BE Comp. Sem VII (R) DEC. 2018

Paper / Subject Code: 42101 / Digital Signal Processing

B.E-Sem VII - (Computer) - Digital Signal Processing - 1/2

19.11.18.

Total Marks 80

(3 Hours)

N.B: 1) Question **number 1** is compulsory.
2) Attempt **any three** out of remaining.
3) Assume suitable data if **necessary** and justify the assumptions.
4) Figures to the **right** indicate full marks.

i a) State whether unit step sequence is energy or power signal. Calculate Corresponding energy or average power as the case may be. [05]

b) Perform convolution operation between given function in time domain if [05]
$x(n)=\{ 2^{-n} \quad -2<=n<=2$
$\{ 0 \quad$ otherwise and
$h(n)=u(n+2)-u(n-2)$

c) Find the auto-correlation of the causal sequence $x(n)=\{2, 4, 6, 8\}$ [05]

d) State the condition for stability of LTI system and determine for the given discrete time system [05]
$h(n)=(2)^n u(n)+(0.5)^n u(n)$ is stable or not.

2 a) Determine whether or not the following signals are periodic. If periodic specify its fundamental period. [10]
i) $x1(n)=\sin(0.2\Pi n+3)$
ii) $x2(n)=\sin(0.5\Pi n)+5\cos(0.25n)$

b) i) If $x(n)=\{3, 4, 0, 6\}$ Find DFT X[k] [10]
ii) Using results obtained in i) and not otherwise find DFT of following sequences
$x1(n)=\{6, 3, 4, 0\}$

3 a) Check whether following systems are [10]
i) Static or Dynamic
ii) Linear or Nonlinear
iii) Shift variant or Shift invariant
iv) Causal or Noncausal
i) $y(n)=n.x^2(n)$
ii) $y(n)=3x(n) + 5$

b) For $x(n)=\{1, 2, -1, 5, 0, 4\}$, Plot the following discrete time signals [10]
$\uparrow$
i) $x(n+3)$
ii) $x(-n-2)$
iii) $x(n).u(n-1)$
iv) $x(n-2).\delta(n-2)$
v) $x(2n)$

4 a) Find the DFT of the 8 point causal sequence using radix 2 DIT-FFT [10]
$x(n)=(2, 1, 2, 1, 1, 2, 1, 2\}$

b) Find the circular convolution of following causal sequences in time domain [05]
$x1(n)=\{1, 2, 5\}$ and $x2(n)=\{4, 7\}$
so that result of linear and circular convolution will be same.

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c) Compare 128 point DFT and Radix 2- DIT-FFT with respect to the number of complex additions and multiplications required. [05]

5 a) In a LTI system the input x(n)={1, 1, 3} and impulse response is h(n)={2, 3}. Determine the response of LTI system using radix-2 DIT-FFT method. [10]

b) Consider the 8 point sequence defined as 0<=n<=7 [05]
x(n)={1, 2, 3 , 0, 1, 2, 5, 2} with a 8 point DFT. Evaluate the following function X[k] without computing DFT
$\sum |X[k]^2|$

c) Determine 4 point DFT amd sketch the magnitude of DFT x(n)={ 1, 1, 0, 0} [05]

6 a) Find Linear Convoltion of following causal signals using overlap add method. [10]
x(n)={1, 2, 0, 1, 2, 3, 1, 1, 2, 1, 0, 3}
h(n)={2, 2, 1}

b) Write a detailed note on speech recognition. [05]

c) Compare Microprocessor with Digital Signal Processor. [05]

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Time: 3 Hours Marks: 80

N.B: Q.1 Compulsory. Solve any 4.

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Q. 1 **Summaries and find Plain text by decrypting cipher text "XVWG" using Hill Cipher Substitution technique.**

KEY matrix →

$$\begin{bmatrix} 3 & 7 \\ 5 & 12 \end{bmatrix}$$

10

Q. 1 b) **Consider a scenario where an intruder wants to access some valuable information from an ongoing communication. What security services should be implemented in system and which mechanism can be used to achieve those security services?**

Q. 2 a) Encrypt " **academic committee will meet today** " using Playfair Cipher with Keyword "**ROYAL ENFIELD**" 10

Q. 2 b) Discuss CBC and OFB Block cipher Modes with examples. 10

Q. 3 a) If generator g=2 and n or p =11, using diffie Hellman algorithm, solve the following: 10

i) Show that 2 is primitive root of 11
ii) If A has public key 9, What is A's Private Key
iii) If B has public key 3, What is B's Private Key
iv) Calculate shared secret Key

Q. 3 b) **Elaborate International Data Encryption Algorithm (IDEA) and its key generation?** 10

Q. 4 a) Explain Digital Signature and Digital Certificate used for authentication 10

Q. 4 b) Calculate Cipher Text using RSA Algorithm for following data: Prime Numbers P=7, Q= 17. Plain Text Message M=10. Find pair of keys and Cipher text (D,C and P).

