Date: 30/04/17

KHULNA UNIVERSITY, KHULNA
Computer Science and Engineering Discipline
4th Year, Term I Examination 2017
Session: 2015-16
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.

Q1.
a) Define broadcast network and point-to-point network. 02
b) Mention the layers in the OSI reference mode. What are the principles behind introducing these layers? 04
c) Briefly discuss the application and transport layers in OSI reference model. 04

Q2.
a) Suppose that a color TV picture is to be transmitted from a source that uses a matrix of 640x480 picture elements (pixels). If a Color TV uses 3 separate RGB pixels to represent one color pixel, where each RGB pixel can take one of 128 color values then find the source data rate (bps). 06
   I. Assume that the TV picture is to be transmitted over a channel with 4 MHz bandwidth and 15 dB signal-to-noise ratio. Find the capacity of the channel (bps).
   II. Discuss whether the TV signal can be transmitted through the mentioned channel? If not how the parameters can be modified to allow the transmission?
b) Differentiate isotropic antenna and parabolic reflective antenna. 02
c) How does the satellite microwave work? 02

Q3.
a) Draw the digital encoded signals of the following bit stream using **B8ZS**, and **HDB3** encoding schemes. 03
   1 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 1
b) Modulate the above digital bit stream to analog signal using **BFSK**, and **BPSK** modulation techniques. 02
c) Draw 8-QAM signal of the following bit stream. 03
   111 011 100 001 101 010 110 000
d) What is Nyquist theorem for sampling? Explain with an example. 02

Q4.
a) 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
b) What is piggybacking? What is the advantage of it? 02
c) Suppose, for the **Sliding Window** based **flow control** protocol, frame numbers follow **K=2** bits model. Show the **protocol behavior steps** of the following scenario, where the transmitter sends **9 frames** to the receiver, **a frame is lost** from transmitter to the receiver end. 03
d) Use the above example to draw the steps for **Go Back N error control** protocol for the following scenario, **an acknowledgement is lost** from receiver to the transmitter end. 03

SECTION B

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

Q5.
a) Design an analog carrier system for Bangladesh, 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 2 KHz voice channel and there are 4 mobile operators in Bangladesh, find out the bandwidth of all the intermediate structures. If required, make necessary assumptions. 06
b) Draw the spectrum of FM radio band, where the complete radio band is 90MHz-94MHz, each radio station is allocated 200 KHz voice channel, and inter-station band gap required is 10 KHz. How many

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radio stations can be allocated in this spectrum? 04

Q6. a) Explain the functionalities of bus and ring topologies. 03
b) Differentiate hub, bridge, switch and router. 02
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) What is the difference of CSMA and CSMA/CD protocol? 03

Q7. a) Draw a computer network of a large organization that has three offices in three different cities of Bangladesh. Consider that every office uses its own network topology to enable the intranet and connects with other offices using the Internet. 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 200.199.198.0, 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

Q8. a) Describe distance vector routing mechanism with example. 04
b) Explain count to infinity problem with example. 02
c) What is congestion? Describe the congestion control mechanism called 'hop-by-hop choke packets'. 04

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KHULNA UNIVERSITY, KHULNA
Computer Science and Engineering Discipline
4th Year, Term I Examination 2017
Session: 2015-2016
Course No: CSE 4125
Course Title: 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) Discuss about some of the application domains of Computational Geometry. 06
   (b) Let P be a set of points in the plane. Let p be the convex polygon whose vertices are points from P and that contains all points in P. Prove that this polygon p is uniquely defined, and that it is the intersection of all convex sets containing P. 04

2. (a) Develop an efficient algorithm for computing convex hull of a given set of points P in the plane. Analyze the complexity of your algorithm. 06
   (b) What are the ways to deal with degenerate cases in geometric algorithms? Explain these briefly. 04

3. (a) Outline the plane sweep algorithm for finding line intersections. 04
   (b) Let S be a set of n disjoint line segments in the plane, and let p be some point that does not lie on any line segment of S. Line segments are closed, that is, they include their endpoints. Describe a sweep-based algorithm that computes all line segments of S that are visible from p (that is, it is not possible from p to look through a line segment of S and see anything behind it). You should report all line segments of S of which at least some point is visible. 06

