3 Hours   **Total Marks = 80**

Note:
  (i) Each question carries 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) Give PEAS description for an Autonomous Mars Rover. Characterize its environment.
    (b) Give the initial state, goal test, successor function, and cost function for the following problem
        "You have to colour a planar map using only 4 colours, in such a way that no two adjacent regions have the same colour".
    (c) Draw and explain architecture of Expert System.
    (d) Explain Hill-climbing algorithm with an example.
    (e) Covert the following propositional logic statement into CNF
            (i)   A$\rightarrow$(B$\leftarrow$$\rightarrow$C)

Q2. (a). Explain decision tree learning with an example.   [10]

(b) Write first order logic statements for following statements: [10]
    (i)   Horses, cows, and pigs are mammals.
    (ii)   Bluebird is a horse.
    (iii)   Whoever can read is literate.
    (iv)   Every tree in which any aquatic bird sleeps is beside some lake.
    (v)   Anything anyone eats and is not killed by is food.

Q3. (a) Design a planning agent for a Blocks World problem. Assume suitable initial state and final state for the problem.   [10]

   (b) Consider a situation in which we want to reason about the relationship between smoking and lung cancer. Intuitively, we know 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.
       (i) Draw the Bayesian network.
       (ii) How many independent values are required to specify all the conditional probability tables (CPTs) for your network?   [10]

Q4. (a) Compare **Greedy Best first search** and **A* search** algorithms based on performance measure with justification: Complete, Optimal, Time and Space complexity.   [10]
   (b) Write a pseudocode for alpha-beta algorithm. Apply alpha-beta pruning on example given in Figure 1 considering first node as max.   [4+6]
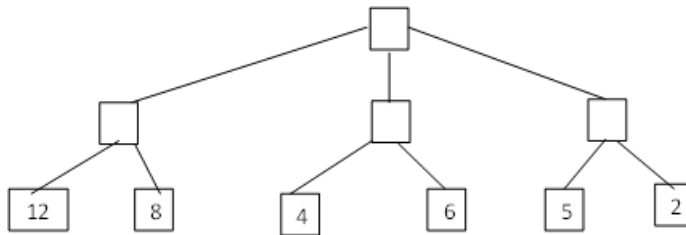
Figure 1.

Q5. (a) Define the terms chromosome, fitness function, crossover and mutation as used in Genetic algorithms. Explain how Genetic algorithms work? [4+6]

(b) Consider the graph given in Figure 2 below. Assume that the initial state is A and the goal state is G. Show how **Greedy Best first Search** would create a search tree to find a path from the initial state to the goal state: [10]
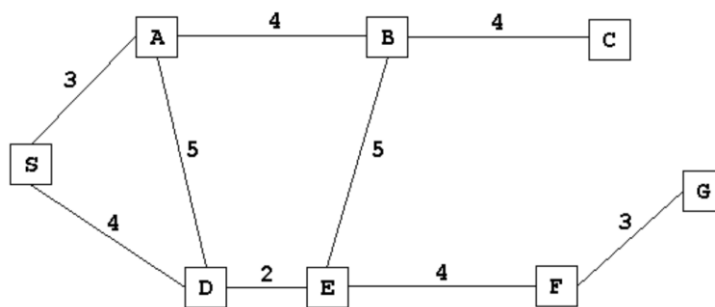

Figure 2.

At each step of the search algorithm, show which node is being expanded, and the content of fringe. Also report the eventual solution found by the algorithm, and the solution cost. Assuming the straight-line distance as the heuristics function: h(S)=10.5, h(A)=10, h(B)=6, h(C)=4, h(D)=8, h(E)=6.5, h(F)=3 and h(G)=0.

Q6. Answer any two (2) of the following [20]
  (i)   What are steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence.
  (ii)   Draw and explain the basic building blocks of Learning Agent.
  (iii) How will you convert the propositional logic statement into CNF? Give a suitable example at each step.

(**Time: 3hrs**)   (**Marks 80**)

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

Q1. (a) Encrypt the message "Cryptography is fun" with a multiplicative cipher with key = 15. Decrypt to get back original plaintext.   **05**

(b) With the help of suitable examples compare and contrast monoalphabetic ciphers and polyalphabetic ciphers?   **05**

(c) What are the properties of hash functions? What is the role of a hash function in security?   **05**

(d) What are the different protocols in SSL? How do the client and server establish an SSL connection   **05**

Q2. (a) What is a digital certificate? How does it help to validate the authenticity of a user? Explain the X.509 certificate format.   **10**

(b) With reference to DES comment on the following: **10**
    i)   Block size and key size
    ii) Need for expansion permutation
    iii) Avalanche and completeness effects
    iv) Weak keys and semi-weak keys
    v)   Role of S-box.

