KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2020
Department of Computer Science and Engineering
CSE 4105
Computer Networks

TIME: 1.5 hours FULL MARKS: 120

N.B. i) Answer **ANY TWO** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY TWO** questions from this section in Script A)

1. a) What does protocol achieve? Differentiate between intranet and extranet. (10)
   b) Why do we need Web caching? Discuss about the consistency of Web caching. (10)
   c) What is P2P architecture. Describe what transport service does an app need? (10)

2. a) Compare among WWW, HTTP and Internet. Show the HTTP request and response message format. (10)
   b) Suppose, *Alice* (ID – "alice@net.edu") wants to send message to *Bob* (ID – "bob@denza.edu"). Show SMTP interactions between SMTP client and SMTP server for this communication. (20)

3. a) Consider the data bits $D = 11011011$ and Generator $G = 10110$. Calculate the Cyclic Redundancy Check bit R. (14)
   b) How does RSA provide digital signature mechanism? (10)
   c) Justify that – "Switch is more intelligent than hub". (06)

SECTION B

(Answer **ANY TWO** questions from this section in Script B)

4. a) Why do we need Network Address Translation (NAT)? Briefly explain how does NAT work. (10)
   b) Compare the contrast link-state and distance vector routing algorithms. (09)
   c) Suppose a source and a destination are connected through a switch and a router. If the source sends a message to the destination, then how do encapsulation and decapsulation happen in each layer of TCP/IP model of above-mentioned devices. Explain with necessary figure. (11)

5. a) Mention different components of Domain Name System (DNS). Explain various types of name server used in DNS by presenting their architecture and working mechanism. (11)
   b) What is the relation between window size and sequence number in case of selective repeat? Why this relation is needed? (09)
   c) List down the steps involved in SSL handshaking. Also present a pictorial view of packet transmission. (10)

6. a) Describe the technologies that are used for transitioning from IPv4 to IPv6. (06)
   b) What is Ethernet? Describe how does CSMA/CD protocol work with a detail look on exponential back-off algorithm. (12)
   c) Suppose, a company has 200 personal computers and 10 servers. The network administrator wants you to dynamically assign the IP address of those personal PCs. How personal computer get the IP address if you have a network address: 172.16.0.0/24. Also, state the dynamic range of IP addresses. (12)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2020
Department of Computer Science and Engineering
CSE 4109
Artificial Intelligence

TIME: 1.5 hours FULL MARKS: 120

N.B. i) Answer **ANY TWO** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY TWO** questions from this section in Script A)

1. a) What is an agent? Explain the structure of a learning agent. (10)
   b) What is the significance of Turing test in artificial intelligence? Explain briefly. (10)
   c) What is PEAS? For each of the following activities, give a PEAS description of the task environment. (i) Playing soccer and (ii) Knitting a sweater. (10)

2. a) Develop a general structure of a fuzzy expert system. Hence, explain this system using "Air Conditional Control" problem. (12)
   b) "A* search is optimal if $h(n)$ is consistent"-Justify the statement. (09)
   c) A doctor knows that the disease meningitis causes the patient to have stiff neck 70% of the time. The prior probability that a patient has meningitis is 1/50,000 and for stiff neck is 1%. Calculate, P(meningitis | stiff neck). (09)

3. a) What do you mean by Adversarial search? "Game playing is one kind of adversarial search"-Justify the statement. (08)
   b) What is local search? Explain how to use local search with min-conflict heuristic algorithm for solving n-queen problem. (10)
   c) Suppose one of the states of "Tic-Tac-Toe" is given in the following figure where you mark crosses (×'s) and machine marks circles (O's). Also suppose that now it is your turn to move. What will be your move using min-max procedure? Draw the complete search tree to show how you will find the wining state. Consider you as "max" and computer as "min". (12)

