Reg.No.:								

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 2009

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JUNE 2023
Fifth Semester
Computer Science and Technology
U19MA509 – PROBABILITY, QUEUING THEORY & GAME THEORY
(Regulation 2019)

Time : Three Hours Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. What is the probability that the product is positive?	2	K3	CO1
2.	Justify the statement, "$P(A/B) = P(A)$ *implies* $P(B/A) = P(B)$."	2	K3	CO1
3.	If the density of a continuous random variable is given by $f(x) = k(1+x)$ for $2 < x < 5$. Find $P(X < 4)$.	2	K1	CO2
4.	The probability that a certain kind of component will survive a shock test is 3/4. Find the probability that exactly 2 of the next 4 components tested survive.	2	K1	CO2
5.	A self-service store employs one cashier at its counter. 8 customers arrive on an average every 5 minutes while the cashier can serve 10 customers in the same time. Assuming Poisson distribution for arrival and exponential distribution for service rate, find average number of customers in the system.	2	K1	CO3
6.	What is the probability that a customer has to wait more than 15 minutes to get his service completed in a M/M/1queuing system, if $\lambda = 6$ per hour and $\mu = 10$ per hour?	2	K1	CO3

7.		Construct the arrow diagram comprising activities A, B,...and L such that the following relationships are satisfied : (i) A, B and C, the first activities of the project, can start simultaneously (ii) A and B precedes D (iii) B precedes E,F,G and H (iv) F and C precedes G (v) E and H precedes I and J (vi) C,D,F and J precedes K (vii) K precedes L (viii) I,G and L are the terminal activities of the project.	2	K3	CO4
8.		In PERT algorithm, how will you calculate the standard normal variate?	2	K1	CO4
9.		Define maxim in principle in game theory.	2	K1	CO5
10.		What do you meant by two-person zero-sum game.	2	K1	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.		Questions	Marks	KL	CO
11. a)	i.	In a shooting test, the probability of hitting the target is 1/2 for A, 2/3 for B and 3/4 for C. If all of them fire at the target, find the probability that 1) none of them hits the target and 2) at least one of them hits the target.	8	K3	CO1
	ii.	In a coin tossing experiment, if the coin shows head, 1 die is thrown and the result is recorded. But if the coin shows a tail, 2 dice are thrown and their sum is recorded. What is the probability that the recorded number will be 2?	8	K3	
		(OR)			
b)	i.	Computer keyboard failures are due to faulty electrical connects (12%) or mechanical defects (88%). Mechanical defects are related to loose keys (27%) or improper assembly (73%). Electrical connect defects are caused by defective wires (35%), improper connections (13%), or poorly welded wires (52%). 1) Find the probability that a failure is due to loose keys. 2) Find the probability that a failure is due to improperly connected or poorly welded wires.	8 8	K3 K3	CO1
	ii.	Customers are used to evaluate preliminary product designs. In the past, 95% of highly successful products received good reviews, 60% of moderately successful products received good reviews, and 10% of poor products received good reviews. In addition, 40% of products have been highly successful, 35% have been moderately successful, and 25% have been poor products. 1) If a new design attains a good review, what is the probability that it will be a highly successful product? 2) If a product does not attain a good review, what is the probability that it will be a highly successful product?			

12.	a)	i.	Suppose that a trainee soldier shoots a target in an independent fashion. If the probability that the target is shot on any one shot is 0.8. What is the probability that the target would be hit on sixth? What is the probability that it takes him less than 5 shots?	8	K1	CO2
		ii.	The number of telephone calls that arrive at a phone exchange is often modeled as a Poisson random variable. Assume that on the average there are 10 calls per hour. What is the probability that there are exactly 5 calls in one hour? What is the probability that there are 3 or less calls in one hour?	8	K3	
			(OR)			
	b)	i.	The amount of time that a camera will run without having to be reset is a random variable having exponential distribution with λ=50 days. Find the probability that such a camera will, 1) have to reset in less than 20 days 2) not have to be reset in at least 60 days.	8	K1	CO2
		ii.	The life of a semiconductor laser at a constant power is normally distributed with a mean of 7000 hours and a standard deviation of 600 hours. 1) What is the probability that a laser fails before 5000 hours? 2) What is the life in hours that 95% of the lasers exceed?	8	K3	
13.	a)	i.	A T-V repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?	8	K3	CO3
		ii.	Consider a single server queuing system with Poisson input, exponential service times. Suppose the mean arrival rate is 3 calling units per hour, the expected service time is 0.25 hours and the maximum permissible number of calling units in the system is two. Derive the steady state probability distribution of the number of calling units in the system and then calculate the expected number in the system.	8	K3	
			(OR)			
	b)	i.	Four counters are being run on the frontier of a country to check the passports and necessary papers of the tourists. The tourists choose a counter at random. If the arrivals at the frontier are Poisson at the rate λ and the service time is exponential with parameter $\lambda/2$, what is the steady-state average queue at each counter?	8	K3	CO3

