

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of computer Science & Engineering

4th year 2nd Semester B.Sc. Engineering Final Examination-2018

Course Name: Machine Learning

Course No.: CSE490

Full Marks: 60

Times: 3(Three) Hours

N.B.:

- i. Answer **SIX** questions, taking any **THREE** from each section.
- ii. All questions are of equal values
- iii. Use **separate answer script** for each section.

Section -A

1. a) What are the main goals of machine learning? Write the five applications of machine learning. 3
b) What is linear regression? Find maximum likelihood for linear regression. 7
2. a) Write down the properties of maximum likelihood estimators. 2
b) What is the predicted probability of a 25 yr. old having pregnancy success with first ART attempt? 2
c) Considering three random variables representing color, size and shape of a fruit, each taking three values (color takes red, green and blue, size takes small, large and medium, and shape takes circle, rectangle and triangle). Assume prior probability of your own for each case and then classify of a new instance (green, large and circle) with Naïve Bayes classifier.
3. a) Write down the advantages and disadvantages of naïve Bayesian classifier. 3
b) Write down the K Nearest Neighbor (KNN) algorithm. Briefly explain the KNN for interpolation. 7
4. a) Compare supervised and unsupervised learning. 3
b) How can you make a decision tree using information gain based on the following table? 7

Predictors				Target
Outlook	Temp	Humidity	Windy	Play Golf
Rainy	Hot	High	False	No
Rainy	Hot	High	True	No
Overcast	Hot	High	False	Yes
Sunny	Mild	High	False	Yes
Sunny	Cool	Normal	False	Yes
Sunny	Cool	Normal	True	No
Overcast	Cool	Normal	True	Yes
Rainy	Mild	High	False	No
Rainy	Cool	Normal	False	Yes
Sunny	Mild	Normal	False	Yes
Rainy	Mild	Normal	True	Yes
Overcast	Mild	High	True	Yes
Overcast	Hot	Normal	False	Yes
Sunny	Mild	High	True	No

Section-B

5. a) How does the perceptron's training algorithm work in case of the logical AND operation? 2
 b) Why is multi-layer learning better than two layer learning in ANN? 2
 c) Write down the back propagation by explicitly mentioning the input, hidden and output layers computations. 6

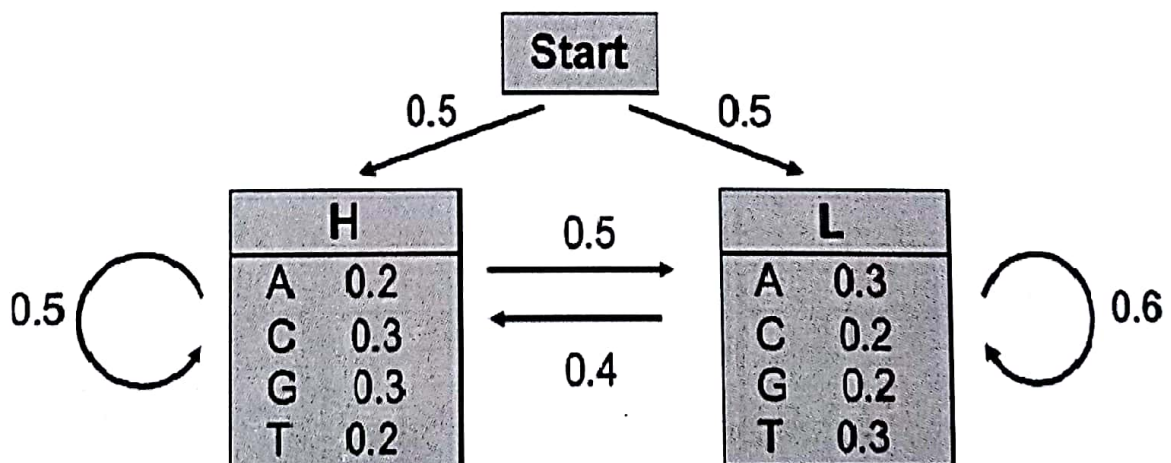
6. a) What is support vector machine? Write down the application of SVM. 2
 b) How does support vector machine work? Explain with example. 3
 c) Write down the strength and weakness of k-means clustering. 2
 d) What is clustering? Discuss different types of clustering. 3

7. a) What is dimension reduction? 1
 b) Discuss the steps of PAC learning model. 3
 c) Calculate F-score for the following table. 3

Actual Class\Predicted class	cancer = yes	cancer = no	Total
cancer = yes	90	210	300
cancer = no	140	9560	9700
Total	230	9770	10000

- d) Explain the reinforcement learning. 3

8. a) What is hidden markov model? Explain with example. 1
 b) Consider the sequence $S=GGCACTGAA$ from the following figure. Calculate the most probable path using the Viterbi algorithm. 6



- c) Define prior probability, posterior probability and likelihood. 3

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Department of Computer Science and Engineering

4th Year 2nd Semester B.Sc. Engineering Final Examination-2018

Course No.: CSE450

Course Title: Artificial Intelligence

Full Marks: 60

Time: 03 hours

N.B.

