KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2017
Department of Computer Science and Engineering
CSE 4105
Computer Networks

TIME: 3 hours FULL MARKS: 210

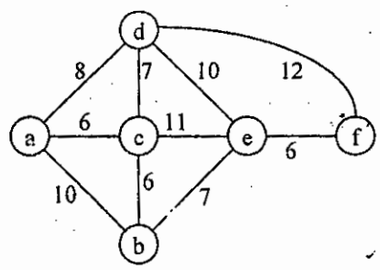
N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

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

1. a) Define statistical multiplexing. Which one is better between statistical multiplexing and Time Division Multiplexing? Explain with an appropriate example. (12)
   b) Suppose source and destination are connected through a switch and a router. If source sends a message to destination then how do encapsulation and decapsulation happen in each layer of TCP/IP model of above mentioned devices? Explain with necessary figure. (11)
   c) Suppose A is transmitting a packet to B. They are directly connected through a physical link. The length of the link is 1 km, the length of the packet is L bits and the transmission rate is 1 Mbps. (i) Now calculate how many bits will be arrived at B in 50 μsec? (ii) If the packet length is 100 bytes then at what transmission rate R, the propagation delay would be equal to the transmission delay of packet? (12)

2. a) Consider sending a 2400 byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation? (10)
   b) Suppose the CSE department of KUET has 200 personal computers. The network administrator does not want to set the IP addresses statically. So, how the personal computers can get IP addresses? Explain steps of getting IP. (11)
   c) Consider the following network. With the indicated link costs, use Dijkstra's shortest path algorithm to compute the shortest path from *b* to all network nodes. Show how the algorithm works by computing a table. (14)



3. a) How does private IP addressing concepts resolve IPv4 address space problem? What are the new problems arises? Explain. (09)
   b) Suppose A wants to send a packet to B. If A does not know B's MAC address then how does it determine this MAC address in the following two situations: (13)
      i) A and B are in the same network.
      ii) A and B are in the different network.
   c) What is Ethernet? Describe the working principle of Ethernet's CSMA/CD protocol with a detail look on exponential back-off algorithm. (13)

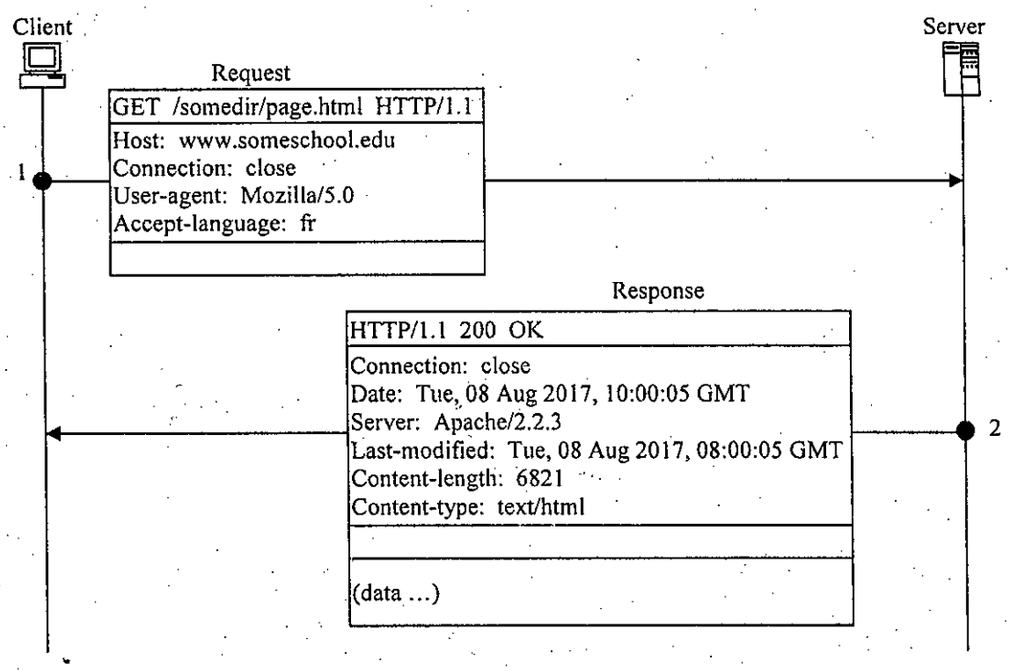
4. a) Describe the technologies that are used for transitioning from IPv4 to IPv6. (06)
   b) How does Multiple Access with Collision Avoidance (MACA) solve hidden terminal problem in wireless network? Explain with example. (08)
   c) How does IEEE 802.11 deal with data fragmentation? Discuss. (10)
   d) The CSE department of KUET just bought a Cisco switch which has 50 ports. The network administrator connected 40 personal computers to that switch. Now explain the learning mechanism of it. (11)

