

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 1st Term Examination, 2016
Department of Computer Science and Engineering
CSE 4105
Computer Networks

TIME: 3 hours

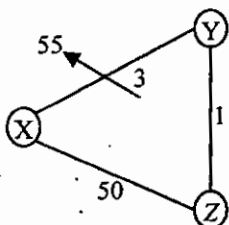
FULL MARKS: 210

- 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) What is layering in computer networks? Write down the major functions of network layer. (07)
b) What are the advantages of packet switching over circuit switching? (06)
c) Suppose a TCP message that contains 2048 bytes of data and 20 bytes of TCP header is passed to IP for delivery across two networks of the Internet (i.e., from the source host to a router to the destination host). The first network uses 14-byte headers and has an MTU of 1024 bytes; the second user 8-byte header with an MTU of 512 bytes. Give the sizes and offsets of the sequence of fragments delivered to the network layer at the destination host. Assume all IP header are 20 bytes. (12)
d) Differentiate between IPv4 and IPv6 header format. Explain the technologies that are used for transition from IPv4 to IPv6. (10)
2. a) Write down the pros and cons of static and dynamic routing. Explain link-state routing algorithm with a proper example. (13)
b) What is DHCP? How does DHCP work? Write down the advantages and disadvantages of DHCP. (12)
c) What does ICMP stand for? What does it do? Describe the error reporting messages of ICMP. (10)
3. a) "A transport-layer protocol provides logical communication between processes running on different hosts, a network-layer protocol provides logical communication between hosts."- Justify the statement. (08)
b) What are the essential tools of RDT protocol? Describe the working mechanism of RDT 2.0. How can the performance problem of RDT be solved? (13)
c) Describe the TCP timers in Brief. (08)
d) Since UDP is unreliable, why is it used at transport layer? (06)
4. a) Consider the following graph. Assume that link (x,y) cost has been changed from 3 to 55. Show that the poisoned reverse technique can resolve the count to infinity problem in this case. (11)



- b) In theory TCP is fair, but in face it is not. Give an example. (07)
- c) What is the NAT traversal problem for P2P applications, say Skype? (05)
- d) Suppose the values of p and q are 7 and 13 respectively. Find suitable public and private keys for RSA algorithm. Verify the keys for the message "CSE". (12)

SECTION B

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

5. a) What are the techniques to resolve IPv4 address space problem? Explain in Brief. (10)
b) What is digital signature? How authentication is provided using digital signature. (10)
c) What is Diffie Hellman key exchange algorithm? Explain its working principle with an example. (10)
d) What do firewalls do? Explain shortly. (05)

6. a) "Sockets are the software interface"-Justify the statement. (05)
b) What are the transport services does an application need? Briefly describe them. (10)
c) What is the benefit of stateless property of HTTP server? How HTTP servers identify users with stateless property? Explain briefly. (10)
d) Differentiate GET and Conditional GET commands of HTTP. How does conditional GET command improve performance of web proxy and local cash mechanism? (10)

7. a) Why is it said that FTP sends control information "out of band"? (05)
b) Suppose Alice, with a web-based email account (such as gmail) sends a message to Bob, who accesses his mail from his mail server using POP3. Discuss how the message gets from Alice's host to Bob's host. Be sure to list the series of application layer protocols that are used to move the message between the two hosts. (10)
c) Write filtering/forwarding algorithm of a switch. List the actions with corresponding condition(s) that a switch may perform when it receives a frame. (08)
d) What is service provided by DNS system? Explain load distribution briefly. (06)
e) If all the links in the Internet were to provide reliable delivery service, would the TCP reliable delivery service be redundant? Why or why not? (06)

8. a) Consider an e-commerce site that wants to keep a purchase record for each of its customer. Describe how this can be done with cookies? (08)
b) Why are content distribution networks (CDNs) important in internet system? Describe the role of DNS in CDN. (07)
c) Write down the advantages and disadvantages of polling and Token passing MAC protocol. (09)
d) Discuss Byte stuffing with an appropriate example. (06)
e) Why a network interface card is masked as semi-autonomous device? (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 4th Year 1st Term Examination, 2016
 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.
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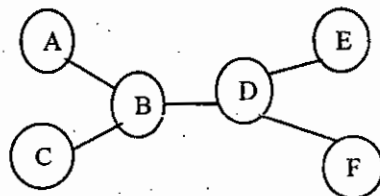
SECTION A