4. (a) Describe Art Gallery Problem. 02
   (b) Prove that a simple polygon with n vertices can always be triangulated, and always with n − 2 triangles 03
   (c) Construct a pseudo code of Fortune's algorithm. Analyze the complexity of this algorithm. 05

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? 04
   (b) Give algorithms for building and searching K-d trees. Analyze the efficiency of those algorithms. 06

6. (a) Prove that for any n > 3 there is a set of n point sites in the plane such that one of the cells of Vor(P) has n-1 vertices. 03
   (b) Explain how Site Events and Circle Events are handled in the Plane Sweep algorithm for computing Voronoi Diagram. 05
   (c) Give example of a False Alarm. 02

7. (a) 'The Voronoi diagram on n sites in the plane has at most 2n−5 Voronoi vertices and at most 3n−6 Voronoi edges' – prove it. 03
   (b) In the polygon triangulation algorithm, first phase, a helper was used with the edges in the status structure, to help decide to which vertex a split vertex must be connected to make the polygon y-monotone. In the figure 7b, edges $\overline{p5p6}$, $\overline{p10p11}$ and $\overline{p15p16}$ have a helper. 07
   (i) Specify for each of these edges which vertex is the helper, when the sweep-line is at the shown position in the figure7b.
   (ii) What are the actions performed by the algorithm when the sweep-line contains p6, and this event is handled?

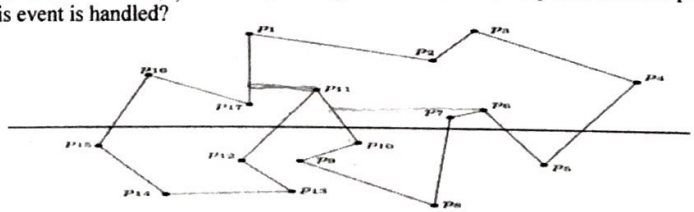

Figure:7b

8. (a) Mention some properties of a Delaunay Graph. 03
   (b) Let R be a robotic arm with a fixed base and seven links. The last joint of R is a prismatic joint, the other ones are revolute joints. Give a set of parameters that determines a placement of R. What is the dimension of the configuration space resulting from your choice of parameters? 04
   (c) Derive an algorithm for computing EMST from Delaunay Graph. 03

KHULNA UNIVERSITY, KHULNA
Computer Science and Engineering Discipline
Year **IV**, Term **I**
Session: **2015-2016**
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) "Compiler is a translator" - why? Draw the block diagram of a language processing system. 03
(b) The syntax analyzer and semantic analyzer can be combined into a single phase. Do you agree or disagree? 02
(c) Consider the following source program- 05

$r = (a + b) * (c - d) + 25.78$ // an arithmetic expression

Where r, a, c are real numbers and remainders are integer numbers. Write the outputs of every phase of a compiler considering the above input program.

2(a) How can you define a programing language? What are the functionalities of a preprocessor? 03
(b) Convert the following infix expression into postfix expression- 03

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

(c) What are the components of a context-free grammar? Consider the following context-free grammar- 04

$$S \rightarrow SS + |SS * |a$$

i. Show how the string $aa + a *$ can be generated by the grammar.
ii. Construct a parse tree for this string

3(a) Describe the different phases of a compiler with a neat diagram. 03
(b) Explain input buffering strategy used in lexical analysis phase. 04
(c) Define positive closure and Kleene closure and establish their relationship. 02
(d) Let $L = \{a, b, c\}$. Now, find some expressions for L^5. 01

4(a) *Define regular definition.* Write the regular definitions for the following languages: 04
i. All strings of letters that contain the five vowels.
ii. All strings of letters and digits having length one to infinity.
iii. All strings of digits of length four started with "CSE".
(b) "Deterministic Finite Automata is a special case of Nondeterministic Finite Automata"-Explain rationally. 02
(c) Construct NFA for the following regular expression using Thompson's construction. Show each of the basic construction steps. 04

$$(x|y)^+(a|b)b$$

SECTION B

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

5(a) Why do we construct transition diagram? Draw the transition diagram for the relational operators available in C programming language. 03
(b) Construct DFA directly from the regular expression $(a|b)^*abc$. 07

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) Is the following grammar left recursive? If so, eliminate left recursion. 04

$$Z \rightarrow E$$
$$E \rightarrow T|E + T|E - T$$
$$T \rightarrow F|T * F|T/F$$
$$F \rightarrow a|(E)$$

Also compute the first and follow for all the non-terminals of above grammar.