Q. 5 a) Explain Hash Based Message Authentication Code. Give Example also. 10

Q. 5 b) Describe various types of Intrusion Detection System (IDS). What are Active and Passive IDS?

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Q. 6 a) Convert given PT = $(CA)_{16}$ with Key (1011001101) using S-DES Algorithm.

Given-

P10 (3,5,2,7,4,10,1,9,8,6) P4 (2,4,3,1)

P8 (6,3,7,4,8,5,10,9) IP (2,6,3,1,4,8,5,7)

E/P (4,1,2,3,2,3,4,1) IP^{-1} (4,1,3,5,7,2,8,6)

S0=

1	0	3	2
3	2	1	0
0	2	1	3
3	1	3	2

S1=

0	1	2	3
2	0	1	3
3	0	1	0
2	1	0	3

Q. 6 b) Explain concept of key management along with its distribution system.

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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 a **Self Driving Car** agent. Characterize its environment.
(b) Give the initial state, goal test, successor function, and cost function for the **Travelling salesman problem**
(c) What will be the job of each of the components (Performance element, Learning element, Critic and problem generator) of learning agent?
(d) Consider an 8 puzzle problem with the following initial state and goal state.

7	2	4
5		6
8	3	1

Initial State

	1	2
3	4	5
6	7	8

Goal State

Generate successors at next two levels. Apply number of misplaced tiles as the heuristic function. Which successor nodes will be selected at each level if we apply Hill climbing algorithm?
(e) Convert the following English sentence into predicate logic and then into CNF
"**The culprit was tall and dark**"

Q2 (a) Explain decision tree learning with an example. What are decision rules? How to use it for classifying new samples? [10]

(b) Write first order logic equivalent of the following statements: [10]
(i) Anand likes only comedy films.
(ii) The culprit has to be one from Tinker, Tailor and Butler.
(iii) Whoever can read is literate.
(iv) Every child loves Santa.
(v) Some birds cannot fly.

Q3 (a) Design a classical planner for air cargo transportation problem using STRIPS. The problem involves loading, unloading cargo and flying it from place to place. Define three actions: Load, Unload and Fly. The actions affect two predicates: In(c, p) means that cargo c inside plane p, and At(x, a) means that object x (either plane or cargo) is at airport a. [10]

(b) Give a formal definition of a Bayesian Belief Network (BBN). Illustrate the process of constructing a BBN with a suitable scenario. What type of inferences can be drawn from BBN network? [10]

PTO

Q4 (a) Compare **Breadth first search (BFS), Depth first search (DFS),Depth limited search (DLS)** and **Iterative Deepening search** algorithms based on performance measure with justification: Complete, Optimal, Time and Space complexity. [10]

(b) Write a pseudo code for alpha-beta algorithm. Apply alpha-beta pruning on example [10]

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given in Figure 1 considering first node as max.

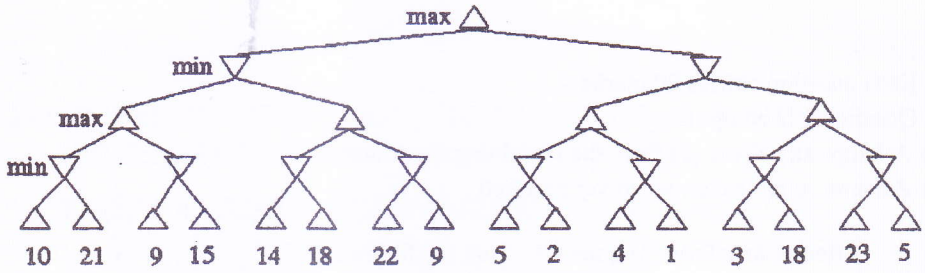

Figure 1

Q5 (a) How will you convert the propositional logic statement into CNF? Give a suitable example at each step? [10]

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

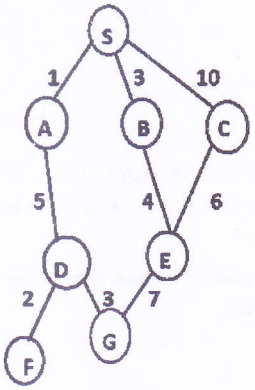

Figure 2

At each step of the search algorithm, show which node is being expanded, and the content of fringe (OPEN). Also report the eventual solution found by the algorithm, and the solution cost. Assuming the straight-line distance as the heuristics function: h(S)= 13, h(A)=7, h(B)=9, h(C)=11, h(D)=2, h(E)=4, h(F)=1, and h(G)=0.

Q6 Answer any two (2) of the following [20]

(a) What are the steps involved in natural language processing (NLP) of an English sentence? Explain with an example sentence.

