RV College of Engineering®
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Academic year 2023-2024 (Even Sem)
DEPARTMENT OF

COMPUTER SCIENCE & ENGINEERING

Date	June 2024	Maximum Marks	50
Course Code	CS241AT	Duration	90 Min
Sem-IV	**Test-1**	Staff: HKK/ASP/SMS/SGR/MNV	

DISCRETE MATHEMATICAL STRUCTURES AND COMBINATORICS

(Common to CSE, ISE & AIML)

		Marks	BT	CO
1a.	Determine if the expansion of $\left(x^2 - \frac{2}{x}\right)^{18}$ will contain a term containing x^{10}.	5	4	2
1b.	If a person places 6 letters into 6 addressed envelopes, what is the probability that exactly two of them are placed correctly.	5	3	2
2a.	Find the number of non negative integer solutions of i. $x_1+x_2+x_3+x_4+x_5=40$ ii. $x_1+x_2+x_3+x_4+x_5\le 40$ iii. $x_1+x_2+x_3+x_4+x_5=40$ with $x_1\ge1, x_2\ge2, x_3\ge3, x_4\ge4, x_5\ge5$ iv. $x_1+x_2+x_3+x_4+x_5=40$ with $x_1<20$	6	3	2
2b.	Simplify using the laws of logic: $\neg[\neg\{(p \vee q) \wedge r\} \vee \neg q]$	4	3	1
3a.	Write the recurrence relation to solve the Tower of Hanoi problem. Also solve that recurrence relation using the generating function.	6	4	4
3b.	~~Draw the circuit diagram to represent the following statement:~~ $[p \vee (p \wedge q) \vee (p \wedge q \wedge \neg r)] \wedge [p \wedge r \wedge t) \vee t]$	~~4~~	2	3
4a.	If a person invests ₹ 25,000 at at 9% annual interest, find the amount he will get at the end of 5 years if • interest compounded half yearly • interest compounded monthly Write the recurrence relation and solve.	6	3	4
4b.	Determine the truth values of p, q, r, s, t when $[p \wedge (q \wedge r)] \rightarrow (s \veebar t)$ is false.	4	2	1
5a.	Show the validity of the argument: $(\neg p \wedge \neg q) \rightarrow (r \wedge s)$ $r \rightarrow t$ $\neg t$ --- $\therefore p$	6	3	3
5b.	Find the number of ways in which 5 people A, B, C, D, and E can be seated at a round table, such that • C and D always sit together • C and D never sit together	4	1	1

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

	Particulars	CO1	CO2	CO3	CO4	CO5	L1	L2	L3	L4	L5	L6
Marks Distribution	Max Marks	12	16	10	12	-	4	8	27	11	-	-

1.a) $x^{10} = x^{38-3r}$ So $r = 28/3$ not an integer So there will not be a term containing x^{10} in the expansion

1.b Total arrangements $= 6! = 720 \Rightarrow {}^6C_2 \times 4 = {}^6C_2 \times 9$

$= 135$

Required probability $= 135/720 = 3/16$

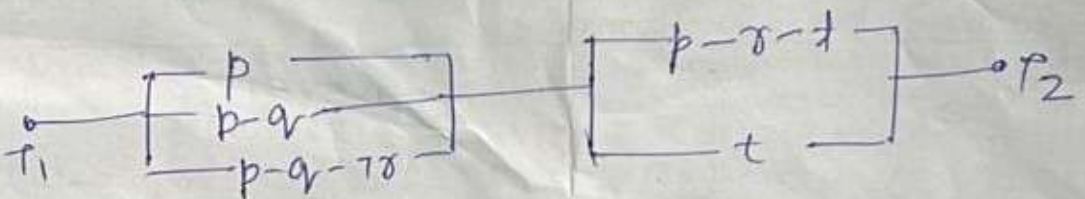
2.a) i) ${}^{44}C_{40}$ (ii) ${}^{45}C_{40}$ (iii) ${}^{89}C_4$ (iv) ${}^{44}C_{40} - {}^{24}C_{20}$

2.b) $q \wedge r$

3.a) Recurrence relation is $a_n = 2a_{n-1} + 1$, $a_0 = 0$

$a_n = 2^n - 1$, $n \geq 0$

3.b)



4.a) i) $P_n = (1.045)^n P_0 = 38824.2$

ii) $P_n = (1.0075)^n P_0 = 39142.4$

4.b) $p = q = r = 1$, $s = t = 0$ or

$p = q = r = 1$, $s = t = 1$

5.a) Valid

5.b) i) $3! * 2 = 6 * 2 = 12$

ii) $4! - 3! = 24 - 12 = 12$