(3 Hours)   [Total Marks :80]

N.B. : (1) Question No 1 is compulsory
(2) Attempt **any three** Questions out of remaining **five** questions.
(3) Assume suitable data wherever required and clearly specify it,
(4) **Figures** to the **right** indicate **full marks.**

1. (a) State the condition for stability of LTI system, determine the range of values of a and b for which the impulse time -invariant system with following given impulse response is stable.   5

$$h(n) = \begin{cases} a^n & n \leq 0 \\ b^n & n < 0 \end{cases}$$

(b) Find the Energy of the signal $x(n) = 0.5^n u(n) + 8^n u(-n-1)$ 5

(c) Find the value of $x(n) = \cos(0.25 \pi n)$ for n= 0, 1, 2, 3. Compute the DFT of x(n) using FFT flow graph.   5

(d) Find the cross correlation of the sequences $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{2, 4, 6\}$ 5

2. (a) Determine whether or not the following signals are periodic If periodic specify its fundamental period.   10
   (i) $x_1(n) = \cos(0.5 \pi n + 0.3)$
   (ii) $x_2(n) = \cos(0.3 \pi n) + 10 \sin(0.25 \pi n)$

(b) Compute Linear convolution of causal x(n) and h(n) using overlapp add method in time domain   10
   $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8\}$, $h(n) = \{1, 1, 1\}$

3. (a) Check whether the given system $y(n) = x(2n) - x(n-1)$ is :   10
   (i) Static or Dynamic   (ii) Linear or non -linear
   (iii) Shift invariant or variant   (iv) Causal or non causal
   (v) Stable or unstable.

(b) State the following DFT properties :   10
   (i) Linearity property
   (ii) Periodicity
   (iii) Time shift
   (iv) Convolution
   (v) Time Reversal

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4. (a) For the causal LTI digital filter with impulse response given by   10
   $h(n) = 0.3\ \delta(n) - \delta(n-1) + 0.38\ \delta(n-3)$ sketch the magnitude spectrum of the filter. Using DFT.

   (b) Let $X(K) = \{20, 0, -4+4j, 0, -4\}$ is the 8 point DFT of a real valued sequence $x(n)$ 10
   (i) Find $X(K)$ for K=5, 6, 7.
   (ii) Find the 8 point DFT $P(K)$ such that $p(n) = (-1)^n\ x(n)$ Using DFT property.

5. (a) Find circular convolution and linear using circular convolution for the following   10
   sequences $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{1, 2, 1, 2\}$. Using Time Domain formula method.

   (b) Derive radix 2 DIT FFT flow graph and find the DFT of the sequence   10
   $x(n) = \{0, 1, 2, 3\}$

6. (a) Write a detailed note on DSP Processor.   10

   (b) Write a detailed note on Carls' Correlation Coefficient Algorithm. Justify the necessary of Algorithm by given suitable example.

(Time: 3hrs)   (Marks 80)

1. Question No 1 is compulsory.
2. Attempt any three out of the remaining five questions.

Q1. (a) Define the following with examples:
   i)Substitution cipher ii) Poly-alphabetic cipher iii) Salami attack   10
   iv) Session Hijacking V)
   (b) With the help of examples explain non-malicious programming errors.   05
   (c) Define the goals of security and specify mechanisms to achieve each goal.   05

Q2. (a) In an RSA system the public key (e,n) of user A is defined as (7,119).   10
       Calculate Φn and private key d. What is the cipher text when you encrypt
       message m=10, using the public key?
   (b) Give the format of X 509 digital certificate and explain the use of a digital 05
       signature in it.
   (c) Encrypt "The key is hidden under the door" using Playfair cipher with   05
       keyword "*domestic*".

Q3. (a) Explain how a key is shared between two parties using Diffie Hellman key   10
       exchange algorithm. What is the drawback of this algorithm?
   (b) Differentiate between i) MD-5 and SHA ii) Firewall and IDS   10

Q4. (a) Explain working of DES detailing the Fiestel structure   10

   (b) What is a Denial of service attack. What are the different ways in which an   10
       attacker can mount a DOS attack on a system?

Q5. (a) List the functions of the different protocols of SSL. Explain the handshake 05
       protocol.

   (b) How does PGP achieve confidentiality and authentication in emails?   05

   (c) Differentiate between the transport mode and tunnel mode of IPSec and   10
       explain how authentication and confidentiality are achieved using IPSec.

Q6.   Write in brief about (any four):   20
      i)   Operating System Security.
      ii)   Buffer overflow attack.
      iii)   IP spoofing
      iv)   Viruses and their types.
      v)   Key generation in IDEA.