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

1. a) What is Artificial Intelligence? Explain, how can we test a machine has reached the general intelligence level of a human being. (12)
- b) What is intelligent agent? Explain the perception-action cycles of a point robot 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: (i) Playing soccer; (ii) Knitting a sweater. (10)

2. a) Explain why problem formation must follow goal formation. (10)
- b) Which of the followings are true and which are false? Explain your answers. (15)
 - (i) "Depth-first search always expands at least as many nodes as A* search with admissible heuristics".
 - (ii) " $h(n) = 0$ is an admissible heuristic for 8-puzzle".
 - (iii) "Breadth-first search is complete even if step costs are allowed".
- c) Prove each of the following statements, or give a counter example: (10)
 - (i) "Uniform-cost search is a special case of A* search".
 - (ii) "Iterative deepening search performs much worse than depth-first search".

3. a) What is Constrained Satisfaction Problem? Solve the following tree structured CSP. Consider there are only three colors (Red, Green, and Blue) available. (10)



- b) Develop a local search algorithm for solving CSP using min-conflicts heuristic. (12)
- c) Suppose one of the states of "Tic-Tac-Toe" given in the following figure where you mark crosses (x's) and the machine marks circles (O's). Also suppose that now it is your turn to move. What will be your move using mini-max procedure? Draw the complete search tree to show how you will find the state. (13)

	O	O
	x	
x		

Consider you as Max and the machine as Min.

4. a) What do you mean by Fuzzy System? Explain. (10)
- b) Discuss the different operations on Fuzzy sets. Use pictorial view for their clarity. (10)
- c) Develop a general structure of a fuzzy expert system. Hence, explain this system using a "Hotel Tipping" problem. (15)

SECTION B

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

5. a) Define "entailment" and "model of a sentence" with proper example. (08)
- b) Define model checking. What is the problem of using it? Explain. (10)
- c) Express the followings sentences in propositional logic. (12)

"The person is a toddler; if the person is a toddler then the person is a child; if the person is a child and male then the person is a boy; if the person is an infant then the person is a child; if the person is a child and female then the person is a girl; the person is female." Also prove that the person is girl using rule of inferences.
- d) Find the Conjunctive Normal form (CNF) for $p \leftrightarrow (\bar{p} \vee \bar{q})$. (05)

6. a) Find predicate, function and term from the following sentences: (06)
 - (i) Brother(John, Richard)
 - (ii) $>(\text{Length}(\text{LeftlegOf}(\text{Richrad})), (\text{Length}(\text{LeftlegOf}(\text{John}))))$
 - (iii) Sibling(John, Richard) \Rightarrow Sibling(Richard, John)

- b) Consider the following sentences: (14)
 "Tony, Mike, and John belong to the Alpine Club. Every member of the Alpine Club who is not a Skier is a mountain climber. Mountain climbers do not like rain, and anyone who does not like snow is not a skier. Mike dislikes whatever Tony likes, and likes whatever Tony dislikes. Tony likes rain and snow." Express the above sentences in the First Order Logic (FOL). Also prove that the sentences logically entail that there is a member of the Alpine Club who is mountain climber but not a skier using resolution proof.
- c) From the following knowledge base (KB) find who is hard worker using answer-extraction (08) process?