SECTION B

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

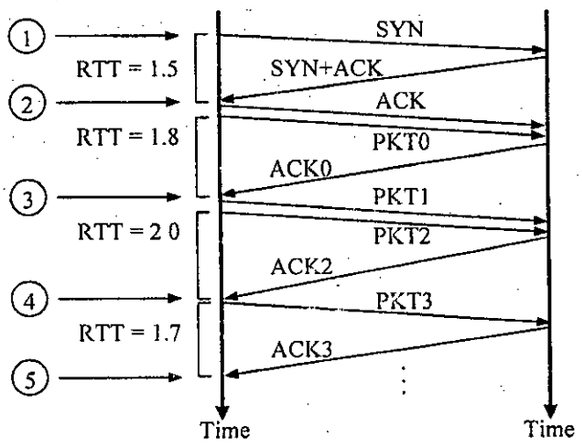
5. a) Compare among the Internet, WWW and HTTP. (09)
   b) What are the limitations of SMTP? How can these be solved by Multipurpose Internet Mail Extensions (MIME)? Briefly explain the working process and *Base64* encoding of MIME. (11)

c) Consider the following communication between a client and a server. The figure shows the different messages transferred between them. Explain each section as well as the statements that are presented in the messages. Also provide a general format of those messages. (15)



6. 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) Design a stop-n-wait type reliable data transfer protocol by showing a finite state machine. Also present the line diagrams to explain its operation for various packet transmission scenarios. (14)
   c) How does selective repeat protocol work? Explain. (10)

7. a) How does TCP recognize the network congestion? Explain, with necessary illustration, the Reno approach of managing this congestion. (14)
   b) What is silly window syndrome? How does TCP handle this issue? (08)
   c) How does TCP set the timeout interval for retransmission timer? What are the Jacobson/Karels proposals for setting that interval? Consider the following communication scenario of TCP. Figure shows the sample RTTs in seconds. Compute the timeout intervals at the points shown by arrows i.e. at initial position and at the end of each acknowledge received. (13)



8. a) Design a protocol to authenticate a live entity. Can it be used for public key system? Why or why not? (12)
   b) Let you are a network administrator, design a rule set for your packet filter firewall to allow your local users only to browse outside and no other traffic except the locally initiated return traffic from outside is allowed to enter your network. (07)
   c) Briefly explain how Secure Socket Layer (SSL) works on top of TCP and what services it provides. (09)
   d) What are the basic differences between TCP and UDP? (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY.
B.Sc. Engineering 4th Year 1st Term Examination, 2017
Department of Computer Science and Engineering
CSE 4109
Artificial Intelligence

TIME: 3 hours FULL MARKS: 210

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

SECTION A

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

1. a) How can you test whether a computer has reached the general intelligence level of human being? Explain it. (12)
   b) What is an agent? Explain the perception-action cycle of a point robot agent wandering in a two-dimensional grid world. (13)
   c) What is PEAS? For each of the following activities, give a PEAS description of the task environment: (10)
      i) Automated car driving;
      ii) Medical diagnosis system.