- i) Answer **SIX** questions, taking any **THREE** from each section.
- ii) All questions are of equal values.
- iii) Use separate answer script for each section.

Section-A

1. a) "AI is the study and construction of rational agents" – do you agree with this statement? If yes justify your answer in two points. 3
b) Give the initial state, actions, transition model, goal test and path cost for the following cases: 6
 - i. You want to find the telephone number of your friend who lives in Gopalganj, given a state of directories alphabetically order by city.
 - ii. You are lost in a small country town, and must find a drug store before your hay fever becomes intolerable. There are no maps and the natives are all located indoors.
c) When UCS identical to BFS? 1
2. a) Determine the environment characteristics (i.e. observable, deterministic or stochastic, episodic or sequential, discrete or continuous) of the "Medical Diagnosis" and also give the reason for that. 5
b) How utility based agent take advantages compare to goal based agent? 3
c) How does the uninformed search strategy differ from the informed search strategy? 2
3. a) Consider the following problem: 8

"The law says that it is a crime for an American to sell weapons to hostile nations. The country Nono, an enemy of America, has some missiles, and all of its missiles were sold to it by Colonel West, who is American".

Now prove that "West is a criminal", using the forward chaining algorithm.

b) Arrange a parse tree for the sentence "The silly robot moved the red pyramid to the big table." 2
4. a) Consider the following sentences: 6
 - i. John likes all kinds of food.
 - ii. Apples are food.
 - iii. Chicken is food.
 - iv. Anything anyone eats and isn't killed by is food.
 - v. Bill eats peanuts and is still alive.
 - vi. Sue eats everything Bill eats.

Now translate these sentences into formulas in predicate logic.

b) Suppose some axioms are given below: 4

A
 $(A \wedge B) \Rightarrow C$
 $(D \vee E) \Rightarrow B$
E

Now prove C using resolution in propositional logic.

Section-B

5. Develop an effective and complete plan using **STRIPS** approach (or any other approaches of your choice) to convert given (Fig-5) Initial State into Goal State. 10

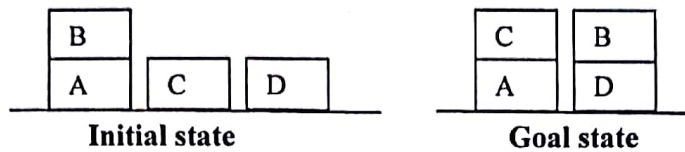


Fig-5 : A simple blocks world problem

6. a) Explain the learning structure algorithm for Bayesian Network. 5
 b) Illustrate the Maximum-Likelihood Estimation method. 5
7. a) Suppose a physician is considering a case of cholestatic jaundice, i.e., the development of a yellow hue to a patient's skin (jaundice) due to elevated blood levels of bilirubin (a pigment produced by the liver). This problem is caused by an inability of the liver to excrete bile normally, often due to a disease within the liver itself (intrahepatic cholestasis) or blockage of the bile ducts outside the liver (extrahepatic cholestasis). In a typical case of this type, the diagnostic hypothesis set might well include two types of intrahepatic cholestasis, hepatitis (Hep) and cirrhosis (Cirr), and two types of extrahepatic cholestasis, gallstones (Gall) and pancreatic cancer (Pan). In the D-S theory, this set of four disorders is called a frame of discernment, denoted Θ or $\{\text{Hep}, \text{Cirr}, \text{Gall}, \text{Pan}\}$. As noted earlier, the hypotheses in Θ are assumed mutually exclusive and exhaustive. Suppose that for a given patient, one observation supports intrahepatic cholestatic = $\{\text{Hep}, \text{Cirr}\}$ to degree 0.8 (m_1) whereas another disconfirms hepatitis (i.e., confirms $\{\text{Hep}, \text{Gall}, \text{Pan}\}$) to degree 0.6 (m_2). Find $Bel_1 \oplus Bel_2 (\{\text{Hep}, \text{Cirr}\})$ and $Bel_1 \oplus Bel_2 (\{\text{Hep}, \text{Gall}, \text{Pan}\})$.
 If the third belief function (m_3) for the same patient, corresponds to a new observation which confirms the diagnosis of hepatitis to the degree 0.7, then compute $m_3 \oplus m_4$, where $m_4 = m_1 \oplus m_2$. 7
 b) Explain the Fuzzy Logic and Fuzzy set theory. 3
8. a) Discuss A* algorithm. Give one example where it is suitable to apply. 4
 b) Consider the Water Jug problem as stated here: "You are given two jugs, a 4gallon one and a 3-gallon one. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into the 4-gallon jug?" Represent this as a problem in State Space Search and state its Production Rules. Show at least one solution to this problem. 4
 c) What is Robotics? Write down the applications of robotics. 2

Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of Computer Science and Engineering

4th Year 2nd Semester B.Sc. Engineering Final Examination-2017

Course Title: Cryptography and Network Security

Course Code: CSE 462

Total Marks: 60

Time: 3 (three) Hours

N.B.: i) Answer **SIX** questions taking any **THREE** from each Section, ii) All questions are of equal values.

iii) Use separate answer script for each section

SECTION-A

- Q.1 (a)** Draw the simplified model of conventional encryption. What are the two general approaches to attacking a conventional cipher? 3
- (b)** Describe the Network and Documents Supporting Security Policies. 2
- (c)** (i) Construct a Playfair matrix with the key *occurrence*. 5
- (ii) Using this Playfair matrix of (i) encrypt and decrypt the following message:
Have a nice day
- Q.2 (a)** Why does PGP generate a signature before applying compression? What is S/MIME? 2
- (b)** Depict the Intrusion Detection Systems (IDSs) and Intrusion Prevention Systems (IPSs). 4
- (c)** What is meant by security policy database selector? Explain the IPSec authentication header with proper diagram. 4
- Q.3 (a)** Describe the mutual authentication process of Smart Card with appropriate diagram. 3
- (b)** What is traffic padding and what is its purpose? Show the differences exist between link and end-to-end encryption approaches using appropriate diagram. 4
- (c)** One local network vendor provides a key distribution facility, as illustrated in Fig-3(c). Describe the scheme. 3

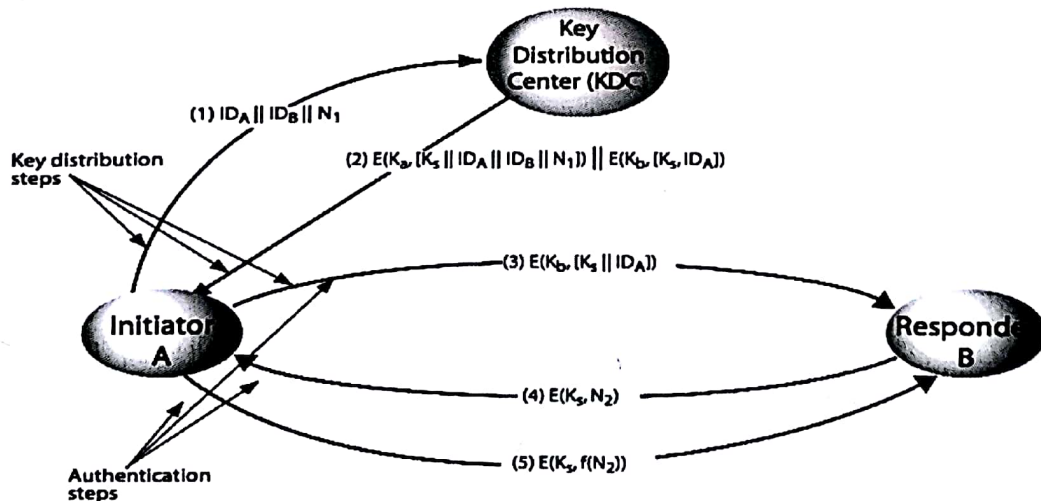


Fig-3(c)

- Q.4 (a)** Derive two keys for S-DES scheme for the following values: 4
 (i) 10-bit key as input key: 1010000110,
 (ii) Two permutation function P10 and P8 as follows:

P10									
3	5	2	7	4	10	1	9	8	6

P8							
6	3	7	4	8	5	10	9

- (b) Write down the AES evaluation criteria used by NIST. Apply the shift row transformations for the following state: 4