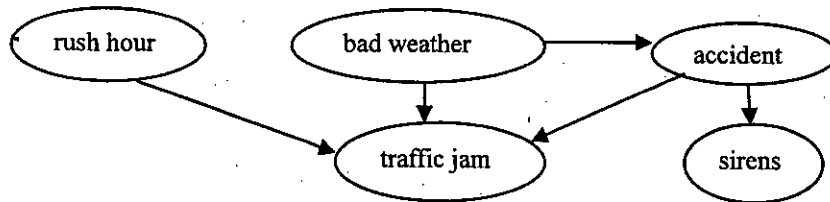
KB

$$\forall x \text{GradStudent}(x) \Rightarrow \text{Student}(x)$$

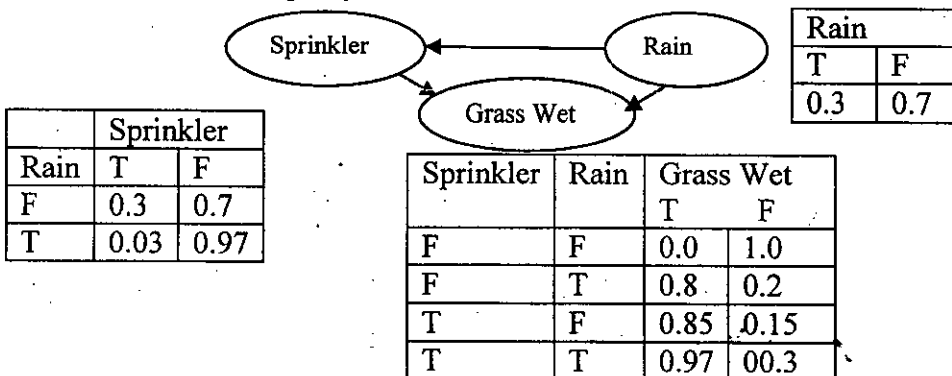
$$\forall x \text{Student}(x) \Rightarrow \text{HardWorker}(x)$$

$$\text{GradStudent}(\text{John})$$

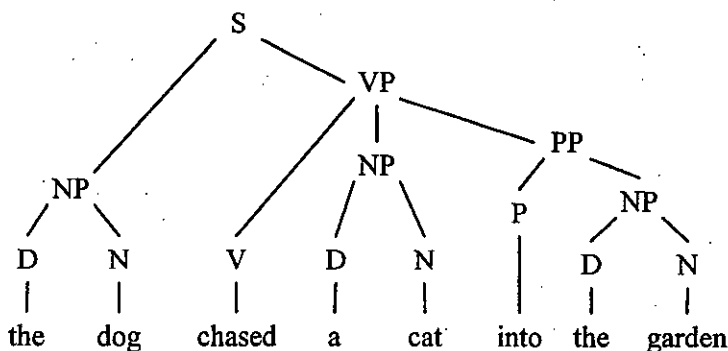
- d) How does backward chain work? Explain. (07)
7. a) Consider you have four attributes A, B, C, D and 25 records. How will you construction a (12)
 decision tree using the given attributes and records? Explain.
- b) Define pruning of a decision tree. Why is it necessary? Explain. (07)
- c) What is default logic? Explain syntax of default logic with example. (10)
- d) Differentiate Monotonic logic and Non-monotonic logic using example. (06)
8. a) Derive the joint probability function of the following Bayesian network. (08)



- b) Consider the following Bayesian network. (12)



- What is the probability that it is raining given that the grass is wet? (06)
- c) Define syntactic tree. Label bracket the following tree. (06)



- d) Consider the following rules and facts: (09)

$$S \Rightarrow [np, vp]$$

$$np \Rightarrow [pn]$$

$$vp \Rightarrow [iv]$$

$$vp \Rightarrow [tv, np]$$

Rules

$$\text{lex}(\text{vincent}, \text{pn}).$$

$$\text{lex}(\text{mia}, \text{pn}).$$

$$\text{lex}(\text{died}, \text{iv}).$$

$$\text{lex}(\text{loved}, \text{tv}).$$

$$\text{lex}(\text{shot}, \text{tv}).$$

Facts

Using top down parsing show that mia loved vincent.

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SECTION A

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

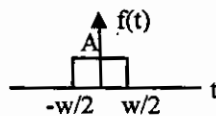
1. a) What is computer vision? How is image processing related to computer vision? Mention (10) some challenges of computer vision problem.
 b) Define histogram equalization. Consider the 5×5 , 3 bits/pixel image shown in Fig. 1(b). (18)

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

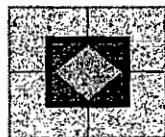
Fig. 1(b)

- i) Perform histogram equalization to the image.
 ii) What will happen if we apply the same process on the resultant image of step (i).
 iii) Explain why the discrete histogram equalization does not, in general, yield a flat histogram.
 c) Perform Fourier transform of the function shown in the following figure follows from (07)

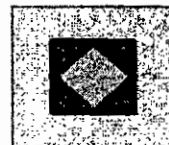
$$F(\mu) = \int_{-\infty}^{\infty} f(t)e^{-j2\pi\mu t} dt$$



2. a) Prove that the convolution of an image in spatial domain is equal to multiplication in (13) frequency domain.
 b) What does it mean by low pass filter? Design an Ideal Low-Pass Filter (ILPF). Explain why (10) there is a ringing effect on the image that is smoothed by ILPF.
 c) Consider the following figure, when the image on the left was filtered using a smoothing filter, (12) the result was image on the right. The filter used was: one of these of size 3×3 : (i) mean filter; (ii) ideal low-pass filter; (iii) Gaussian low-pass filter; (iv) median filter. For each of the four possible filters listed above, give at least one reason why you think it was or was not, the filter actually used.