2. a) What is a min-max procedure? Explain this procedure using "Tic-Tac-Toe" game (12)
   b) What makes an admissible heuristic? Why is this important for search? Explain why using the number of squares in the wrong position for the 8-puzzle is a bad idea even through it is admissible. What is a better heuristic? (14)
   c) Why problem formulation must follow goal formulation? Explain. (09)

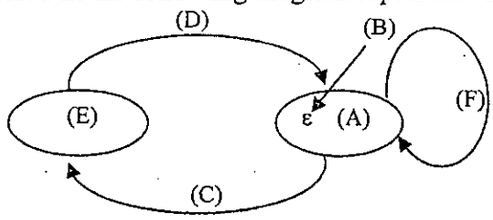
3. a) What is a fuzzy set? Differentiate between fuzzy and crisp sets using example. (10)
   b) Explain different fuzzy linguistic hedges using example(s). (10)
   c) Develop a general structure of a fuzzy expert system. Hence, explain this system using "Air conditioner control" problem. (15)

4. a) Formulate graph coloring problem as a constraint satisfaction problem. Draw the constraint graph for an arbitrary graph. (09)
   b) Define horizon effect. Is there any way to overcome the horizon effect? Explain. (07)
   c) What is the drawback of forward checking? How the arc consistency is used to solve this? (12)
   d) Prove that uniform costs search act like BFS when step costs are equal. (07)

SECTION B

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

5. a) What is propositional logic? With respect to AI, what is it good for? (07)
   b) Define knowledge based agent. Write down the architecture of a knowledge based Agent. (10)
   c) What does each of the lettered in the following diagram represent? Explain. (08)

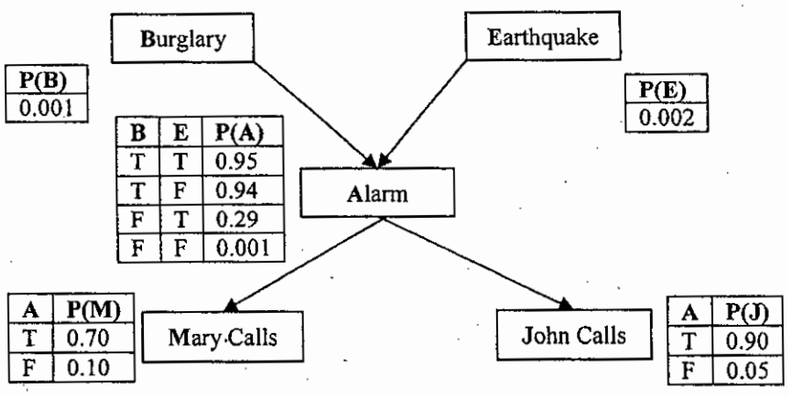


   d) Suppose you have a Wumpus world that consists of 2 cells: (1,1) and (2,1). In the truth table below, P_{ij} represents the fact that there is a Pit at (i, j) and KB represents the overall truth value of the knowledge base. (10)

$P_{1,1}$	$P_{2,1}$	KB
F	F	F
F	T	F
T	F	T
T	T	T

Does the knowledge Base$\models P_{2,1}$? Explain your answer. What does it mean for an inference procedure to be complete?

6. a) Define Probabilistic Reasoning. Consider the following Bayesian Network for Alarm Domain. (13)



Compute (i) P(J, M, A, ¬B, ¬E) (ii) P(J, M, A, E, B)

b) What is uncertainty? What are the types of uncertainty? Explain with suitable example(s). (07)

c) List the approaches for Handling uncertainty. Explain one of them. (10)

d) Make a relationship between Problem Domain and knowledge Domain. (05)

7. a) What do you mean by NLP? Construct a grammar for the following sentence: "The fact that fishes swim astonished him". Also draw the syntactic tree. (15)

b) Define syntax, semantics, pragmatics and discourse with example. (12)

c) What do you mean by default logic? Give formal definition of default logic. (08)

