Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering Department

4th Year 1st Semester B.Sc. Engineering Examination-2020

Course No: CSE411
Full Marks: 60
N.B.

Course Title: Communication Engineering
Time: 3 hours

i) Answer **SIX** questions, taking any **Three** from each section.
ii) All questions are of equal values.

Section: A

Q.1 (a) Define data and data communication. What do you mean by bandwidth and data rate? 4
(b) Define Channel capacity. What key factors affect channel capacity? 3
(c) In a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with 8 signal levels, calculate maximum bit rate. 3

Q.2 (a) Can we say if a signal is periodic or non-periodic by just looking at its frequency domain plot? How? 3
(b) How does distortion effect attenuation in transmission? 2
(c) Draw the sine wave for the same amplitude and frequency with different phase. 2
(d) Assume we need to download text documents at the rate of 80 pages per sec. A page is an average of 20 lines with 60 characters in each line. What is the required bit rate of the channel? 3

Q.3 (a) For the bit stream 01011001, sketch the waveforms for NRZ-I and NRZ-L encoding format. 4
(b) What is pulse rate and bit rate? Show the relation between them. 2
(c) Briefly describe the pulse code modulation (PCM) technique. 4

Q.4 (a) What is the advantages of QAM over ASK or PSK? 3
(b) For the bit stream 10011010, sketch the waveforms for Manchester and differential Manchester schemes. 4
(c) Distinguish between multilevel TDM, multiple-slot TDM, and pulse-stuffed TDM. 3

Section: B

Q.5 (a) If the peak voltage value of a signal is 10 times the peak voltage value of the noise, what is the SNR? What is the SNRdB? 3
(b) What are the role of carrier signal in the analog transmission? 2
(c) We need to use synchronous TDM and combine 20 digital sources, each of 100 Kbps. Each output slot carries 1 bit from each digital source, but one extra bit is added to each frame for synchronization. Answer the following questions: 5
  i. What is the size of an output frame in bits?
  ii. What is the output frame rate?
  iii. What is the duration of an output frame?
  iv. What is the output data rate?
  v. What is the efficiency of the system (ratio of useful bits to the total bits)?

Q.6 (a) What is parity bit? Generate code words for data word 10101 using even parity and odd parity. 2
(b) Find the Hamming distance between two pairs of words 10101 and 11110. 3
(c) Discuss the concept of redundancy in error detection. For P= 110011 and M= 1110011, find CRC using modulo 2 arithmetic. 5

Q.7 (a) Distinguish between a link and a channel in multiplexing. 2
(b) Can the value of a checksum be all 0s (in binary) or all 1s (in binary)? Defend your answer. 2
(c) What is the purpose of cladding in an optical fiber? 2
(d) Draw the constellation diagram for the following cases. Find the peak amplitude value for each case and define the type of modulation (ASK, FSK, PSK, or QAM). The numbers in parentheses define the values of I and Q respectively. 4
  i. Two points at (0, 2) and (0, -2).
  ii. Four points at (2, 2), (-2, 2), (-2, -2), and (2, -2).

Q.8 (a) Describe the advantages and disadvantages of Optical Fiber cable. 3
(b) Write short notes about Multilevel 2B1Q and 8B6T. 4
(c) What are the propagation time and transmission time for a 2.5 KB (kilobyte) message if the bandwidth of the network is 1 Gbps? Assume that the distance between the sender and the receiver is 12000 km and that light travels at $2.4 \times 10^8 \ m/s$. 3

Bangabandhu Sheikh Mujibur Rahman Science & Technology University
Department of Computer Science and Engineering
4th Year 1st Semester B.Sc. (Engg.) Final Examination-2020

Course No.: CSE401   Course Title: Artificial Intelligence

Full Marks: 60   Time: 03 hours

N.B.

i) Answer **SIX** questions, taking any **THREE** from each section.

ii) All questions are of equal values.

Section-A

1. a) Is AI a science, or is it engineering? Or neither or both? Explain.   2

   b) Explain the autonomy of the agent along with by giving the suitable examples.   3

   c) Consider two intelligent agents playing chess with a clock. One of them is called "Niaz   5
   Murshed", while the other is "Gary Kasparov". Now, do the following tasks:
      i. Roughly specify the task environment (PEAS description) for "Niaz Murshed".
      ii. Determine each of the properties of this task environment as – fully observable or
   partially observable, deterministic or stochastic, episodic or sequential, static,
   dynamic, or semi-dynamic, discrete or continuous and single agent or multi-agent.
   Explain your answer in each case.

2. a) Give the problem formulation for the following problem: 4
   "There is a six glass boxes in a row, each with a lock. Each of the first five boxes holds
   a key unlocking the next box in line; the last box holds a banana. You have the key to
   the first box, and you want the banana."

   b) Make the main differences between the general Tree Search algorithm and the Graph   2
   Search algorithm.

   c) Traverse the all nodes, start from node A, using the techniques of BSF and DFS for the   4
   following graph by showing the open list and closed list in each step:
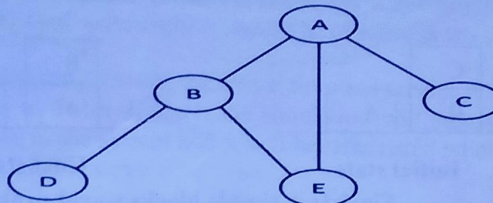

Fig-2.1: A graph.