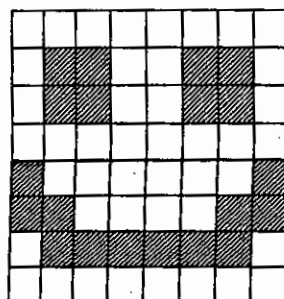


original image

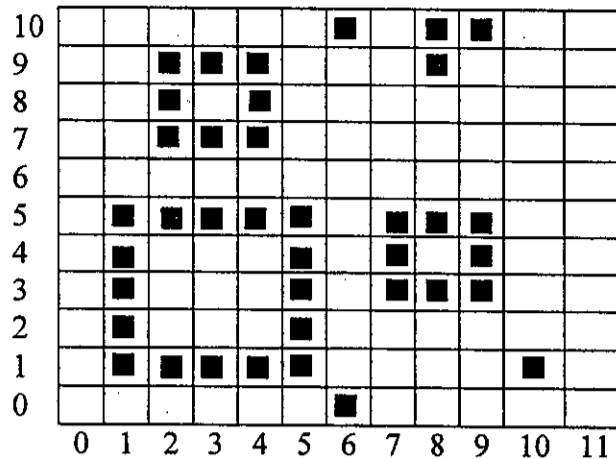


filtered image

3. a) Sketch and explain a model for image restoration process. How can you estimate the image (12) degradation functions?
 b) What is the importance of image segmentation? Segment the binary image shown in (12) following figure. Using split-and-merge technique. Also, show the quad tree corresponding to the segmentation.



- c) If we apply the Hough transform on the following image, what would be the maximum value (11) for the accumulator cell in the (P,Q) space? What is the corresponding (P,Q) value?

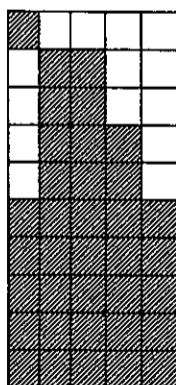


4. a) Explain how the k-means clustering can be used for image segmentation. What are the (13) weaknesses of k-means clustering algorithm? How can they be overcome?
 b) What is motion field? Explain a direct method for estimation of motion field stating the key (15) assumptions and deriving the necessary equations.
 c) State the steps of calculating Ostu's threshold for an image. (07)

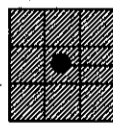
SECTION B

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

5. a) What is digital image processing? What are the fundamental steps in digital image (09) processing?
 b) Discuss about different neighborhood and connectivity of a pixel with appropriate example. (12)
 c) Define blind spot and brightness adaption. State some example of optical illusions. (06)
 d) What do you mean by image compression? Briefly describe any one of the image (08) compression techniques.
6. a) What is discretization? How are images presented in computer? (07)
 b) What is the property of an adaptive filter? Write a pseudocode for adaptive median filter. (12) Instead of median filter, when will you prefer the adaptive one? Explain why.
 c) State and explain the data redundancies that can be identified in an image and can be (10) exploited for image compression.
 d) Explain how human visual system perceives a color. (06)
7. a) Define convex hull. Write down the drawbacks of convex hull and how this can be resolved? (07)
 b) Define Thinning. Draw the skeleton of the following binary image. Is it possible to recover (15) the original image from the skeleton?



Set A



SE

Center

- c) Why pruning is necessary? Write down the equations to compute pruning of a binary image. (06)
 d) Define Erosion and Dilation for Gray-scale image with appropriate example. (07)
8. a) When we use top-hat and bottom-hat transformation in grayscale image? (04)
 b) Define Hue, saturation and intensity. Write down the process of conversion of a pixel value (18) from RGB space to HSI space.
 c) Define pseudo color image processing. Discuss about intensity slicing with appropriate (08) diagram.
 d) How can you apply a spatial filter on a full color image? Explain. (05)