8. a) What do you mean Dempster/Shaffer theory? Explain with example(s). (06)

b) Consider the following table, where S=snow, R=rain and D=Dry. (15)

	ϕ	{S}	{R}	{D}	{S, R}	{S, D}	{R, D}	{S, R, D}
Mfreeze	0	0.1	0.1	0.2	0.1	0.1	0.1	0.3
Mstrom	0	0.1	0.2	0.2	0.1	0.1	0.2	0.1
Mboth								

Here, assume two pieces of evidence: Temperature is below freezing and Barometric pressure is falling.

Compute (i) Mboth (ii) Belief ({S R}) using Mboth (iii) Belief ({S R}) using Mfreeze (iv) Belief ({S R}) using Mstorm.

c) What is rule based expert system? Explain basic structure of a rule based expert system. (09)

d) What is conflict resolution? Explain with example(s). (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2017
Department of Computer Science and Engineering
CSE 4127
Computer Vision and Image Processing

TIME: 3 hours FULL MARKS: 210

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

SECTION A

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

1. a) Relate and differentiate between computer vision and image processing. Explain the possible challenges one has to face in solving a computer vision problem. (10)
   b) Define convolution. Show by using an example that $f \star e = f$, where f is an image, e is a unit impulse, and $\star$ is a convolution operator. (10)
   c) Sharp the following image using unsharp mask. Use a 3×3 Gaussian blurring kernel with $\sigma = 1$ and do zero padding where necessary. (15)

$$\begin{bmatrix} 1 & 2 & 4 & 5 \\ 5 & 2 & 5 & 5 \\ 1 & 1 & 3 & 6 \\ 2 & 4 & 6 & 7 \end{bmatrix}$$

2. a) What is the necessity of transforming an image into frequency domain? Let, $F(u, v)$ is a [M, N] point Discrete Fourier Transform (DFT) of an image defined by $f(x, y)$. Then show that $F(u, v) = F(u + pM, v + qN)$, where p, q are arbitrary constant. (10)
   b) Describe Canny edge detection algorithm in detail. (12)
   c) Design a Butterworth Lowpass Filter (BLPF) to smooth an image. How can you choose the cut-off frequency D_0 to pass α percent of image power? Also explain why the lower order BLPF is more preferable than higher order one. (13)

3. a) Define order statistic filter. Use a 3×3 alpha-trimmed mean filter with $d = 4$ to filter noises from the image presented below. (13)

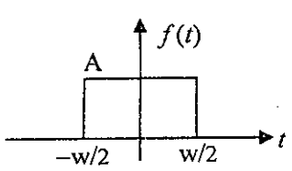
$$\begin{bmatrix} 2 & 3 & 5 & 8 & 7 \\ 8 & 12 & 4 & 6 & 3 \\ 5 & 7 & 6 & 3 & 9 \\ 4 & 1 & 4 & 8 & 3 \\ 6 & 7 & 8 & 14 & 17 \end{bmatrix}$$

   b) What is periodic noise? How can you remove such noise from an image? (05)
   c) Explain inverse filtering process to restore a noisy image. What is the shortcoming of inverse filter? How does Wiener filter overcome such shortcoming? (12)
   d) What is image segmentation? Mention some applications of it. (05)

4. a) Find a global threshold for the following image. What are the problems of using a single global threshold to segment an image? How can these be resolved? (13)

$$\begin{bmatrix} 1 & 2 & 1 & 0 & 12 & 14 \\ 2 & 3 & 4 & 8 & 13 & 12 \\ 9 & 2 & 3 & 15 & 13 & 7 \\ 3 & 2 & 2 & 10 & 11 & 13 \\ 1 & 2 & 0 & 5 & 12 & 14 \\ 2 & 3 & 6 & 8 & 15 & 13 \end{bmatrix}$$

   b) Perform Fourier transform of the function shown in the following figure. The transformation equation is given by $F(u) = \int_{-\infty}^{\infty} f(t) e^{-j2\pi ut} dt$. (08)



   c) Define motion field and optical flow. Explain the Lucas-Kanade optical flow estimation method stating their key assumptions. (14)