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(3 Hrs) Maximum Marks = 80

Note:
   (i) Each question carry 20 marks
   (ii) Question 1 is compulsory
   (iii) Attempt any three (3) from the remaining questions
   (iv) Assume suitable data wherever required

Q1. Attempt any four (4) questions from the following [20]
   (a) Define heuristic function. Give an example heuristics function for Blocks World Problem.
   (b) Find the heuristics value for a particular state of the Blocks World Problem.
   (c) Define Rationality and Rational Agent. Give an example of rational action performed by any intelligent agent
   (d) Compare and Contrast problem solving agent and planning agent
   (e) Represent the following statement into FOPL.
      (i) Anyone who kills an animal is loved by no one.
      (ii) A square is breezy if and only if there is a pit in a neighboring square (Assume the wumpus world environment).
      (iii) Give the PEAS description for an Internet shopping agent. Characterize its environment

Q2. (a) Consider the graph given in Figure 1 below. Assume that the initial state is S [10] and the goal state is 7. Find a path from the initial state to the goal state using A* Search. Also report the solution cost. The straight line distance heuristic estimates for the nodes are as follows: $h(1) = 14$, $h(2) = 10$, $h(3) = 8$, $h(4) = 12$, $h(5) = 10$, $h(6) = 10$, $h(S) = 15$.
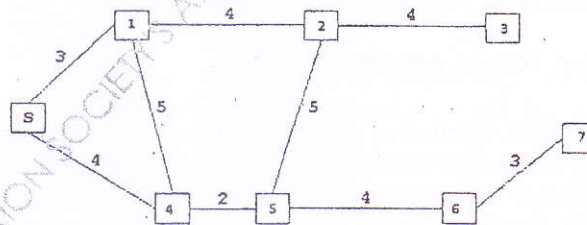

Figure 1.

(b) Draw and describe the architecture of expert system. [6]
(c) Convert the following propositional logic statement into CNF [4]
   $A \rightarrow (B \leftrightarrow C)$

Q3. (a) Consider the following axioms: [4+4+4]

All people who are graduating are happy.

All happy people smile.

Someone is graduating.

    (i) Represent these axioms in first order predicate logic.

    (ii) Convert each formula to clause form

    (iii) Prove that **"Is someone smiling?"** using resolution technique. Draw the resolution tree.

(b) What are the basic building blocks of Learning Agent? Explain each of them with a neat block diagram.   [8]

Q4. (a) Construct a decision tree for the following set of samples. Write any two decision rules obtained from the tree. Classify a new sample with (gender = " Female", height = " 1.92m")   [6+2+2]

Person ID	Gender	Height	Class
1	Female	1.6m	Short
2	Male	2m	Tall
3	Female	1.9m	Medium
4	Female	2.1m	Tall
5	Female	1.7m	Short
6	Male	1.85m	Medium
7	Female	1.6m	Short
8	Male	1.7m	Short
9	Male	2.2m	Tall

(b) What are the problems/frustrations that occur in hill climbing technique? Illustrate with an example.   [6]

(c) Draw a game tree for a Tic-Tac-Toe problem.   [4]

Q5. (a) Write a short note on genetic algorithm.   [8]

(b) It is known that whether or not a person has cancer is directly influenced by whether she is exposed to second-hand smoke and whether she smokes. Both of these things are affected by whether her parents smoke. Cancer reduces a person's life expectancy.   [6]

    (i) Draw the Bayesian Belief Network for the above situation

    (ii) Associate a conditional probability table for each node

(c) Explain a partial order planner with an example   [6]

Q6. (a) Write a PROLOG program to find Fibonacci series   [10]

(b) What are the levels of knowledge used in language understanding? Also write down the techniques used in NLP.

[10]

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(3Hours)   [80 Marks]

N.B. :   1) Question **No.1** is compulsory
         2) Attempt any **Three** questions out of remaining.
         3) Assume suitable data wherever necessary and state them clearly.

1.   Answer the following:-   (20)
         (a) What do you understand by zero memory operation.
         (b) Discuss different discontinuties in image.
         (c) What is an Unitary matrix .
         (d) Define Morphological operations Erosion and Dilation

2. (a)   Discuss color models for a digital image.   (10)

   (b)   For the given 3 bits per pixel, 4 × 4 size image perform following operations. (10)
         (i)   Intensity level slicing with background, $r_1 = 3$ and $r_2 = 5$
         (ii)   Bit plane slicing.

6	2	3	2
1	5	0	7
4	3	2	1
2	5	7	6

3. (a)   Explain:The first difference makes the chain code invariant to rotation.   (10)
   (b)   Explain Homomorphic filtering with the help of block diagram.   (10)

4. (a)   Write 8 × 8 Hadamard transform matrix and its signal flow graph for fast Hadamard
         transform. Using this butterfly diagram (Signal flow graph) compute Hadamard
         transform for $x(n)) = \{1,2,1,1,3,2,1,2\}$ (10)

   (b)   Find the DCT of the given Image using matrix multiplication method.   (10)

$$f(x,y) = \begin{bmatrix} 2 & 4 & 4 & 2 \\ 4 & 6 & 8 & 3 \\ 2 & 8 & 10 & 4 \\ 3 & 8 & 6 & 2 \end{bmatrix}$$

5. (a)   Discuss the different types of redundancies in images with examples.   (10)
   (b)   Construct Improved Gray Scale (IGS) quantization code for given gray scale data, (10)
         $\{100, 110, 124, 124, 130, 200, 210\}$. Also Compute e_{rms} (root mean square error).

6.   Write detail notes on (any Two)   (20)
         (a)   Edge Linking using Hough transform .
         (b)   Thinning with example.
         (c)   Differential Pusle Code Modulation (DPCM)
         (d)   Segmentation techniques: Region growing and split and merge.

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