Date:04.12.2017

KHULNA UNIVERSITY, KHULNA

Computer Science and Engineering Discipline

4th Year, Term I Examination 2017

Session: 2016-17

Course No: CSE 4111

Full Title of Course: Computer Networks

Full Marks: 60 Time: 03 Hours

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate sheet for each section.

Section A

There are FOUR questions in this section. Answer any THREE questions.

1. (a) Briefly describe a communication model. 02
   (b) Distinguish between circuit switching and packet switching. 02
   (c) What is a protocol? Write a short note about OSI model protocol architecture. 03
   (d) Differentiate TCP and UDP protocol. Name some application protocols that will use the mentioned underlying transport layer protocols. 03

2. (a) FM radio spectrum is 76MHz to 106MHz and each radio station can be assigned 200KHz. 06
   i. What is the maximum number of radio stations possible in FM band? If $SNR_{dB} = 27$, what is the capacity (bps) of each radio station?
   ii. Human audio spectrum is 20Hz to 20KHz. If the signal is modulated using M = 128 signaling levels, what is the capacity (bps) of human audio?
   iii. Discuss whether the audio of (ii) can be transmitted through the channel of (i)? If not how the parameters of (i) can be modified to allow the transmission? Show in detail.

   (b) Draw the frequency domain of the following time domain signal. Also, find out the spectrum, absolute bandwidth and possible data rate of the given signal, when frequency f = 3 MHz and signaling level $M = 16$. 04

$$\left(\frac{5}{3}\right)[\sin(2\pi(f)t) + \left(\frac{1}{3}\right)\sin(2\pi(2f)t) + \left(\frac{1}{5}\right)\sin(2\pi(3f)t) + \left(\frac{1}{7}\right)\sin(2\pi(5f)t) + \left(\frac{1}{9}\right)\sin(2\pi(6f)t)]$$

3. (a) Describe the three ways wireless signal can propagate. 03
   (b) Draw the digital encoded signals of the following bit stream using **Bipolar MI**, **B8ZS**, and **HDB3** encoding schemes. 03

1 0 0 0 0 1 1 0 0 0 0 0 0 0 0 1 1 0

   (c) Modulate the above digital bit stream to analog signal using **QPSK** and **8-QAM** modulation techniques. 04

4. (a) Imagine that a noise event causes a burst error to occur that lasts for 0.1 ms (millisecond). 03
   i. If data is being transmitted at 10Mbps, how many data bits will be affected?
   ii. If data is being transmitted at 100Mbps, how many data bits will be affected?

   (b) Suppose, for the **Selective Reject** based **error control** protocol, a frame number is given by **K=3** bits. Theoretically, the window size can be maximum 2^K-1. Show the ***protocol behavior steps*** of the following scenarios, where the transmitter sends an allowed number of frames to the receiver with some time gap between two frame's arrivals: **a) a frame is lost** from transmitter to the receiver end, **b) an acknowledgement is lost** from receiver to the transmitter end. 04

   (c) In a CRC error-detecting scheme, the generator polynomial is $X^3 + X^2 + 1$. Encode the bits 11100100. 03

Section B

There are FOUR questions in this section. Answer any THREE questions.

5. (a) Design an analog carrier system, where MOBILEs are assigned to a BTS, a set of BTS is managed by a BSC, next a set of BSC is managed by a MSC, a couple of MSC is connected to the PSTN and later PSTN provides high capacity optical fiber for trunk calls to other countries. Consider here different mobile operators as MSC. If a mobile voice call is allocated 3KHz voice channel and there are 5 mobile operators in Bangladesh, find out the bandwidth of all the intermediate structures. If required, make necessary assumptions. 05

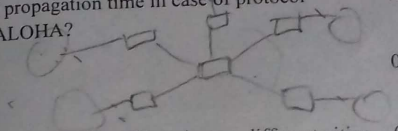
(b) Describe time division multiplexing. 03

(c) For the **Sliding Window** based **flow control** protocol, a frame number is chosen using **K** bits. Theoretically, the window size can be maximum 2^K-**1**. Explain why? 02

6. (a) What is a mesh topology? Show some advantages and disadvantages of this topology. 02