SECTION B

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

5. a) What is a digital image? What are the stages through which an image passes in a image processing system? Briefly explain each stage. (10)
   b) Briefly discuss about Weber law and optical illusions. (09)
   c) What is mean by sampling and quantization? Write down the transformation matrices of image Scaling, Rotation and Translation. (08)
   d) Define image compression. Briefly describe any one of the image compression techniques. (08)

6. a) Define bit plane slicing for piecewise linear transformation and histogram equalization. Calculate each plane for the following 4-bit image. (10)

$$\begin{bmatrix} 11 & 13 & 3 & 5 & 8 \\ 8 & 6 & 0 & 11 & 10 \\ 9 & 0 & 2 & 9 & 7 \\ 7 & 12 & 6 & 13 & 14 \\ 3 & 4 & 10 & 0 & 2 \\ 8 & 0 & 15 & 5 & 1 \end{bmatrix}$$

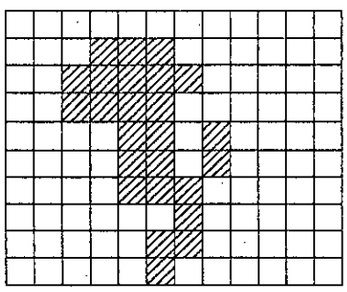
   b) Consider the following 5×5 image with grayscale range of [0, 9]. (17)

$$\begin{bmatrix} 0 & 5 & 7 & 7 & 5 \\ 7 & 2 & 6 & 2 & 6 \\ 6 & 9 & 7 & 7 & 0 \\ 6 & 6 & 1 & 7 & 6 \\ 9 & 3 & 2 & 4 & 8 \end{bmatrix}$$

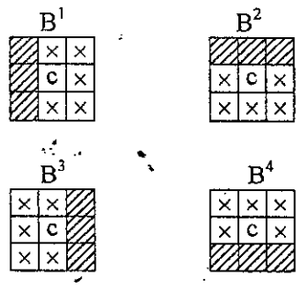
   i) Plot the histogram of the image.
   ii) Perform histogram equalization and then show the equalized image and plot histogram again.
   iii) Histogram matching is a useful contrast manipulation technique that transforms an image's histogram to match with that of another image. Clearly describe how can you achieve it.

   c) What do you mean by contrast stretching? Explain a simple non-linear contrast stretching method. (08)

7. a) Define full color image processing. Discuss about intensity slicing with appropriate diagram. (08)
   b) Define convex hull. Draw the convex hull of the following binary image. (17)



Binary imge: A



Structure elements: c is the center

   c) Define morphological gradient. When do we use top-hat and bottom-hat transformation in grayscale image? (10)

8. a) Define pigments. Write down the process of conversion of pixel value from RGB color space to HSI color space. (16)
   b) Prove that in continuous domain, probability distribution function of equalized image is always uniform. Discuss it with appropriate example. (07)
   c) Consider a portion of a binary image as shown below. Perform the following operations on the image. (12)
      i) Opening
      ii) Closing

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \end{bmatrix}$$

Binary image

$$[\,\textcircled{1}\quad 1\quad 1\,]$$

Structuring Element (SE)

The circle indicates the center of SE

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2017
Department of Computer Science and Engineering
CSE 4211
Machine learning