ii. In a heavy machine shop, the overhead crane is 75 percent utlised. Time study observations gave the average slinging time as 10.5 minutes with a standard deviation of 8.8 minutes. What is the average calling rate for the services of the crane and what is the average delay in getting service? If the average service time is cut to 8 minutes, with standard deviation of 6 minutes, how much reduction will occur, on average, in the delay of getting served? 8 K3

14. a) i. The following table lists the jobs of a network along with their time estimates: 8 K2 CO4

Job		Duration (Days)		
I	J	Optimistic	Most likely	Pessimistic
1	2	3	6	15
1	6	2	5	14
2	3	6	12	30
2	4	2	5	8
3	5	5	11	17
4	5	3	6	15
6	7	3	9	27
5	8	1	4	7
7	8	4	19	28

1) By drawing the project calculate the length and variance of the critical path.
2) What is the approximate probability that the jobs on the critical path will be completed in forty-one days?

ii. In the following table optimistic, most likely and pessimistic times are respectively shown against each connected activity from 10 to 100 in a project. Find the critical path by constructing a network: 8 K3

Activity	Times	Activity	Times	Activity	Times	Activity	Times
10-20	4,8,12	50-70	3,6,9	20-30	1,4, 67	50-80	4,8,6
20-40	8,12, 16	60-100	4,6,8	30-50	3,5,7	70-90	4,8,12
40-50	0,0,0	80-90	2,5,8	40-60	3,6,9	90-100	4,10, 16

The scheduled completion time for the project is 48 days. Calculate the probability of finishing the project within this time.

(OR)

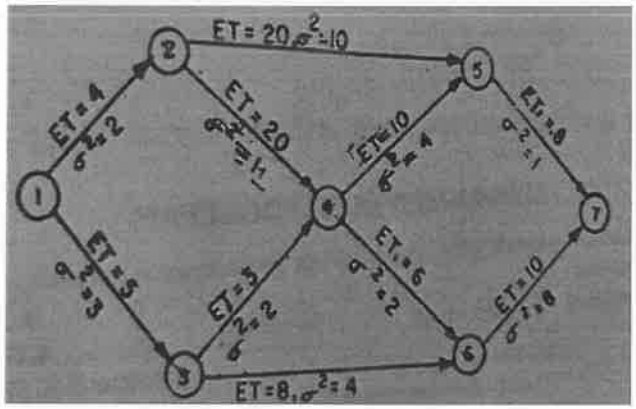
b) i. Summary of various jobs of a project is given below: 8 K2 CO4

Jobs	Duration	Jobs	Duration
A	13	G	7
B	5	H	12
C	8	J	8
D	10	K	9
E	9	L	4
F	7	M	17

The constraints governing the jobs are as follows: A and B are start jobs; A controls C,D and E; B controls F and K; G depends on C;H depends on D; E and F control J and M; L depends on K; M is also controlled by L; G,H,J and M are the last jobs. Draw a network and find out the project duration. What is the critical path?

ii. Given the following PERT network, construct 8 K3

1) earliest expected completion time for each event
2) the critical path



15. a) i. Consider a 3X5 game as shown in the table, which represents the payoff matrix of the player A. Solve it optimally using dominance property. 8 K3 CO5

Player A	Player B					
		1	2	3	4	5
	1	2	5	10	7	2
	2	3	3	6	6	4
	3	4	4	8	12	1

ii. Player A and B play a game in which each player has three coins (20p, 25p, and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the coins is an even number, A wins B's coin. If that sum is an odd number, B wins A's coin. Develop a payoff matrix with respect to player A. Find the optimal strategies for the players. 8 K3

(OR)

b) i. In a game of matching coins with two players, suppose A wins one unit of value, when there are two heads. Wins nothing when there are two tails and loses half unit of value when there are one head and one tail. Construct the pay-off matrix, the best strategies for each player and the value of the game to A. 8 K3 CO5

ii. Consider the payoff matrix with respect to the player A as shown below. Solve this game optimally using graphical method 8 K3

Player B	Player B					
		1	2	3	4	5
	1	4	2	1	7	3
	2	2	7	8	1	5