(b) Describe how collision occurs in a bus topology. 03

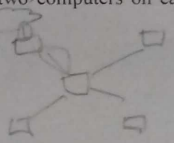
(c) What is the significance of transmission time and propagation time in case of protocol design? How do we choose slot time for Slotted ALOHA? 02



(d) Describe the Ethernet protocol? 03

7. (a) Draw a computer network of a large organization that has five offices in two different cities of Bangladesh. Every office uses its own network topology to enable LAN and connects with other offices using their own Intranet. Choose appropriate networking devices for your design to establish inter-networking of the offices. 04

(b) If the above organization has bought a Class C address 202.202.199.0, help the company to identify the sub-networks available in your designed network, by identifying the subnet mask, assigning addresses to each of the sub-networks, assigning needed IP addresses to the networking devices and computers. Assume that there are two computers on each of the offices. 06



8. (a) What is the significance of datagram life time in routing? 01

(b) What is IP fragmentation? Give an example. 02

(c) Demonstrate how flooding works in routing. What are the advantages and disadvantages of routing? 03

(d) Consider the subnet of Fig. 8(d). Distance vector routing is used, and the following vectors have just come in the router C: from B: (5,0,8,12,6,2); from D: (16,12,6,0,9,10); and from E: (7,6,3,9,0,4). The measured delays to B, D, and E, are 6,3, and 5 respectively. What is C's new routing table? Give both the outgoing line to use and the expected delay. 04

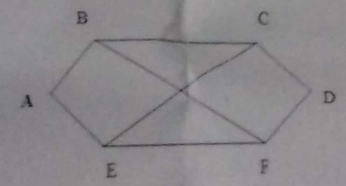


Fig. 8(d)

Date: 19.11.2017

KHULNA UNIVERSITY, KHULNA

Computer Science and Engineering Discipline

4th Year, Term I Examination 2017

Session: 2016-17

Course No: CSE 4125

Full Title of Course: Computational Geometry

Full Marks: 60 Time: 03 Hours

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate sheet for each section.

Section A

There are FOUR questions in this section. Answer any THREE questions.

1. (a) Write some application domains of computational geometry. 2

   (b) What is *degenerency*? How do you classify line segment intersection problem? 1+2

   (c) Define convex polygon. Write the algorithm of complexity O(*nlogn*) to compute the convex hull. 1+4

2. (a) What are the common features of sweep line algorithms? 3

   (b) What data structures are used in the sweep line algorithm for finding line intersection? Discuss how those data structures change as the sweep line algorithm proceeds for the following set of line segments. 2

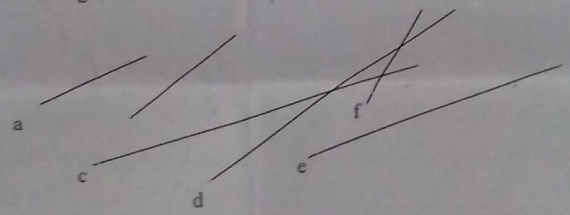


Figure: 2(b)

   (c) Consider a sweep line algorithm is applied for breaking the following simple polygon into pieces of y-monotone polygons. Discuss how the status changes as the algorithm proceeds with handling the events. 5

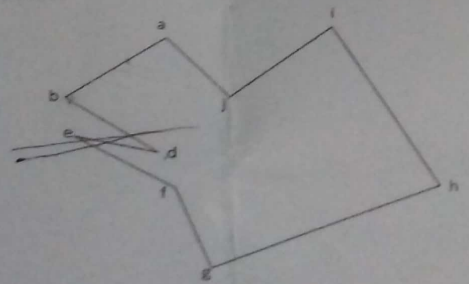


Figure: 2(c)

Keywords: Ant Colony Optimization, MEMETIC, motif finding problem

4. (a) What is Art Gallery Problem? 2
(b) Prove that a triangulated polygon is 3-colorable. 3
(c) Show that a simple polygon with n vertices can always be triangulated, and always with $n - 2$ triangles. 5

Section B

There are FOUR questions in this section. Answer any THREE questions.

