

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering
4th Year 1st Semester B.Sc. Engineering Final Examination-2017

Course Title: Computer Simulation and Modeling
Full Marks: 60
N.B.

Course Code: CSE402
Time: 3(Three) hours

- i) Answer **SIX** questions, taking any **THREE** from each section.
- ii) All questions are of equal values.
- iii) Use separate answer script for each section.

SECTION-A

1. (a) What are the components of a system? Explain with example. 4
(b) Draw the flow chart of steps in a simulation study. 2
(c) Explain in detail when simulation is the appropriate tool and when simulation is not the appropriate tool. 4
2. (a) Draw and describe the flow diagram of service just completed and unit entering system of a queuing system. 2+2
(b) What are meant by **Bernoulli** and **Binomial** distributions? 2
(c) Consider the experiment of tossing a single die. Define X as the number of spots on the up face of the die after a toss. Then $R_X = \{1, 2, 3, 4, 5, 6\}$. Assume the die is loaded so that the probability that a given face lands up is proportional to the number of spots showing. The distribution for this random experiment is given by

x_i	1	2	3	4	5	6
$p(x_i)$	$\frac{1}{21}$	$\frac{2}{21}$	$\frac{3}{21}$	$\frac{4}{21}$	$\frac{5}{21}$	$\frac{6}{21}$

Calculate the **Expectation** and **variance**.

3. (a) Briefly describe **Erlang** distribution. 3
(b) In a restaurant, customers arrive at lunchtime from one to eight groups. The numbers of persons per groups are 30, 110, 45, 71, 12, 13, 7, and 12 respectively. Find out the value and demonstrate the graphical representation of **probability distribution** and **cumulative probability distribution** for each group. 7
4. (a) Write down the limitations of PERT and CPM network. 2
(b) What is the difference between merge event and burst event? 2
(c) Draw and explain AOA and AON network. 6

SECTION-B

5. (a) Exponential decay model is negative growth model. Justify it. 3
(b) Explain the stock and flow diagram with example. 5
(c) Why system dynamics is used for a system? 2

6. (a) Describe verification and validation is entirely different in their meaning and processing. 3
 (b) In market model, demand and supply are denoted by D and S respectively. Demand and supply are given by the following equations: 7

$$D = a + bp$$

$$S = c - dp_0$$

$$D = S$$

where values of parameters a , b , c , d and initial value of product price p_0 are given in Table-1 for two models. Draw the Cobweb model of two models for 8 iterative processes and determine whether models are stable or unstable.

Table-1

Model 1	$a = 12, b = 30, c = 1.0, d = 0.9, p_0 = 30$
Model 2	$a = 10, b = 0.9, c = -2.4, d = 1.2, p_0 = 5$

7. (a) Briefly explain the scaled down model and mathematical model. 5
 (b) Why Distributed Lag model is used? 2
 (c) Find the sequences of random numbers for the following values: 3
 $X_0 = 5, a = 3, c = 3$ and $m = 7$
8. (a) Write the features of Goodness of Fit test and Test of Independence. 3
 (b) Write the differences between K-S test and Chi-square test. 2
 (c) In Table-2, given the 10 intervals, the upper limits and observed value of each interval for 100 numbers of random sample. 5

Table-2

Interval	Upper limit	Observed Value
1	0.1	10
2	0.2	9
3	0.3	7
4	0.4	8
5	0.5	6
6	0.6	10
7	0.7	15
8	0.8	13
9	0.9	14
10	1.0	8

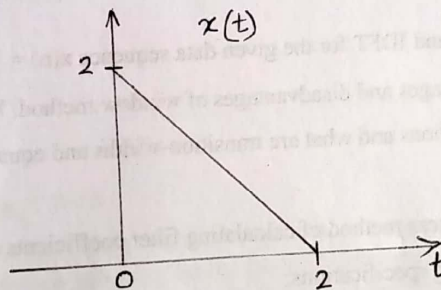
Find the empirical chi-square value and give your decision whether the samples are accepted or rejected by using Goodness of Fit test (where the table value of chi square is 16.919).