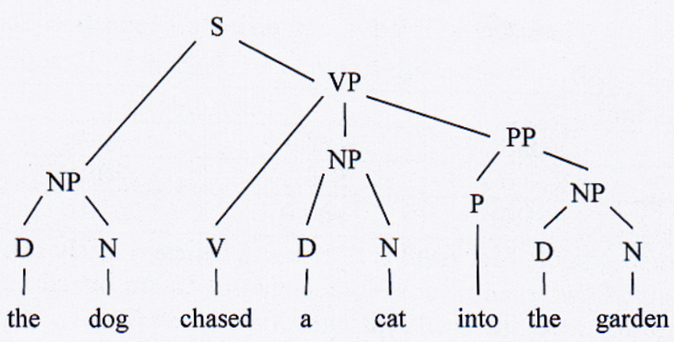
	O	O
	×	
×		

SECTION B

(Answer **ANY TWO** questions from this section in Script B)

4. a) How can you construct a knowledge-based agent using declarative approach? Use example(s). (08)
   b) What is unification in First-Order Logic (FOL)? Explain different inference rule for FOL. (09)
   c) Use forward and backward chaining mechanism to prove that curiosity killed the cat for the following knowledge domain: (13)
   "Everyone who loves all animals is loved by someone. Anyone who kills an animal is loved by none. Jack loves all animals, Either Jack or curiosity killed the cat, who is named Tuna"

5. a) Do the label bracket of the following tree. (10)

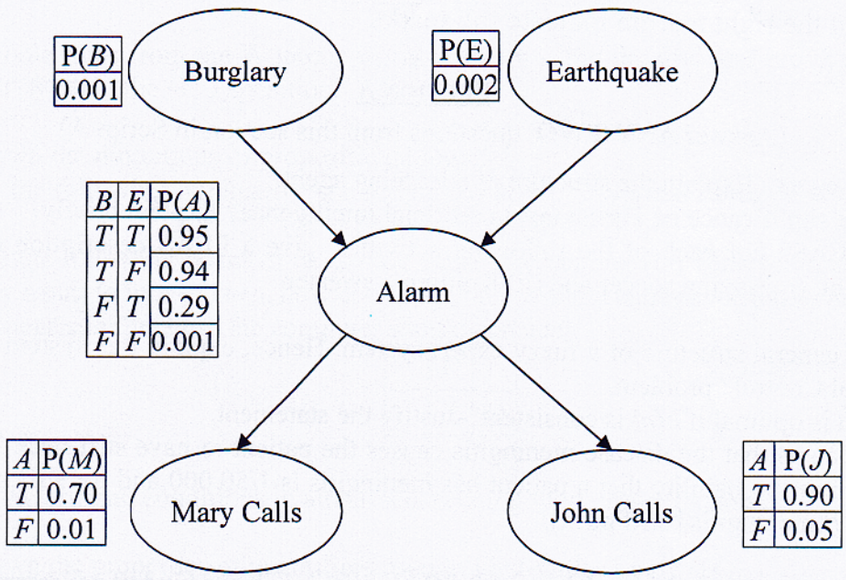


b) List out the several approaches for handling uncertainty. Briefly discuss the default reasoning approach. (12)

c) Define planning. Write down the goals of planning. (08)

6. a) Define syntax, semantics, pragmatics and discourse with example. (08)

b) Define probabilistic reasoning. Consider the following Bayesian Network for the following Alarm domain. Compute (i) $P(J, M, A, \neg B, \neg E)$; (ii) $P(J, M, A, E, B)$. (12)



c) Consider the probability distribution shown in the following table. Find out (i) $p(\neg$toothache$)$; (ii) $p($cavity $\wedge$ toothache$)$; (iii) $p($toothache $|$ cavity$)$; (iv) $p(\neg$cavity $|$ toothache$)$. (10)

	toothache		¬toothache	
	catch	¬catch	catch	¬catch
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2020
Department of Computer Science and Engineering
CSE 4111
Machine Learning

TIME: 1.5 hours FULL MARKS: 120

N.B. i) Answer **ANY TWO** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY TWO** questions from this section in Script A)

1. a) Differentiate learning and generalization in the contexts of machine learning. Which one is more desirable and why? (08)

   b) Define classification, regression and logistic regression in short. Differentiate between the concepts: classification and regression; and regression and logistic regression. (10)

   c) Using K-Means clustering, cluster the following objects for $K = 2$.