5. (a) What is a K-d tree? How is it useful for range search query? 3
(b) Give algorithms for building and searching K-d trees. Analyze the time complexity of those algorithms. 5
(c) How can we triangulate a y-monotone polygon? 2

6. (a) Describe the data structures used in Fortune's Algorithm for computing Voronoi Diagram. 3
(b) Explain with example how the data structures change as a Circle Event is handled in Fortune's Algorithm. 5
(c) What is polygon clipping? Give example. 2

7. (a) Prove that 'Every edge of the Euclidean Minimum Spanning Tree (EMST) is an edge in the Delaunay graph'. 3
(b) Explain how a Delaunay Graph can be used for developing a 2-approximation algorithm for finding Euclidian Travelling Salesman Problem of a given set of points. What is the time complexity of that algorithm? 5
(c) Cite an example of a false alarm. 2

8. (a) Define Motion Planning Problem. 2
(b) Construct a pseudo code of Fortune's algorithm. Find out its complexity. 5
(c) Discuss how sampling technique works for a robot to find a path between a start point and a target point. 3

KHULNA UNIVERSITY, KHULNA

Computer Science and Engineering Discipline

4th Year, 1st Term

Session: **2016-2017**

Course No: **CSE 4103**

Full Title of Course: **Computer Graphics**

Full Marks: **60** Time: **03** Hours

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate sheet for each section.

SECTION A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1(a) What is a digital image? What is the resolution of an image? Compute the resolution of a 2×2 inch image that has 512×512 pixels. 03

(b) What is an image's aspect ratio? If we want to resize a 1024×768 image to one that is 640 pixels wide with the same aspect ratio, what would the height of the resized image? 02

(c) Briefly describe RGB and CMY color models. 03

(d) If we use direct coding of RGB values with 10 bits per primary color, how many possible colors do we have for each pixel? 03

2(a) What do you mean by scan conversion? 01

(b) What are the steps required to plot a line whose slope is between 0° and 45° using Bresenham's method? 04

(c) Indicate which raster locations would be chosen by Bresenham's algorithm when scan converting a line from pixel coordinate (1,1) to pixel coordinate(8,5). 04

(d) What are the three major adverse side effects of scan conversion? 01

3(a) Write the DDA algorithm for scan converting a line whose slope is between 45° and $-45°$. 03

(b) Describe Bresenham's circle algorithm. 06

(c) How can we eliminate overstrike? 01

4(a) Prove that, two mirror reflection transformations are simply special cases of scaling. 03

(b) Derive the transformation that rotates an object point Θ^0 about the origin. Write the matrix representation for this rotation. 04

(c) Show that, $S_{a,b} \cdot S_{c,d} = S_{c,d} \cdot S_{a,b}$ 03

SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5(a) What is the relationship between rotation $R_\theta, R_{-\theta}$ and R_θ^{-1} ? 03

(b) Find the condition under which we have $S_{sx,sy} \cdot R_\theta = R_\theta \cdot S_{sx,sy}$ 04

(c) What do you mean by WCS and NDCS? What is normalization transformation? 03

6(a) Let R be the rectangular window whose lower left-hand corner is L(-3,1) and upper right-hand corner is at R(2,6). Find the region code for the end points of the lines using the Cohen-Sutherland algorithm. 04

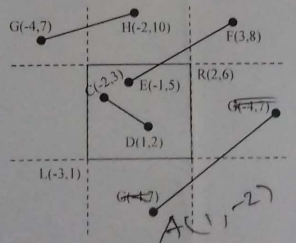


Fig. 6(a)

(b) Describe Sutherland-Hodgman algorithm. 04

(c) Apply the Weiler-Atherton algorithm to clip the following polygon. 02

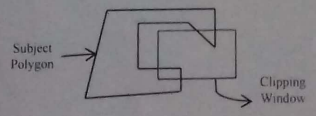


Fig. 6(b)

Abstract. Finding motifs in gene sequences is one of the ...
lems of bioinformatics and belongs to NP ...
colony optimization ...
niques ...