Q3. (a) What are the different types of viruses and worms? How do they propagate?   **10**
(b) What are the various ways for memory and address protection in Operating System?   **10**

Q4. (a) Explain briefly with examples, how the following attacks occur: **10**
    i)   Phishing attack
    ii) Denial of Service attack
    iii) SQL injection attack
    iv) Cross-site scripting attack

(b) How is security achieved in the transport and tunnel modes of IPSec? What are security associations?   **10**

Q5. (a) What are the different threats to emails? Give an algorithm to secure emails being sent from user A to user B.   **10**

(b) A and B wish to use RSA to communicate securely. A chooses public key as (7,119) and B chooses public key as (13,221). Calculate their private keys. A wishes to send message m=10 to B. What will be the ciphertext? With what key will A encrypt the message "*m*" if A needs to authenticate itself to B.   **10**

Q6. (a) Compare and contrast (any two): **10**
   i) Block and stream ciphers
   ii) MD-5 versus SHA
   iii) Key generation in IDEA and Blowfish

(b) What are the different components of an Intrusion Detection System? **10**
   Compare the working of signature based IDS with anomaly based IDS.

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(3 Hours)   **Total Marks: 80**

N.B   : (1) Question **No. 1** is **compulsory**
        (2) Attempt **any three** questions out of remaining **five.**

1. (a) Distinguish between hard computing and soft computing.   **5**

    (b) Explain fuzzy extension principle with suitable example.   **5**

    (c) Prove that f `(net) = (1 - O^2) / 2 for bipolar continuous activation function   **5**

    (d) What are hybrid systems? Explain any 2 types of hybrid systems.   **5**

2. (a) Explain EBPTA with the help of block diagram.   **10**

    (b) What do you understand by learning? Compare the different learning rules w.r.t   **10**
         weight adjustments, initial weights, type of learning, neuron characteristics and
         number of neurons.

3. Design a fuzzy logic controller for an air-conditioner. Consider room temperature   **20**
    and humidity as input and AC temperature as output. Use four descriptors each
    for inputs and output. Derive proper set of rules and using appropriate de-
    fuzzification technique get exact AC temperature. The design should be
    supported by appropriate figures. Also prove that if the room temperature is hot
    and humidity is high then the AC temperature is set to cool.

4. (a) Explain working of LVQ with the help of an algorithm. Also construct and test   **10**
         an LVQ net with five vectors assigned to two classes. The given vectors along
         with the classes are as shown in Table 1.

Vector	Class
[0 0 1 1]	1
[1 0 0 0]	2
[0 0 0 1]	2
[1 1 0 0]	1
[0 1 1 0]	1

    Consider α = 0.1. Show the weight change for only one epoch.

    (b) Draw and explain the architecture of ANFIS. Briefly explain the application of   **10**
         ANFIS.

5. (a) Explain Genetic Algorithm with a suitable flowchart. Explain Roulette wheel selection and rank selection methods used in GA. **10**

(b) Explain the alpha cut and strong alpha cut features of fuzzy membership function. **10**

Also consider the following fuzzy sets.

A = {(0, 1), (0.1, 2), (0.2, 3), (0.3, 4), (0.4, 5), (0.5, 6), (0.6, 7)}

B = {(1, 1), (0.9, 2), (0.8, 3), (0.7, 4), (0.6, 5), (0.5, 6), (0.4, 7)}

Find the following

A/B

$(A \cap \overline{B})_{0.4}$

$\overline{A}_{0..2}$

$\dfrac{\overset{.}{B}_{0.6}}{\overline{A}_{0.8}}$

6. (a) What is linear separability? Using the linear separability concept, obtain the response for AND function with bipolar inputs and targets. **10**

(b) Explain the Newton's methods of derivative based optimization techniques. **10**

(3 Hours)   **80 Marks**

N.B.   1. Question No.1 is Compulsory
        2. Attempt any THREE questions out of remaining.
        3.Assume suitable data wherever required

Q.1.   Answer the following   5*4=20M
  a.   Explain Fidelity Criteria
  b.   Give the Difference between Lossless and Lossy Compression
  c.   Explain Opening and Closing
  d.   Two images can have the same histogram (Justify / Contradict with reason)

Q.2.a Using the Butterfly diagram , compute Hadamard transform for   10 M
       X(n)={ 1,2,3,4,1,2,1,2}

Q.2.b. Find the arithmetic codeword for the message: INDIA   10 M

Q.3.a What are the different types of redundancies in an image? Explain Run   10 M
       Length Encoding with appropriate example. What are its drawbacks?

Q.3 b. Find the DCT of the following image   10 M

2	4	4	2
4	6	8	3
2	8	10	4
3	8	6	2

Q.4.a   Perform Histogram Equalization and Draw new equalized histogram of the   10 M
        following image data

Grey levels	0	1	2	3	4	5	6	7
No of pixels	790	1023	850	656	329	245	122	81

Q.4.b. Explain Global processing via Graph Theoretic Technique ?Find the optimal   10 M
        path for the following image

5	6	1
6	7	0
7	1	3

Q.5.a   Given   10 M

10	44	16
10	14	48
11	10	22

Find 3 bit IGS coded image and calculate compression Factor , BPP and MSE

Q.5. b   Explain Hough Transform with suitable example   10 M

Q.6   Write short notes on   5*4=20M

1) 4,8 and M-connectivity
2) Vector quantization
3) Median Filter
4) HSI color model

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