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SECTION-A

- Q.1 (a) State the definition of sampling, quantization and coding. 3
- (b) Sketch the continuous time signal $x(t) = \sin 7t + \sin 10t$ for an interval $0 \leq t \leq 2$. Plot the corresponding discrete-time signal with a sampling period $T=0.2s$. 3
- (c) Briefly explain invertible, non-invertible, time-invariant and time variant system. 4
- Q.2 (a) What is periodic and aperiodic time signal? 2
- (b) Prove that the cosine signal is periodic with periodicity T . 3
- (c) Test whether the given signal is periodic or not. If so, find the fundamental period. 4
- $x(t) = te^{\sin(t)}$
 - $x(t) = e^{j\omega t}$
 - $x(t) = \cos(t + \frac{\pi}{3})$
- (d) What are the differences between deterministic signal and random signal? 1
- Q.3 (a) What is even and odd signal? Show that the product of two even signals or two odd signals is an even signal and that the product of an even signal and an odd signal is an odd signal. 3
- (b) Find the odd and even components of the following signal. 4
- $x(t) = e^{j2t}$
 - $x(t) = \cos t + \sin t$
- (c) Draw the odd and even representations for the given signal. 3



- Q.4 (a) What is LTI system? 1
- (b) Express the given signal sequence as a time-shifted impulse. 3

n	-2	-1	0	1	2
X(n)	3	2	1	4	5

- (c) Determine the convolution sum of two sequences. $x(n)=\{1,2,3,4\}$; $h(n)=\{1,1,1,1\}$
- (d) Explain in detail the distributive property and associative property.

SECTION-B

- Q.5 (a) What is Z-transform? Why Z-transform is used? 2
- (b) Find the z-transform and mention the region of convergence (ROC) for the following discrete time sequences. 4
- $X(n) = \{2, 1, 2, 3\}$
 - $X(n) = \{2, 1, 2, 3\}$
 - $X(n) = \{1, 2, 1, -2, 3, 1\}$
- (c) Find the inverse z-transform of the given function, 4
- $$x(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$
- Q.6 (a) Write down all steps of RADIX-2 fast Fourier transform (FFT) algorithm. 2
- (b) Derive all equation of decimation-in-time fast Fourier transform (FFT) algorithm and draw FFT butterfly structure.. 3
- (c) Draw the flow diagram of eight point fast Fourier transform (FFT) algorithm. 2
- (d) Find out the complex values $X(k)$ for $k=0,1,2,3$ of discrete Fourier transform (DFT) by using it to derive the time series $[1,0,0,1]$. 3
- Q.7 (a) Write down the difference between finite impulse response (FIR) and infinite impulse response (IIR) filters. 3
- (b) Describe all the properties of Discrete Time Fourier Series (DTFS). 4
- (c) The transfer function for FIR filter is given by: 3
- $$H(z) = 1 + 2.3453z^{-1} - 0.3457z^{-2} + 1.2385z^{-3}$$
- Draw the realization block diagram for each of following cases:
- Transversal structure
 - A two-stage lattice structure.
- Q.8 (a) Find the 8 point DFT and IDFT for the given data sequence $x(n) = \{1, 2, 3, 4\}$. 3
- (b) Write down the advantages and disadvantages of window method. What are the name of common window functions and what are transition-widths and equations of these window functions? 3.5
- (c) Using the simple pole-zero method of calculating filter coefficients of a bandpass digital filter is required the following specifications: 3.5
- Complete signal rejection at dc and 250 Hz.
 - a narrow passband centred at 125.
 - a 3db bandwidth of 10 Hz.
- Consider a sampling frequency of 500 Hz, obtain the transfer function of the filter, by suitable placing z-plane poles and zeros and its difference equations.

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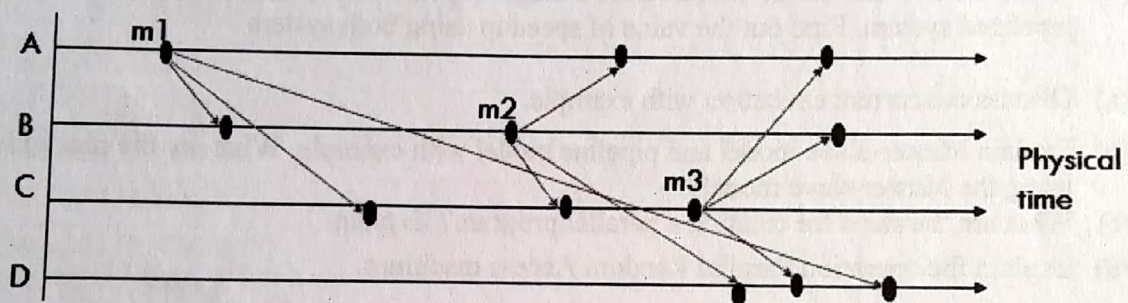
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SECTION-A