(b) Draw and describe each component in the Architecture of Expert System with a suitable example

(c) Explain how Genetic algorithms work. Define the terms chromosome, fitness function, crossover and mutation as used in Genetic algorithms

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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) Describe the various soft computing characteristics. (05)
   (b) Explain any five defuzzification techniques. (05)
   (c) Explain the different types of activation functions. (05)
   (d) With suitable example explain the concept of linear separability (05)

2. Design a fuzzy logic controller for a train approaching or leaving a station. The inputs are the distance from the station and speed of the train. The output is the amount of brake power used. Use four descriptors for each variable. Derive a set of rules for control action and appropriate defuzzification. The design should be supported by figures. Prove that when the train is nearer to station and speed is medium, the brake power used is high. (20)

3 (a) Explain how learning happens in unsupervised learning. Also write the algorithm of KSOFM. (10)

(b) Consider R and S be fuzzy relations defined as follows (4)

$$\tilde{R} = \begin{bmatrix} 0.8 & 0.1 \\ 0.2 & 0.7 \\ 0.6 & 0.3 \end{bmatrix} \quad \tilde{S} = \begin{bmatrix} 0.2 & 0.4 & 0.3 \\ 0.9 & 0.5 & 0.1 \end{bmatrix}$$

Find the following fuzzy compositions

1. $\tilde{T} = \tilde{R} \circ \tilde{S}$
2. $\tilde{J} = \tilde{R} \bullet \tilde{S}$

(c) A = {0.../1 + 0.3/2 + 0.1/3 + 0.5/4 + 0.3/5 + 0.4/6 + 0.7/7} (6)
B = {0.1/1 + 0.8/2 + 0.6/3 + 0.4/4 + 0.7/5 + 0.1/6 + 0.9/7}

Find the following

1. $(\bar{A} \cap \bar{B})_{0.5}$
2. $\bar{B}'_{0.3}$
3. $(A \cap B)'_{0.7}$
4. $(A/B)_{0.4}$
5. $(A \cup B)$
6. $(\overline{B - A})$

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4. (a) Comment on the following: (4)
For a bipolar binary neuron, the weight change formula for a perceptron training rule reduces to
$$\Delta w = \pm 2cx$$

(b) Implement perceptron training rule for a network with the following data (6)
(X_1 = [2 1 -1], d_1 = -1); (X_2 = [0 -1 -1], d_2 = 1),
Initial weights: W_1 = [0 1 0].
Repeat the training sequence (X_1, d_1), (X_2, d_2) until two correct responses in a row are achieved. Assume c=1 and f(net) = sgn(net).

(c) Explain Genetic Algorithm in detail with the help of flowchart. (10)

5. (a) Explain Error Back Propagation Training Algorithm with the help of neat block diagram. (10)

(b) What are hybrid systems? Explain Adaptive Neuro Fuzzy Inference system (ANFIS) with the help of example. (10)

6. (a) Explain the Newton's Methods of optimization in detail. (10)

(b) Explain the Genetic-Neuro Hybrid Systems. Also mention its advantages and disadvantages (10)

Paper / Subject Code: 42106 / Elective- II 3)Image Processing

BE (COMPUTER) SEM VII CBSGS 10/12/18 (1/2)

(3 hours) **Marks:[80]**

N.B. 1. Question **No. 1** is compulsory
2. Attempt any **three** out of remaining
3. Assume suitable data if **necessary** and justify the assumptions
4. Figures to the **right** indicate full marks

Q.1. (a) Explain unitary matrix. [05]

(b) Explain opening and closing operations in terms of dilation and erosion. [05]

(c) Explain zero memory operations. [05]

(d) Explain fundamental steps in Image Processing. [05]

Q.2. (a) Explain DCT and its properties. Find the DCT for the following image [10]

2	0	1	0
1	1	0	1
1	0	0	1
2	1	2	3

(b) What are the different types of redundancies in digital image? Give methods to remove those redundancies. [10]

Q.3. (a) Explain global processing via graph theoretic technique. Find the optimal path for the following image. [10]

2	2	7
2	7	5
0	1	5

(b) What is image segmentation? Explain the principles of and differences among the three basic approaches to region growing, region splitting and merging and thresholding. [10]

Q.4. (a) A digital image with 8 quantization level is given below. Perform Histogram equalization. [10]

$f(x,y) = |x-y|$

for x=0 to 7

y=0 to 7

(b) Justify/contradict the following statement :- [10]

a) Enhancement process does not add any information to the image.

b) Shape number uniquely describes an object.

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Q.5. (a) Find the Arithmetic codeword for the sequence a1a2a2a3a3 for the symbol a1 a2 and a3 with following frequencies : [10]

Source Symbol	Frequency
a1	0.2
a2	0.4
a3	0.4

(b) State & prove symmetry & periodicity property of DFT. Explain basic difference between DFT and DCT. [10]

Q.6. Write short notes on **(Any two)** [20]

a. Moments, Normalised moment and Central moments

b. Fidelity criteria

c. HSI color model

d. Edge linking using Hough transform