Object	Attribute 1	Attribute 2
A	10	150
B	150	10
C	X	Y
D	150	150

The attribute values of object C are $X =$ $Y =$ (Last three digits of your Roll Number). (12)

2. a) Suppose bias weight of an artificial neuron is $-X$, where X is the last three digits of your Roll Number. Sketch two input AND logic and OR logic by setting appropriate values of other weights of the neurons. (10)

   b) What are the significant properties of XOR in the context of machine learning? Is it possible to construct XOR logic with a neuron taking input from developed AND logic and OR logic? Do it if possible; otherwise explain the reasons for inability. (10)

   c) What is the local gradient in Back Propagation (BP) algorithm? "Local gradient may be zero even error remains" – Justify the statement with an appropriate activation function. (10)

3. a) Why dimensionality reduction is important in machine learning? How does principal component analysis reduce dimensionality? (10)

   b) What is Bayes theorem? Shortly describe Naive Bayes Classifier. (10)

   c) Consider the label data points in the following table. (10)

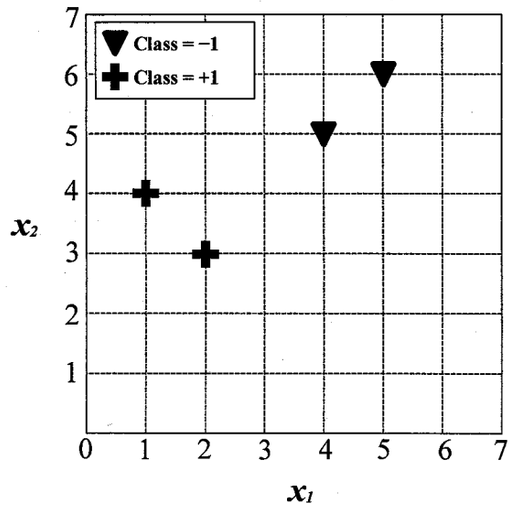
X_1	X_2	Label
05	15	+
10	30	−
30	40	+
40	100	−
80	130	+
120	250	−
Y_1	Y_2	?

Identify the label of data point (Y_1, Y_2) using KNN for $K = 3$, where $Y_1 =$ Last three digits of your Roll Number and $Y_2 = 2Y_1$.

SECTION B

(Answer **ANY TWO** questions from this section in Script B)

4. a) Suppose you are training on a tiny dataset with 4 points shown in the following figure. This dataset consists of two examples with class label +1 (denoted with plus), and two examples with class label −1 (denoted with triangle). (10)



i. Find the weight vector w and bias b. What is the equation corresponding to the decision boundary?

ii. Circle the support vectors and draw the decision boundary.

b) Consider the following training dataset, where A, B, and C are three binary attributes, and D is a binary class label. (20)

Instance	A	B	C	D
1	0	0	0	0
2	0	0	1	0
3	0	1	0	1
4	0	1	1	1
5	1	0	1	1
6	1	0	1	1
7	1	1	0	0
8	1	1	0	0

i. What is the expected information (entropy) required to classify the training dataset?

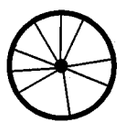
ii. Using ID3 algorithm, build a decision tree for this classification problem.

iii. Use the built decision tree to classify two samples below.

Instance	A	B	C	D
9	1	1	1	?
10	1	0	0	?

