date:

Q. No.		Marks
	$S_0 = \|S\| = 24!$, $S_1 = \sum\|A_i\| = 3\times 24! + 23!$.	2M
	$S_2 = \sum\|A_i \cap A_j\| = (3\times 22!) + (3\times 21!)$	
	$S_3 = \sum\|A_i \cap A_j \cap A_k\| = 20! + (3\times 19!)$, $S_4 = \|A_1 \cap A_2 \cap A_3 \cap A_4\| = 17!$	
	(i) $E_2 = S_2 - {}^3C_1 S_3 + {}^4C_2 S_4$	3M (2+2+3)
	(ii) $L_2 = S_2 - 2C_1 S_3 + 3C_1 S_4$	
	(iii) $E_3 = S_2 - 4C_1 S_4$	
	Unit - 3	
4 a)	Let X denotes the no of individuals get bad reaction from a certain injection.	3M
	Given, $p = 0.001$, $n = 2000$	
	In the poisson distribution	
	$P(X) = \frac{e^{-\mu}\mu^X}{X!}$, where $\mu = np \Rightarrow \mu = 2$	
	$\Rightarrow P(X) = \frac{2^X}{2!} e^{-2}$	
	$P(X>2) = 1 - P(X\le 2) = 1 - \{P(X=0) + P(X=1) + P(X=2)\}$	3M (3+3)
	$= 1 - \left[e^{-2}\frac{2^0}{0!} + e^{-2}\frac{2^1}{1!} + e^{-2}\frac{2^2}{2!}\right] =$	
	$= 1 - 0.6767 = 0.323$	
b)	Let X denotes the life of a bulb	3M
	Given, $\mu = 2040$ hrs, $\sigma = 60$ hrs	
	$Z = \frac{X-\mu}{\sigma} = \frac{X-2040}{60}$	

X	2150	1920	2160
$Z = \frac{X-2040}{60}$	1.83	-2	2

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course: Statistic & Discrete Mathematics Course Code: 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Date: 22/11/19 **SCHEME OF VALUATION** Date:

Q. No.		Marks
	(i) $P(X>2150) = P(Z>1.83) = 0.5 - A(Z=1.83)$ $= 0.0336$ ∴ The no of bulbs expected to burn for more than 2150 hrs $= 0.0336 \times 2000 \simeq 67$.	2M
	(ii) $P(1920<X<2160) = P(-2<Z<2) = 2P(0<Z<2)$ $= 0.9544$ ∴ the no of bulbs expected to burn for more than 1920 but less than 2160 hrs $= 0.9544 \times 2000$ $\simeq 1909$ (3+2+2)	3M
4.c)	The marginal distributions of X & Y are given below $\mu_X = \sum x_i f(x_i) = 2$, $\mu_Y = \sum y_j g(y_j) = 0.6$ $E(XY) = \sum_i \sum_j x_i y_j J_{ij} = 0$ $Cov(X,Y) = E(XY) - \mu_X \mu_Y = -1.2$ $E(X^2) = \sum x_i^2 f(x_i) = 5$, $E(Y^2) = \sum y_j^2 g(y_j) = 9.6$ $\sigma_X^2 = E(X^2) - (\mu_X)^2 = 1$, $\sigma_Y^2 = E(Y^2) - \mu_Y^2 = 9.24$ $\rho(X,Y) = \frac{Cov(X,Y)}{\sigma_X \sigma_Y} = -0.3947$ (2+2+3)	2M 2M 3M
	Unit - 4	
5 a)	H_0 : Coin is unbiased ie $p = 1/2$ H_1 : Coin is biased ie $p \neq 1/2$ Here $n = 412$, no of success $= X = 216$	2M

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course : Statistics & Discrete Mathematics Course Code : 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Date : 22/11/19 **SCHEME OF VALUATION** Date :