7(a) Define tilting. Find the tilting matrix. 04

(b) Find a transformation which aligns the vector V=I+J+K with the vector N=2I-J-K. 04

(c) Write down the inequalities of point clipping. 02

8(a) The standard perspective projection is shown in the given figure. The view plane is xy plane and the center of projection is $C(0,0,-d)$. Let $P(x,y,z)$ is projected onto $P'(x',y',z')$. 03

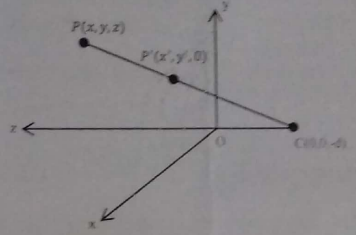


Fig. 8(a)

(b) Derive the equation of parallel projection onto xy plane in the direction of projection $V = aI + bJ + cK$ 03

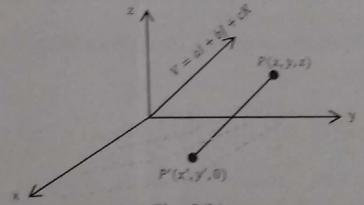


Fig. 8(b)

(c) Classify orthogonal projection and explain each type. 04

Date: 23.11.2017

KHULNA UNIVERSITY, KHULNA

Computer Science and Engineering Discipline

4th Year, Term I Examination 2017

Session: 2016-17

Course No: CSE 4121

Full Title of Course: Applied probability and Queuing Theory

Full Marks: 60 Time: 03 Hours

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate sheet for each section.

Section A

There are FOUR questions in this section. Answer any THREE questions.

1. (a) Define probability, event, sample space and conditional probability. 2
   (b) Suppose four fair dice are thrown. What is the probability that the same number appears on two or three of the four dice? 3
   (c) Suppose there are two urns. Urn 1 contains twelve white balls and three black balls, while urn 2 contains five white balls and five black balls. One ball is drawn at random from urn 2 and placed in urn 1. A ball is then drawn from urn 1. It happens to be black. What is the probability that the transferred ball was black? 3
   (d) A coin is to be tossed until a head appears twice in a row. If the coin is fair, what is the probability that it will be tossed exactly five times? 2

2. (a) Define a random variable. 1
   (b) Suppose that a particular trait of a person (such as eye color or left handedness) is classified on the basis of one pair of genes and suppose that *d* represents a dominant gene and *r* a recessive gene. Thus a person with *dd* genes is pure dominance, one with *rr* is pure recessive, and one with *rd* is hybrid. The pure dominance and the hybrid are alike in appearance. Children receive one gene from each parent. If, with respect to a particular trait, two hybrid parents have a total of five children, what is the probability that exactly four of them have the outward appearance of the dominant gene? 3
   (c) At a party *N* men throw their hats into the center of a room. The hats are mixed up and each man randomly selects one. Find the expected number of men who select their own hats. 4
   (d) Calculate the cumulative distribution function of a random variable uniformly distributed over (α, β). 2

3. (a) Show that Poisson random variable can approximate a binomial random variable. 3
   (b) If the number of accidents occurring on a highway each day is a Poisson random variable with parameter $\lambda = 3$, what is the probability that at least one accident occurs today? 2
   (c) Calculate the expectation of exponential distribution function. 3
   (d) Let *X* be uniformly distributed over (0, 1). Calculate $E[X^4]$. 2

4. (a) Write down the moment generating function of exponential distribution function with parameter λ and then calculate the variance. 3
   (b) Suppose the joint density of *X* and *Y* is given by- 3

$$f(x,y) = \begin{cases} 6xy(2-x-y), & 0 < x < 1, 0 < y < 1 \\ 0 & Otherwise \end{cases}$$

   Calculate the conditional expectation of *X* given that *Y*=*y*, where $0 < y < 1$.
   (c) Suppose that the chance of rain tomorrow depends on previous weather conditions only through whether or not it is raining today and not on past weather conditions. Suppose also that if it rains today, then it will be rain tomorrow with probability 0.7 and if it does not rain today, then it will rain tomorrow with probability 0.4. Calculate the probability that it will rain four days from today given that it is raining today. 4

Section B

There are FOUR questions in this section. Answer any THREE questions.