5. a) "In PSO, each and every particle changes position in each iteration even the particle is the global best (G)" – do you agree with the statement? Justify your answer with appropriate assumption in velocity update equation. (09)

b) Is it possible to find out the population size from the Roulette wheel given below? Explain. (07)



c) Apply the Enhanced Edge Recommendation algorithm on the following two chromosomes to produce two children. Show all the steps. (14)

Parent 1	4	2	1	3	5	6
Parent 2	4	3	1	2	6	5

6. a) "Pheromone evaporation pushes ACO convergence" – Is it true? Justify your opinion. (10)

b) What two requirements should a problem satisfy in order to be suitable for solving it by GA? (05)

c) Assume 4 cities {A, B, C, D}, which are represented by a fully connected graph. The following tables represent the pheromone levels on each edge of the graph and the distances between each city (assume the pheromone levels and distances are symmetric). (15)

Table-1

Pheromone Levels				
	A	B	C	D
A				
B	0.25			
C	0.11	0.98		
D	0.34	0.54	0.67	

Table-2

Distance				
	A	B	C	D
A				
B	12			
C	10	6		
D	8	15	3	

Assume an ant started its journey at city A and has travelled to city C.

i. What are the probabilities that the ant will travel to cities A, B and D? [Let $\alpha = 1, \beta = 1$]

ii. Assume the ant completes its tour using the route ABCD. What will be the pheromone levels on each edge once they have been updated? [Let Q = 100 and evaporation parameter = 0.5]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2020
Department of Computer Science and Engineering
CSE 4127
Image Processing & Computer Vision

TIME: 1.5 hours FULL MARKS: 120

N.B. i) Answer **ANY TWO** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY TWO** questions from this section in Script A)

1. a) Consider the following two gray scale images (Image *A*, Image *B*) of size $N \times N$. Although they look quite different, their histograms are identical. If each of the images are blurred with the Mask *M*, then (10)
   i) Would the resultant histograms still be the same? Explain.
   ii) Calculate the approximate histograms of the resultant images.

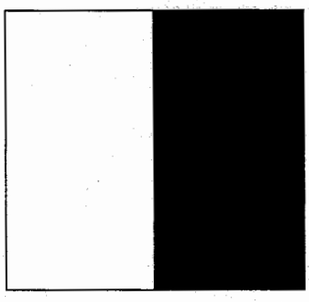


Image: *A*

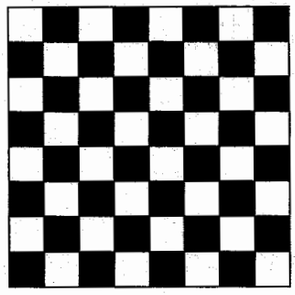


Image: *B*

$$\frac{1}{9}\begin{bmatrix}1 & 1 & 1\\ 1 & 1 & 1\\ 1 & 1 & 1\end{bmatrix}$$

Mask: *M*

b) Let an image *A* has gone through an intensity transformation function $S = T(r) = cr^{\gamma}$, where c, γ are constants to get the output image *B*. Some pixel intensities of *A* and *B* are shown below. (13)
   i) Find the missing input intensities P, Q.

	4		15
		Q	
P		16	

$\longrightarrow T(r) \longrightarrow$

	12		87
		105	
22		96	

Image: *A* Image: *B*

c) Do you think the discrete histogram equalization technique is generally able to produce a flat histogram? Justify your answer. (07)

2. a) Suppose an image with intensities in the range [0,1] has the PDF $P_r(r)$ as shown in Fig. i. Assume continuous quantities and find the transformation in terms of r and z that will transform the intensity levels of the image so that they will have the specified $P_z(z)$ as shown in Fig ii. (12)