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(c) Show that the following grammar is LL (1). 03

$$S \rightarrow AaAb|BbBa$$
$$A \rightarrow \in$$
$$B \rightarrow \in$$

7(a) What do you mean by LR (K)? Table 7(a) is a predictive parsing table. Show the moves made by predictive parser on input $\boldsymbol{id * id * id}$ and check its validity. 04

Table 7(a)

NON - TERMINAL	INPUT SYMBOL					
	id	+	*	(	)	$
E	$E \rightarrow TE'$			$E \rightarrow TE'$		
E'		$E' \rightarrow +TE'$			$E' \rightarrow \epsilon$	$E' \rightarrow \epsilon$
T	$T \rightarrow FT'$			$T \rightarrow FT'$		
T'		$T' \rightarrow \epsilon$	$T' \rightarrow *FT'$		$T' \rightarrow \epsilon$	$T' \rightarrow \epsilon$
F	$F \rightarrow$ id			$F \rightarrow (E)$		

(b) Show that the following grammar 06

$$S \rightarrow Aa|bAc|dc|bda$$
$$A \rightarrow d$$

is not SLR.

8(a) Generate the intermediate code for the statement: sum = A[i, j] + B[i, j]. Construct DAG and simplify the code. 05

(b) Optimize the following code: 05

```
Product = 0
i=1
do
product = product + A[i] * B[i]
i = i + 1
while (i<=20)
```

KHULNA UNIVERSITY, KHULNA

Computer Science and Engineering Discipline

4th Year, Term I Examination 2017

Session: 2015-16

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. What do you mean by probability mass function and probability density function? 04

   (b) State and prove Bayes' theorem. 06

2. (a) a) Define random variable with an example. 02

   (b) In answering a question on a multiple-choice test a student either knows the answer or guesses. Let p be the probability that she knows the answer and 1-p the probability that she guesses. Assume that a student who guesses at the answer will be correct with probability $1/m$, where m is the number of multiple-choice alternatives. What is the conditional probability that a student knew the answer to a question given that she answered it correctly? 05

   (c) State Markov's theorem of inequality. 03

3. (a) If X is a random variable that takes only nonnegative values, then for any value $a > 0$ show that $P\{X \geq a\} \leq \frac{E[X]}{a}$ 03

   (b) Define stochastic process. 02

   (c) Let X be a random variable with probability density 05

$$f(x) = \begin{cases} c(1-x^2), -1 < x < 1 \\ 0, otherwise \end{cases}$$

   i) That is the value of c?

   ii) What is the cumulative distribution function of X?

4. (a) If X_1 and X_2 are independent binomial random variables with respective parameters (n_1,p) and (n_2,p), calculate the conditional probability mass function of X_1 given that $X_1 + X_2$=m. 04

   (b) The joint density of X and Y is given by 04

$$f(x,y) = f(x) = \begin{cases} \frac{1}{2} y e^{-xy}, & 0 < x < \infty, 0 < y < 2 \\ 0, & otherwise \end{cases}$$

   What is $E[e^{X/2}|Y=1]$?

