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Question Paper Code: 41271

M.E. DEGREE EXAMINATION, DECEMBER 2014.

First Semester

VLSI Design

14PMA123 - APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. The inference rule $((\bar{b} \wedge (a \Rightarrow b)) \Rightarrow$

(a) a (b) ā (c) b (d) $\bar{b}$

2. Two vectors are orthogonal, if their inner product is

(a) 0 (b) 1 (c) 2 (d) ∞

3. $J_{\frac{1}{2}}(x) =$

(a) $\sqrt{\frac{2}{\pi x}}\sin x$ (b) $\sqrt{\frac{2}{\pi x}}\cos x$ (c) $\sqrt{\frac{2}{\pi x}}\cot x$ (d) $\sqrt{\frac{2}{\pi x}}\sec x$

4. Which one is satisfies the principle of optimality?

(a) Shortest path problem (b) Longest path problem

(c) both (a) and (b) (d) None of the above

5. The queue model (M/M/c);(∞/FCFS); where (c, ∞) represented as

a) Single server, finite capacity b) Multi server, infinite capacity

c) Multi server, finite capacity d) Single server, infinite capacity

PART - B (5 x 3 = 15 Marks)

6. Define quasi tautology and quasi contradiction.

7. Define pseudo inverse.

8. Write the generating function for Bessel's function $J_n(x)$.

9. State Bellman's principle of optimality.

10. Define steady state, unsteady state in queueing models.

PART - C (5 x 16 = 80 Marks)

11. (a) Classify fuzzy propositions. Explain each type with examples. (16)

Or

(b) (i) Explain absolute quantifiers with example. (8)

(ii) What are the four valued logic and its uses? (8)

12. (a) Obtain the singular value decomposition of $\begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$ (16)

Or

(b) (i) Find the QR-decomposition of the matrix $A = \begin{bmatrix} 2 & 1 & 3 \\ -1 & 0 & 7 \\ 0 & -1 & -1 \end{bmatrix}$ (8)

(ii) Find the least square solution and least square error of the equation

$$\begin{bmatrix} 2 & 1 \\ 1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$ (8)

13. (a) Prove the following

(i) $\frac{d}{dx}(x^n J_n(x)) = x^n J_{n-1}(x)$ (8)

(ii) $2J_n'(x) = J_{n-1}(x) - J_{n+1}(x)$ (8)

Or

(b) State and prove the orthogonality property of Bessel's function. (16)

14. (a) Solve the following linear programming problem by the method of dynamic programming.

Maximize $Z = 2x_1+5x_2$

Subject to: $2x_1+x_2 \leq 430$

$2x_2 \leq 460$

$x_1, x_2 \geq 0$. (16)

Or

(b) (i) For the network in Fig. 1, it is desired to determine the shortest route between cities 1 to 7. Define the stages and the states using backward recursion, and then solve the problem (8)

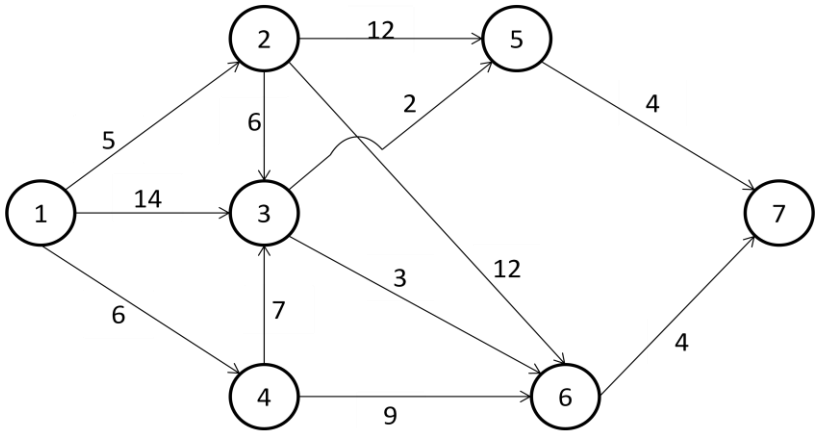

Fig. 1

(ii) What are the essential characteristics of dynamic programming problem? (8)

15. (a) (i) Customers arrive at a one-man barbershop according to a Poisson process with a mean inter arrival time of 12 minute. customers spend an average of 10 minute. in the barber's chair

(i) What is the expected number of customers in the barber shop and in the queue?

(ii) Calculate the percentage of time an arrival can walk straight into the barber's chair without having to wait.

(iii) How much time can a customer expect to spend in the barber's shop?

(iv) What is the average time of customers spending in the queue?

(v) What is the probability that the waiting time in the system is greater than 30 minute?

(vi) Calculate the percentage of customers who have to wait prior to getting into the barber's chair.

(vii) What is the probability that more than 3 customers are in the system? (16)

Or

(b) (i) There are 3 typists in an office. Each typist can type an average of 6 letters per hour and the letters to be typed arrive at the rate of 15 per hour. If the arrivals are poisson distributed and assuming exponential service, find

(i) The probability that all typists are busy

(ii) Average number of letters waiting to be typed (8)

(ii) A Self-Service store employs one cashier at its counter. 9 Customers arrive on an average 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service rate, find

(i) Average number of customers in the system.

(ii) Average time a customer spends in the system. (8)