- Q.1 (a)** What is distributed system? 1
- (b)** Describe the challenges in distributed systems. 3
- (c)** Describe the automatic banking system basis on distributed systems. 3
- (d)** What is heterogeneity of a distributed system? How can we solve this for the user? 3
- Q.2 (a)** What is distributed algorithm in interaction model? 1
- (b)** Write down the differences between latency and bandwidth. 2
- (c)** Distinguish between Ring-based election Algorithm and Bully Algorithm. 2
- (d)** Can D determine who sent the message earlier? How you can solve the event ordering? 5



- Q.3 (a)** Compute the delay and true offset of messages exchanging between a pair of NTP peers. 4
- (b)** Write down the output of the following figure: 3(b) using logical and vector clocks. 4

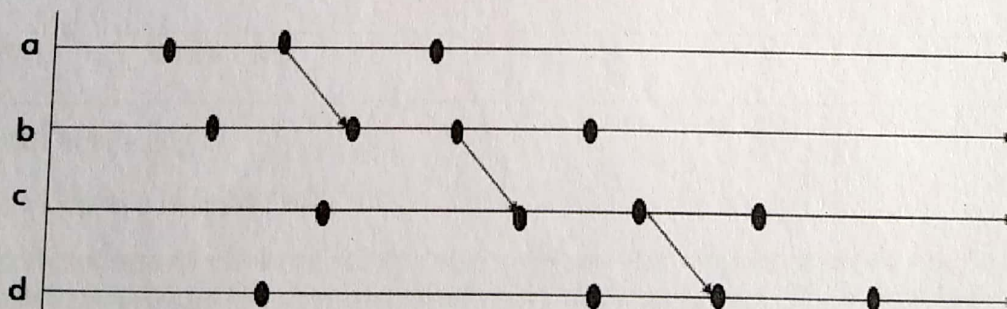


figure: 3(b)

- (c)** Write short note on ordered multicast? 2

- Q.4 (a)** What are the requirements of mutual exclusion? Also describe the Ricart and Agrawala's Algorithm and find out the Message complexity, Client delay and Synchronization delay. 5
- (b)** What are the requirements of leader election? Also describe the Ring-based Election Algorithm. 5

SECTION-B

- Q.5 (a)** Write down the differences between parallel system and distributed system. 3
- (b)** Describe the Bully Election Algorithm with example. 5
- (c)** What are the different models of a parallel programming? 2
- Q.6 (a)** Describe the ISIS algorithm for total ordering. 4
- (b)** Write down all steps of six stages instruction pipeline with flowchart. 3
- (c)** Consider $X = 0.4567 \times 10^6$ and $Y = 0.2353 \times 10^4$, find out $Z = X + Y$ using arithmetic pipeline with flowchart. 3
- Q.7 (a)** Describe the branch delay of 4-stages pipeline. 3
- (b)** Consider the expression $(A_i * B_i + C_i)$ for $i = 1, 2, 3, \dots, 7$. Draw the flowchart and execution table of expression using pipeline processing. 3
- (c)** Write down the difference between SISD and MIMD computer system. 2
- (d)** Consider 200 tasks to be executed for 6-stages pipeline and 1 task to be executed for non-pipelined system. Find out the value of speedup using both system. 2
- Q.8 (a)** Discuss concurrent execution with example. 2
- (b)** Explain Master-slave model and pipeline model with example. What are the precautions in using the Master-slave model? 3.5
- (c)** What are the steps for creating a parallel program? Explain. 2.5
- (d)** Explain the operation Parallel Random Access machines. 2