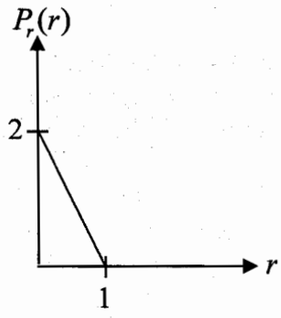


Fig. i

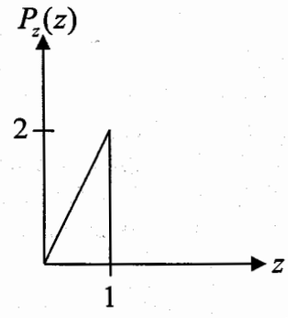


Fig. ii

b) Explain convex deficiency. Is it possible to reduce the hit-or-miss transform to simple erosion? Justify your answer. (12)

c) What does it mean by sampling and quantization in digital image acquisition? (06)

3. a) Consider the following 4×8 image. (15)

21	169	169	243	21	95	132	95
243	169	132	95	109	169	109	132
95	21	132	169	169	95	109	109
95	132	169	21	95	243	132	169

i) Compress the image using Huffman coding.

ii) Calculate the compression ratio and the percentage of the original fixed-length representation that is removed as the coding redundancy.

b) Calculate the morphological thinning on image E using P as the initial structuring element and show the outcome of each step separately. (15)

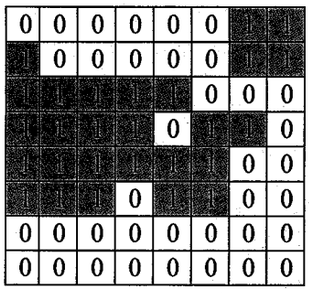
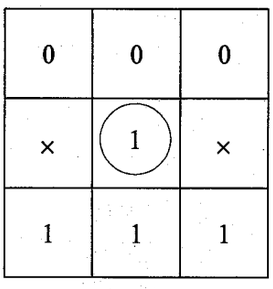


Image: E



Structuring Element: P

SECTION B

(Answer **ANY TWO** questions from this section in Script B)

4. a) Let a Gaussian function $G(x,\sigma)=e^{-x^2/2\sigma^2}$ and its derivative G' is sampled at 5 points symmetric to the origin with $\Delta x=1,\sigma=1$. The sampled values of G and G' are used as $1D$ separable kernel to convolve an image in x and y direction, respectively. Find (14)

i) The x and y directional $1D$ kernels; scale and round the values to integer.

ii) The $2D$ kernel from $1D$ kernels.

iii) Note the benefits of using separable $2D$ kernels.

b) Consider the following 4-bit image corrupted with impulse noise. To remove the noise (16)

i) Use a contraharmonic mean filter of size 3×3 with appropriate order Q.

ii) Use a suitable order-statistics filter of size 3×3.

Show results only for the middle row.

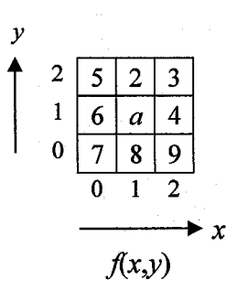
7	6	8	5	4
3	10	9	8	11
8	x	11	12	1
5	8	2	10	7
9	3	4	15	14

Here, $x=\begin{cases}0; & \text{if your roll is an odd number}\\ 15; & \text{Otherwise}\end{cases}$

5. a) Let you are assigned to warp the following image $f(x,y)$ with the transformation matrix T. You are also constrained with the conditions that the transformation should be done using backward mapping technique having bilinear interpolation and the warped image should be large enough to contain all the processed samples. If so (14)

i) Find the size of the warped image.

ii) Find the intensity at pixel (1,3) of the warped image.

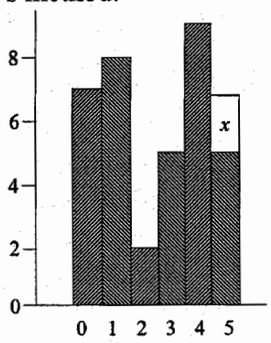


$f(x,y)$

$$T=\begin{bmatrix}1 & -0.5\\ 0.5 & 1\end{bmatrix}$$

Here, $a=$ last digit of your roll + 1.

b) An image intensity distribution shown by the following bar chart. Find a global optimal threshold for the image using Otsu's method. (16)



Here, $x =$ sum of last two digits of your roll number.
Therefore, $frequency(5) = x+5$.