5. (a) Suppose four white and four black balls are distributed in two urns in such a way that each contains four balls. We say that the system is in state i, $i = 0, 1, 2, 3, 4$ if the first urn contains i white balls. At each step, we draw one ball from each urn and place the ball drawn from the first urn into the second, and conversely with the ball from the second urn. Let Xn denote the state of the system after the nth step. Explain why $\{Xn, n = 0, 1, 2, \ldots\}$ is a Markov chain and calculate its transition probability matrix. 4

(b) Consider the Markov chain containing three states 0, 1, 2 and having the transition probability matrix 3

$$P = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$

Determine whether they are transient or recurrent.

(c) Suppose that customer arrive at a Poisson rate of one per every 12 minutes, and that the service time is exponential at a rate of one service per 8 minutes. Calculate average number of customer in the system and average time a customer spends in the system. 3

6. (a) Arrival of customer in a system with Poisson process with parameter λ.. Let T_n denotes the elapsed time between the (n-1)st and nth event. Show that T_n, n= 1, 2, 3, …., are independently and identically distributed exponential random variables having mean $\frac{1}{\lambda}$. 3

(b) For M/M/1 queuing system prove that $L = \frac{\rho}{1-\rho}$, where the symbols have the usual meanings. 5

(c) Write shortly about Kendall's classification of queuing system. 2

7. (a) The manager of a market can hire either X or Y. X, who gives service at an exponential rate of 20 customers per hour, can be hired at a rate of TK300 per hour. Y, who gives service at an exponential rate of 30 customers per hour, can be hired at a rate of TKC per hour. The manager estimates that, on the average, each customer's time is worth TK40 per hour and should be accounted for in the model. Assume customers arrive at a Poisson rate of 10 per hour 4

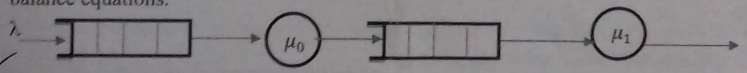
(i) What is the average cost per hour if X is hired? If Y is hired?

(ii) Find C if the average cost per hour is the same for X and Y.

(b) For birth-death process, show that $P_n = \frac{\lambda_{n-1}\lambda_{n-2}\ldots\ldots\lambda_0}{\mu_n\mu_{n-1}\ldots\ldots\mu_1} P_0$ where the symbols bear the usual meanings. 4

(c) Write some parameters for measuring queue performance. 2

8. (a) For the following two-stage tandem network, show the state diagram and calculate the balance equations. 5



(b) Suppose the survival times after lung transplant may roughly follow an exponential function. 3

Then, find the probability that a patient will die in the third year after surgery.

(c) Define moment generating function. 2

Date: 11.12.2017

KHULNA UNIVERSITY, KHULNA
Computer Science and Engineering Discipline
4th Year, 1st Term
Session: **2016-2017**
Course No: **CSE 4105**
Full Title of Course: **Compiler Design**
Full Marks: **60** Time: **03** Hours

- The figures in the margin indicate full marks. The questions are of equal value.
- Use separate sheet for each section.

SECTION A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1(a) Explain the advantages of (i) a compiler over an interpreter (ii) an interpreter over a compiler. 02

(b) What are the phases of a compiler? Consider the following source program- 06

$result = a + (b - cost) * 84.55$ // an arithmetic expression

Here, a, b and cost contain integer values. Write the outputs of every phase of a compiler considering the above input program.

(c) What is the need for separating the analysis phase into lexical analysis and parsing? 02

2(a) Define annotated parse tree with example. 02

(b) What do you mean by regular definition? Consider the following regular definition: 03

$digit \rightarrow 0|1|2|\ldots\ldots|9$

$digits \rightarrow digit^+$

$number \rightarrow digits\ (.digits)\ ?\ (E\ (+|-)?\ digits)?$

Draw the transition diagram for numbers.

(c) What are the components of a context-free grammar? Consider the following context-free grammar- 02

$$A \rightarrow AA + |AA * |b$$

Show how the string $bb + bb +*$ can be generated by the grammar.

(d) Write the regular expression for the following: 03

i. Set of all strings containing zero or more instance of a or b.

ii. Set of all strings of a's and b's of length two.

iii. Set containing string a and all strings consisting of zero or more a's followed by b.