TIME: 3 hours FULL MARKS: 210

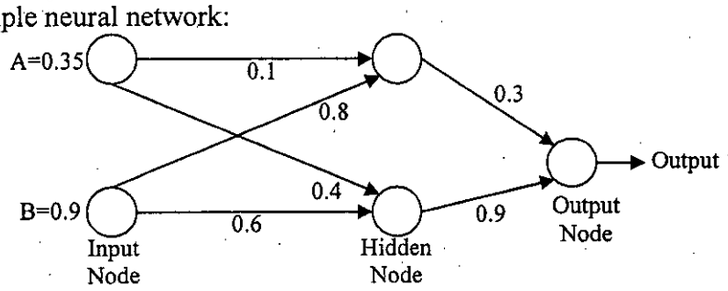
N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

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

1. a) What is Machine Learning? Briefly discuss some practical applications of Machine Learning. (08)
   b) Distinguish between supervised and unsupervised learning with example. (07)
   c) How do you differentiate regression and classification problems in Machine Learning? Give some practical examples. (10)
   d) Briefly explain the curse of dimensionality problem. (10)

2. a) What do you mean by feed forward network? (05)
   b) Consider the simple neural network: (10)



   (i) Perform a forward pass on the network.
   (ii) Perform a backward pass on the network
   (iii) Perform a further forward pass and comment on the result.
   Use sigmoid function as activation function.
   c) Explain in difficulties to solve XOR problem with single neuron. Solve XOR problem through manipulation by hidden neurons for AND and OR logic. (10)
   d) Draw minimal neural models for the following two logics having inputs A, B and C. (10)
   (i) NN1=(A+B)C' (ii) NN2=ABC'

3. a) What is the effect of learning rate in BP? How momentum parameters speed up training in BP? (10)
   b) What are the basic differences between RBF network and MLP. (08)
   c) What is local gradient in BP training procedure? For a neural network with two hidden layers, write local gradients for each layer. (10)
   d) Differentiate learning and generalization? Which one is more desirable and why? (07)

4. a) What is the purpose of mathematical optimization? Define following terminologies with respect to mathematical optimization: (i) Objective function (ii) variables/parameter (iii) Constraints (iv) Constrained and unconstrained optimization (v) language multiplier. (07)
   b) How to solve an unconstrained optimization problem using Gradient descent. Explain in detail. (08)
   c) Solve the following constrained optimization problems: (i) Given the objective function (20)

$f(x,y) = x^3 + y^3$ *subject* to

$g_1(x,y) = x^2 - 1 \geq 0$

$g_2(x,y) = y^2 - 1 \geq 0$

Find the optimum value.

(ii) A company has determined that its production is the cobb-douglas function, $f(x,y) = x^{2/3}y^{1/3}$ where x=number of labour hours, y=number of capital units, the budget constraint for the company is 100X+100Y=400000. What is the maximum production?

SECTION B

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

5. a) What is meant by Bio-inspired computing? Write some the popular Bio-inspired computing algorithm. (10)
   b) Why do we prefer heuristic approaches over classical methods to solve optimization problems? Explain with example. (10)
   c) Explain the trade-off criteria for deciding whether to use a heuristic for solving a given problem. (08)
   d) Define Genetic Algorithm (GA). Write simple GA. Write nature to computer mapping. (07)

6. a) Explain exploitation and exploration with examples. (10)
   b) Why do we not use one point crossover to solve TSP? Explain. (07)
   c) State the differences between roulette wheel selection and tournament selection. (08)
   d) Solve traveling salesman problem using particle swarm optimization. (10)

7. a) What is Swarm Intelligence (SI)? What are the properties of SI system? (10)
   b) Write PSO algorithm. What problems are arise when PSO is used in multimodal problems? (10)
   c) Write working procedure of MPSO. (05)
   d) Differentiate between Gbest swarm and Lbest swarm. (10)

8. a) Describe the important of transition probability in ACO algorithm. (10)
   b) "Pheromone evaporation pushes ACO convergence." is it true? Justify your opinion. (07)
   c) Write ACO algorithm. (08)
   d) Explain the employed bee phase, on looker bee phase and scout bee phase in ABC optimization algorithm. (10)