Q. No.		Marks
	In the binomial distribution $\mu = np = 400 \times 1/2 = 200$ & $\sigma = \sqrt{npq} = 10$ For two tailed test, under H_0, $Z = \frac{\hat{p} = E(p)}{SE(p)} = \frac{216 - 200}{10} = 1.6$ ✓ For two tails test, from the normal distribution table at 5%. l.o.s $Z_\alpha = 1.96$ ✓ Conclusion: since $Z_{cal}(1.6) < Z_{tab}(1.96)$ ∴ H_0 is accepted at 5%. l.o.s. (2+3+1)	3M 1M
5.b)	H_0: There is no discriminate between the two horses H_1: There is a discriminate between the two horses Let x & y be the variables respectively corresponds to horse A & horse B. $n_1 = 7, n_2 = 6, \bar{x} = \frac{\sum x_i}{n} = 31.3, \bar{y} = \frac{\sum y_i}{n} = 28.2$ $\sum (x_i - \bar{x})^2 = 31.43, \sum (y_i - \bar{y})^2 = 26.84$ $s^2 = \frac{1}{(n_1+n_2-2)} \left[\sum (x_i - \bar{x})^2 + \sum (y_i - \bar{y})^2 \right] = 5.2973$ Under H_0, $\lvert t \rvert = \left\lvert \frac{\bar{x} - \bar{y}}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \right\rvert = 2.42$ From t-table $(t_{\alpha/2})_{0.05}$ the d.f. 11 = 2.2 Conclusion: since $t_{cal}(2.42) > t_{tab}(2.2)$. ∴ H_0 is rejected at 5% of l.o.s. (1+3+2+1)	1M 3M 2M 1M
c)	H_0: The data follows a binomial distribution H_1: The data doesn't follows a binomial distribution	1M

BMS COLLEGE OF ENGINEERING, BANGALORE -19

(Autonomous Institute, Affiliated to VTU)

Course : Statistics and discrete mathematics Course Code : 19MA3BSSDM

Signature of the Paper Setter Signature of the Paper Scrutinizer

Date : 22/11/19 **SCHEME OF VALUATION** Date :

Q. No.		Marks
	$p = 1/2 \Rightarrow q = 1/2$ & $N = 320$ x : 0 1 2 3 4 5 $f(x) = {}^nC_x p^x q^{n-x} \times N$: 10 50 100 100 50 10	2M
	O_i : 6 27 72 112 71 32 E_i : 10 50 100 100 50 10 $\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} = 78.688$ (78.938) From table, $(\chi^2_{0.05})_{d.f.=5} = 11.07$ Conclusion: $\chi^2_{cal} > \chi^2_{tab}$ $\therefore$ H_0 is Rejected at 5% of los.	3M 1M
	OR	
6.a)	$H_0 : \mu = 1600$ hrs, $H_1 : \mu \neq 1600$ hrs $n = 100$, $\bar{x} = 1580$, $s = 90$, $\sigma_{\bar{x}} = s/\sqrt{n} = 9$ Under H_0, $Z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = 2.22$ From the table $(Z_{\alpha/2}) = (Z_{0.05/2}) = 1.96$ Conclusion: $\because Z_{cal} > Z_{tab}$ $\therefore$ H_0 is Rejected at 5% los (2+3+1)	2M 3M 1M
6.a)	$H_0 : \mu = 0$, $H_1 : \mu \neq 0$ $\bar{x} = \frac{\sum x_i}{n} = 0.6$, $s^2 = \frac{1}{(n-1)} \sum (x_i - \bar{x})^2 = 3.08$, $n = 12$ Under H_0, $t = \left\lvert \frac{\bar{x} - \mu}{s/\sqrt{n}} \right\rvert = 2.94$ From t-table $(t_{\frac{0.05}{2}})_{d.f.=11}$ is 2.201 Conclusion: since $t_{cal} > t_{tab}$ $\therefore$ H_0 is is Rejected at 5% los (3+3+1)	3M 3M 1M

6b) H_0 : N.H. $\sigma_1^2 = \sigma_2^2$ (1M)