3(a) Differentiate between NFA and DFA. 02

(b) Construct a DFA that accepts any strings over {a,b} that contains the string "aabb" in it. Implement **complementation** and **reversal** operation on that DFA. 03

(c) Find the equivalent DFA for the NFA given by M=[{A,B,C},(a,b),∂,A,{C}],where ∂ is given by 05

Table 1: Transition Function

	a	b
A	A,B	C
B	A	B
C	-	A,B

4(a) Explain input buffering strategy used in lexical analysis phase of a compiler. 03

(b) Define symbol table. Explain symbol table management strategies. 02

(c) Construct DFA directly from the regular expression $(a|b)^*abbb$. 05

SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5(a) Consider the following grammar: 04

$A \rightarrow uA \mid wuA \mid B + B \mid \varepsilon$

$B \rightarrow bB \mid CB \mid \varepsilon$

$C \rightarrow cAw$

A, B, and C are the non-terminals in the grammar.

(a) Construct the FIRST sets for the grammar.

(b) Construct the FOLLOW sets for the grammar.

(c) What are the roles of FIRST and FOLLOW set in Predictive Parsing?

(b) Define ambiguous grammar. Explain two disambiguating methods with proper example. 03

(c) Define transition diagram. Consider the following regular definitions: 03

$$D \rightarrow 0|1|2|\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots|9$$
$$L \rightarrow A|B|C|\ldots\ldots\ldots|Z|a|b|c|\ldots\ldots\ldots\ldots\ldots\ldots|z$$
$$ID \rightarrow \$(L \cup D)^*$$

Draw the transition diagram for ID.

6(a) Define ambiguity. Consider the following grammar: 03

$$stmt \rightarrow \textbf{if } expr \textbf{ then } stmt$$
$$| \textbf{ if } expr \textbf{ then } stmt \textbf{ else } stmt$$
$$| \ other$$

Here, **other** stands for any other statement.
Show that the following conditional statement is ambiguous with respect to the above grammar.

$$\textbf{if } E_1 \textbf{ then if } E_2 \textbf{ then } S_1 \textbf{ else } S_2$$

(b) Define left recursion. Consider the following grammar. 03

$$A \rightarrow A + BC|C$$
$$E \rightarrow E + T|T$$
$$T \rightarrow E + F|F$$
$$F \rightarrow F(E) * |b$$

Eliminate left recursion from the above grammar.

(c) State the conditions that make a grammar LL(1). Show that the following grammar is LL(1). 04

$$S \rightarrow iEtSS'|a$$
$$S' \rightarrow eS|\in$$
$$E \rightarrow b$$

7(a) Consider the following grammar: 05

$$S \rightarrow AA$$
$$A \rightarrow aA|b$$

Construct the *SLR(1)* parsing table for the grammar.

(b) What is meant by common prefix problem? In the following context-free grammar, the symbols ***0, 1, 2*** and ***3*** are terminals and S is the initial symbol. 03

$$S \rightarrow 0 \mid 1\ S\ 2\ S\ 3 \mid 1\ A\ 3$$
$$A \rightarrow S \mid A\ S$$

Convert this grammar to an equivalent that is LL(1).

(c) Contrast between S-attributed definition and L-attributed definition. 02

8(a) Consider the following expression $(a + b) * (a + b + c)$. 04
And mention its three address code, quadruples, triples and indirect triples representation.

(b) For the definition given in the following table 2, draw the dependency graph for the parse tree generated by id1, id2, id3: integer. 04

Table 2: Syntax Directed Translation

Production	Semantic Rules
$D \rightarrow L;T;$	*L.inh := T.type*
$T \rightarrow integer$	*T.type:=integer*
$T \rightarrow real$	*T.type:=real*
$L \rightarrow L_1, id$	$L_1.inh = L.inh$ *addtype(id.entry, L.inh)*
$L \rightarrow id$	*addtype(id.entry, L.inh)*

(c) Construct syntax tree and directed acyclic graph (DAG) for the expression: 02

$$a + a * (b - c) + (b - c) * d$$