6. a) Let you have planned to describe an image texture as an Entropy of Gray Level Co-occurrence Matrix (GLCM). For the given image below (15)
   i) Find the GLCM with displacement $d = [1,0]$.
   ii) Determine the measure of Entropy.

0	1	4	2	2
3	4	3	0	1
1	1	4	2	0
3	2	4	3	1
4	3	0	2	2

b) Using a 2×2 window, estimate the optical flow using Lucas-Kanade method for the following two successive frames of a video sequence. Show result for (1,1) position only. (15)

	0	1	2	3	→ x
0	1	1	0	1	
1	1	9	9	9	
2	1	9	10	9	
3	0	9	9	10	
↓ y					

Frame at t

	0	1	2	3	→ x
0	1	1	0	1	
1	0	*a*	1	0	
2	1	1	9	9	
3	0	1	9	9	
↓ y					

Frame at $t+1$

Here, $a = \begin{cases} 0; & \text{if your roll is even} \\ 1; & \text{Otherwise} \end{cases}$

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2020
Department of Computer Science and Engineering
IEM 4127
Industrial Management

TIME: 1.5 hours FULL MARKS: 120

N.B. i) Answer **ANY TWO** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY TWO** questions from this section in Script A)

1. a) Define industrial management. Describe the process of management and explain how it can be used to accomplish results in any organization. (15)
   b) Discuss critically the basic components of scientific management as propounded by Taylor. How far it is relevant in Bangladeshi situation? (15)

2. a) Define the bureaucracy theory school. "A successful organization should react as an organic and open system". To what extent, you agree with this statement. Explain. (11)
   b) Why the role of top management should be defined in decentralization? If it is not well defined, then what will be the implications? Explain. (13)
   c) Write short notes on group dynamics and positive motivation. (06)

3. a) Discuss about the areas where Laissez-Faire leadership can be applied. (12)
   b) An old car was purchased for 3,00,000 TK. Its life was estimated as ten years and the scarp value as 80,000 TK. Using the reducing balance method, calculate (18)
      i) The depreciation rate (%).
      ii) The depreciation fund at the end of three years.

SECTION B

(Answer **ANY TWO** questions from this section in Script B)

4. a) What is forecasting? What is the purpose of establishing control limits for forecast errors? (10)
   b) The sale of mobile phone of a store over the last 8 years is shown in the table below. Plot the data, and visually check to see if a linear trend line would be appropriate. Then determine the equation of the trend line, and predict sales for years 2022 and 2023. (20)

Year	Unit Sales
2014	348
2015	370
2016	385
2017	355
2018	368
2019	390
2020	410
2021	425

5. a) Define project management. What is a breakdown structure and how it is useful for project planning? (10)
   b) A manager just received a new price list from a supplier. It will now cost $1.00 a box for order quantifies of 801 or more boxes, $1.10 a box for 200 to 800 boxes, and $1.20 a box for smaller quantities. Ordering cost is $80 per order and carrying costs are $0.10 per box a year. The firm uses 3,600 boxes a year. The manager has suggested a "round number" order size of 800 boxes. The manager's rationale is that with a U-shaped cost curve that is fairly flat at its minimum, the differences in total annual cost between 800 and 801 units would be small anyway. How would you reply to the manager's suggestion? What order size would you recommend? (20)

6. a) What reasons usually prompt an existing organization to seek a new location? How can management avoid the problem of considering a new location? (10)

b) Use the assignment method to determine the best way to assign workers to jobs, given the following cost information. Compute the total cost for your assignment plan. (20)

		JOB		
		A	B	C
Worker	1	5	8	7
	2	6	7	9
	3	4	5	3