H_1 : A.H $\sigma_1^2 \neq \sigma_2^2$

$n_1 = 5 \quad n_2 = 6 \quad \sum x_{1i} = 41150$

$\sum x_{1i}^2 = 338727500$

$S_1^2 = \frac{63000}{4} = 15750$

$\sum x_{2i} = 378316200 \quad \sum x_{2i}^2 = 3783162000$

$S_2^2 = \frac{54600}{5} = 10920$

$F = \frac{S_1^2}{S_2^2} = \frac{15750}{10920} = 1.442$ (4M)

At 5% $F_{(4,5)} = 5.19$. (1M)

Conclusion: $\because F <$ Table Value

accept N.H. The Variances are not significantly different (1M)

6c) H_0 : N.H : $M_1 - M_2 = 0.05$ (1M)

H_1 : A.H : $M_1 - M_2 < 0.05$

Test statistic: $Z = \frac{(\bar{x}_1 - \bar{x}_2) - \delta}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = 2.65$ (4M)

$Z_{0.05} = 1.645$ (1M)

Reject H_0 and accept A.H. (1M)

Unit - 5

7a) A : studying , B : not studying

$$P = \begin{matrix} & A & B \\ A & 0.3 & 0.7 \\ B & 0.4 & 0.6 \end{matrix}$$ 2M

Note : Please do not write Back side Pages

Q. No. | Marks

Let $V = (x \; y)$ such that

$VP = V$ where $x + y = 1$

$$[x \; y] \begin{bmatrix} 0.3 & 0.7 \\ 0.4 & 0.6 \end{bmatrix} = [x \; y]$$ (3M)

solving $V = (4/11, 7/11)$

In the long run the student will study $4/11$ or 36.36% of the time. (1M)

7b) state space : A : Sunny B : Rainy

$$\text{t.p.m} \quad P = \begin{matrix} \\ A \\ B \end{matrix} \begin{matrix} \begin{matrix} A & B \end{matrix} \\ \begin{bmatrix} 0.8 & 0.2 \\ 0.4 & 0.6 \end{bmatrix} \end{matrix}$$ 2M

(i) $P^{(0)} = [1 \quad 0]$

$P^{(2)} = P^{(0)} P^2$ 2M

$$= [1 \quad 0] \begin{bmatrix} 0.72 & 0.28 \\ 0.56 & 0.44 \end{bmatrix} = [0.72 \quad 0.28]$$

The chance of rain day after tomorrow is 0.28

(ii) Let $V = (x \; y)$ such that

$VP = V$ where $x + y = 1$

$$[x \; y] \begin{bmatrix} 0.8 & 0.2 \\ 0.4 & 0.6 \end{bmatrix} = [x \; y]$$

Solving $x = 0.667 \quad y = 0.333$

In the long run it will be raining 0.33 or 33% of the times (3 M)

TC: Let the time unit be an hour then

$\lambda = 7$, $\mu = 10$ (1M)

$\rho = \frac{\lambda}{\mu} = 0.7$

Mean queue length $L_q = L_s - \rho$

$= \frac{\rho}{1-\rho} - \rho = \frac{49}{30} = 1.633$

Mean waiting time in the queue

$W_q = \frac{\lambda}{\mu(\mu-\lambda)} = \frac{7}{30} = 0.233$ hrs $\approx$ 14 minutes

probability that the number of waiting customer is greater than 2 is.

$P(\geq 3) = \rho^3 = (0.7)^3 = 0.343$ (2+2+2) M

The scheme is discussed by the following members

1) Bhabisha (Dr. T. N. Vishalakshi)

2) Shazia P.A [SHAZIA P.A]

3) T.B. Mallikarjuna (Dr. B. Mallikarjuna)

TO COE,

This scheme and solutions are is approved for valuation.

Dr. RANGASWAMY, M.Sc.,Ph.D.
Associate Professor
and
H.O.D. of Mathematics
B.M.S. College of Engineering
Bangalore - 560 019.