   (c) What do you mean by Markov chain? 02

Section B

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

5. (a) If $\mathbf{P}^{(n)}$ denote the matrix of n-step transition probabilities P_{ij}^n, then show that $\mathbf{P}^{(n+m)} = \mathbf{P}^{(n)}.\mathbf{P}^{(m)}$. 04

   (b) Derive Kolmogorov's forward equations. 03

   (c) What is a birth-death process? Define statistical equilibrium. 03

6. (a) The capacity of a communication line is 2000 bits per second. This line is used to transmit eight-bit characters. The application call for traffic from many devices to be sent on the line 04

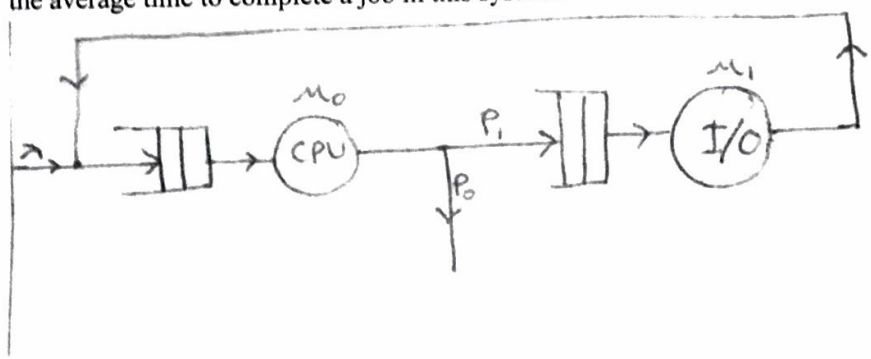
with a total volume of 12000 characters per minutes. What is the average number of characters waiting to be transmitted? What is the average transmission time per character?

(b) What do you mean by traffic intensity of a queuing system? 02

(c) What are the differences of M/M/1, M/G/1 and M/M/m queues? 04

7. (a) What do you mean by tandem queue? 02

(b) Draw the state diagram and balance equations for the following open queuing network. Find the average time to complete a job in this system. 08



8. (a) Consider the Markov chain with states 0, 1, 2, 3 with the following transition probability matrix. 04

$$P = \begin{bmatrix} 0 & 0 & 0.5 & 0.5 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$$

Determine which states are transient and which states are recurrent.

(b) Suppose $\{N(t), t >= 0\}$ is a renewal process with renewal function $M(t) = 5t$. What is the probability distribution of the number of renewals by time 15? 04

(c) What are the elements of a queuing system? 02

KHULNA UNIVERSITY, KHULNA
Computer Science and Engineering Discipline
4th Year I, Term I Examination 2017
Session: 2015-2016
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 the difference between computer graphics and image processing, in term of image? 02
   (b) Write short notes on RGB and CMY color model. 04
   (c) If we use direct coding of RGB values with 10 bits per primary color, how many possible colors do we have for each pixel? 02
   (d) If we use 2-byte pixel values in a 24-bit lookup-table representation, how many bytes does the lookup table occupy? 02

2. (a) Define aspect ratio and resolution of an image with example. 03
   (b) How a line is scan-converted using its equation directly? Explain. 05
   (c) Why circle is called a symmetric figure? 02

3. (a) What is Anti-aliasing? Write short note on C curve and Koch curve. 03
   (b) Write down the steps which are required to scan convert a circle using midpoint circle algorithm. 05
   (c) What is overstrike? Identify where it occurs. 02

4. (a) Define geometric transformation. Prove that two reflection transformations are simply special cases of scaling. 05
   (b) Reflect the polygon whose vertices are A(-1,0), B(0,-2), C(1,0) and D(0,2) about the line $y = x+1$. 05

Section B

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

5. (a) Show that reflection about the line $y = x$ is attained by reversing coordinates. That is, 03
   (b) $M_L(x, y) = (y, x)$. 03
   (c) Show that $T_{v1} . T_{v2} = T_{v2} . T_{v1} = T_{v1+v2}$. 03
   (d) Find the condition under which we have $S_{sx, sy} . R_\Theta = R_\Theta . S_{sx, sy}$. 01
   (e) Define window-to-viewpoint mapping.

6. (a) Define tilting. Find the tilting matrix. 04
   (b) Find the matrix for the mirror reflection with respect to the plane passing through the origin and having a normal vector whose direction is N= I+J+K. 06

7. (a) Define perspective projection. Explain its anomalies. 06
   (b) Define the perspective projection onto the view plane Z=5 where the center of projection is the origin (0, 0, 0). 04

8. (a) Define Orthographic projection. Classify it and explain each type. 05
   (b) Derive the general equation of parallel projection onto a given view plane in the direction of a given projector $\vec{V}$. 05