63	C9	FE	30
A2	B5	67	D4
EF	3C	5E	32
AB	CD	EF	21

- (c) Draw the single round of DES algorithm. 2

SECTION-B

- Q.5 (a)** List and briefly define three classes of intruders. What are the two common intrusion techniques used to protect a password file? 4
 (b) Show the taxonomy of malicious program. What are typical phases of operation of a virus or worm? 4
 (c) Explain the Signature Actions. 2
- Q.6 (a)** Demonstrate the public-key cryptosystem for secrecy and authentication. 4
 (b) You are given $p = 3$, $q = 11$ and $d = 9$. Give the sender's and receiver's computations for the plaintext "PADMA" by using RSA algorithm. 4
 (c) Show the differences between conventional encryption and public-key encryption. 2
- Q.7 (a)** Describe the scheme of publicly available directory. In this scheme, any weakness is present or not. If yes, how to recover the weakness. 4
 (b) Users A and B use the Diffie-Hellman key exchange technique with a common prime $q=71$ and a primitive root $a = 7$ 4
 (i) If user A has private key $X_A = 5$, what is A's public key Y_A ?
 (ii) If user B has private key $X_B = 12$, what is B's public key Y_B ?
 (iii) What is the shared secret key?
 (c) List the steps of SHA-1 logic. 2
- Q.8 (a)** Depict the three major components to most worm attacks. 3
 (b) What requirements should a digital signature scheme satisfy? What is the basic difference between direct and arbitrated digital signature? 2
 (c) Draw the schematic diagram of basic uses of MAC. What is hash function and what properties should have to be useful for message authentication in hash function? 5

SECTION-A

1. (a) Explain the fundamental steps in digital image processing. 3
 (b) Write a short note on: i) Image formation in the eye, ii) Brightness adaptation in an eye. 5
 (c) Define quantization. Quantization means loss of information-is it true or not and why? 2
2. (a) With a suitable diagram, explain the process of image acquisition using single sensor. 3
 (b) Define 4-adjacency, 8- adjacency and m- adjacency. 3
 (c) Find D_s and D_m for the 2-D section with $V=\{0,1\}$ and $V=\{1,2\}$ between p and q. 4

$$\begin{matrix} & \begin{matrix} 5 & 4 & 3 & 1 & 1 \end{matrix} & (q) \\ \begin{matrix} 5 \\ 3 \\ 2 \\ 1 \end{matrix} & \begin{bmatrix} 4 & 0 & 2 & 0 \\ 2 & 0 & 2 & 4 \\ 1 & 1 & 3 & 5 \\ 3 & 5 & 1 & 3 \end{bmatrix} \end{matrix}$$

3. (a) Write a short note on KL transform. 3
 (b) Image is a function-explain it. 2
 (c) Consider a 2×2 transform matrix A and the image U, given below: 5

$$A = \frac{1}{2} \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix} \quad U = \begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix}$$

Calculate the transformed image V and the basis images. Check the image U using basis images and transformed image V.

4. (a) Explain the difference between fixed length and variable length coding with example. 2
 (b) What is image thresholding? Write down the importance of it. 4
 (c) What is histogram equalization? Derive the mathematical term for histogram equalization in image processing. 4

SECTION-B

5. (a) Explain the following: i) Gray-level slicing, ii) Bit plane slicing. 3
 (b) Find out DFT coefficients of a digital image $f(x,y)$ of size $N \times N$ where $f(x,y)=1$, for all values of x and y. 3
 (c) Perform histogram equalization on the following 8×8 image. The gray level distribution of the image is given below 4

Gray level(r_k)	0	1	2	3	4	5	6	7
No.of Pixels(P_k)	8	10	10	2	12	16	4	2

6. (a) What is morphology? Write down the application of it. 3
 (b) Describe dilation and erosion mathematically. Prove that dilation and erosion are dual of each other. 4
 (c) Explain any four important noise probability density functions. 3
7. (a) Explain the pseudo color image processing with neat functional block diagram. 4
 (b) $(RGB) = (0.683, 0.1608, 0.1922)$ convert this in to HIS model. 3
 (c) Explain a general image compression system model with block diagram. 3
8. (a) What is image segmentation? Why image segmentation is necessary? 3
 (b) Discuss opening and closing morphological operation. 3
 (c) What is the basic principle of edge detection technique? List some commonly used edge detecting operators. 4