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Section-A

1.
 - a) Explain the five components of a data communications system. 4
 - b) Give one real time example of simplex, half duplex and full duplex data flow between two communicating devices. 2
 - c) Draw the four basic network topologies separately for four devices and cite an advantage of each type. 4
2.
 - a) Which signal has a wider bandwidth, a sine wave with a frequency of 100 Hz or a sine wave with a frequency of 200 Hz? 1
 - b) Can we say if a signal is periodic or nonperiodic by just looking at its frequency domain plot? How? 3
 - c) A non-periodic composite signal contains frequencies from 10 to 30 KHz. The peak amplitude is 10 V for the lowest and the highest signals and is 30 V for the 20-KHz signal. Assuming that the amplitudes change gradually from the minimum to the maximum, draw the frequency spectrum and bandwidth. 4
 - d) For transmitting broadcasting TV images which transmission technique is preferable and why? 2
3.
 - a) What is a peer-to-peer process? 1
 - b) What is the difference between a port address, a logical address, and a physical address? 3
 - c) How parity check matrix can be used to detect error? 2
 - d) Distinguish the following terms: 4
 - i. Baseband transmission and broadband transmission, and
 - ii. Low-pass channel and a band-pass channel.
4.
 - a) Describe the evolution of 3G cellular system from 2G cellular system. 3
 - b) Why cellular system use different frequency band for uplink and downlink? 3
 - c) For the data streams 10010011, draw the graph for the following line coding schemes: 4
 - i. 2B 1Q
 - ii. MLT-3

Section-B

5.
 - a) Describe the switching protocol of ATM. 3
 - b) Define carrier signal and its role in analog transmission. 2
 - c) Draw the constellation diagram for the following: 3
 - i. QPSK, with a peak amplitude value of 4
 - ii. 8-QAM with two different peak amplitude values, 2 and 5, and four different phases.
 - d) Find the bandwidth for the PM (set $\beta = 3$) situation if we need to modulate an 8-KHz voice. 2
6.
 - a) How we can multiplex and de-multiplex the analog signal, using the FDM technique? 6

- b) Fig-6(b) shows synchronous TDM with the data rate for each input connection is 2Mbps and one data stream for output. The unit of data is 1 bit. Find (a) the input bit duration, (b) the output bit duration, (c) the output bit rate, and (d) the output frame rate.

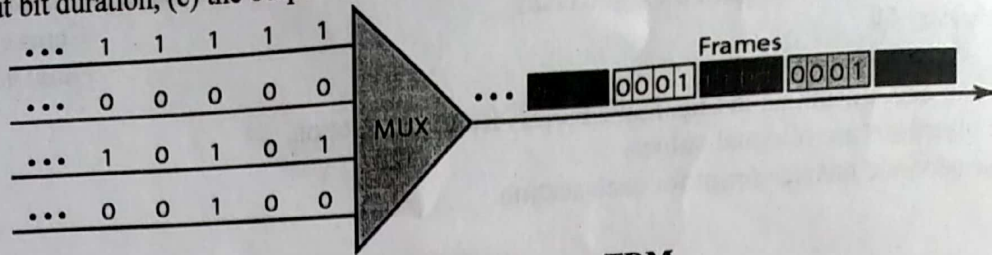


Fig-6(b): Synchronous TDM.

7. a) In the optical fiber communication, how step index differs from graded index? 3
 b) An analog signal has a bit rate of 8000 bps and it has 128 signal elements. Find out the baud rate for this signal 3
 c) Describe the basic operation of packet switching. How packet size affects the overall data transmission in packet switching. 4
8. a) What is Hamming distance? What is minimum Hamming distance? 2
 b) In CRC, show the relationship between the following entities (size means the number of bits): 4
 i. The size of the dataword and the size of the codeword
 ii. The size of the divisor and the remainder
 iii. The degree of the polynomial generator and the size of the divisor
 iv. The degree of the polynomial generator and the size of the remainder
 c) Can the value of a checksum be all 0s (in binary) or all 1s (in binary)? Defend your answer. 2
 d) In table-8(d), the sender sends dataword 10. If a 3-bit burst error occurs the first three bits of the codeword, can the receiver detect the error using the block coding technique? Defend your answer. 2

Table-8(d): Dataword with corresponding codeword.

Dataword	Codeword
00	00000
01	01011
10	10101
11	11110