3. a) Analyze 8-puzzle problem with respect to the following problem characteristics: 5
   i. Is the problem decomposable?
   ii. Can solution step be ignored?
   iii. Is the good solution absolute or relative?
   iv. Is the solution state or a path?
   v. What is the role of knowledge?

   b) Discuss A* algorithm. Give one example where it is suitable to apply.   5

4. a) Define the following terms with example: 3
      i. Logical equivalence   ii. Validity   iii. Satisfiability

   b) Distinguish among horn clauses, definite clauses and goal clauses?   2

   c) By showing each step, convert the following sentence into CNF: 5
   $[(Food \rightarrow Party) \vee (Drinks \rightarrow Party)] \rightarrow [(Food \wedge Drinks) \rightarrow Party]$

Section-B

5. a) What is wrong with the following arguments?

i) Men are widely distributed over the earth

ii) Socrates is a man.

iii) Therefore, Socrates is widely distributed over the earth.

How should the facts represented by these sentences be represented in logic so that this problem does not arise?

5

b) Write a Prolog program to merge two sequentially ordered (ascending) lists into one ordered list.

3

Hint: Goal: merge([1, 3, 5, 7], [0, 2, 4, 6], L)

L = [0, 1, 2, 3, 4, 5, 6, 7]

Goal: merge([a, c], [b, d], [a, b, c, d])

Yes

c) Arrange a parse tree for the sentence "The silly robot moved the red pyramid to the big table."

2

6. a) How does fuzzy logic solve the problem of binary logic? Explain with example.

3

b) In a simplified diagnosis problem where fever might occur due to the four reasons like – Allergy (All), Flu, Cold and Pneumonia (Pneu) i.e. the frame of discernment, θ might consist of the set {All, Flu, Cold, Pneu}. Suppose one observation of fever of a particular patient, supports Flu, Cold or Pneumonia to degree 0.6 (m1) and the other one disconfirms Pneumonia to degree 0.8 (m2). Now, using the Dempster-Shafer rule, calculate - m1⊕m2, Bel1⊕Bel2 ({Flu, Cold, Pneu}), Bel1⊕Bel2 ({All, Flu, Cold}). Also calculate the plausibility of the corresponding belief.

7

7. a) Consider the following block world problem:

5

Initial state   Goal state

Fig-5.1: A simple blocks world problem.

Now, show how the "STRIPS" solves this problem.

b) What are the main components of an Expert System? Write the main characteristics of this.

5

8. a) Define the Bayesian Network?

3

b) How to build an NLP pipeline? Explain.

5

c) Why NLP is difficult?

2

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering Department

4th Year 1st Semester B.Sc. Engineering Examination-2020 (Online)

Course No: CSE403
Full Marks: 40
N.B.

Course Title: Computer Simulation and Modeling
Time: 02 hours

i) Answer **Six** questions, taking any **Three** from each section.
ii) All questions are of equal values.

Q.1 (a) Briefly explain why simulation and modeling are used?   3

     (b) In some cases simulation is the appropriate tool and also in other cases simulation is not the appropriate tool, justify it.   4

     (c) Extract from the following description the entities, attributes and activity of the system: 3

         An aircraft is flying under the control of an autopilot. A gyroscope in the autopilot detects the differences between actual heading and desired heading. It sends a signal to move the control surfaces. In response to the control surface movement, the airframe steers toward the desired heading.

Q.2 (a) Let there be two equations, you have to make an interpolation solution by finding the values of unknown variables. In this case simulation is required or not? Explain your answer with proper logic and examples.   5

     (b) Suppose a new robot is invented for brain surgery as an application of medical science. Explain why it is needed to make a simulation with that robot before applying it to humans? How will simulation results be effective in this purpose?   5

Q.3 (a) In a single-channel queuing system, the arrival time and service time of five customers is shown in **Table-1**. Here, the simulation will start when the first customer arrives in the system and it will be terminated when the last customer completes his/her service.   5

Table-1: Simulation Table for Single-Channel Queuing System

Customer	Arrival Time (Minutes)	Service Time (Minutes)
1	0	3
2	2	4
3	8	2
4	12	4
5	15	5

Using the Table-1, calculate the following terms:

     i.   Average waiting time for a customer

21 Nov   2nd semester Exam
17 oct   lab final 3st
24-9   2nd semster class
5-20   pL 2nd semister
old Nov

ii.   The probability that a customer has wait in the queue

iii.   The proportion of idle time of the server

iv.   The average service time

v.   The average inter arrival time

(b)   What is the purpose of use simulation in a queuing system? List the factors that affect the performance of the simulation system.   2.5+2.5

Q.4   (a)   Generate the five random numbers using the linear congruential method, where the seed is 17, multiplier is 27, increment is 53 and modulus is 100.   5

(b)   When we need to use random numbers and how can we check the randomness of a sequence of random numbers?   2+3

Section D

Q.5   (a)   What are the different uses of Student's T-test and Chi square test? Why is it important in use in real life problem solving?   3+2

(b)   What do you mean by discrete and continuous random variable? What do you understand about confidence intervals?   3+2

Q.6   (a)   What are Bernoulli trials and Bernoulli distributions? What are the applications of the Poisson distribution?   3+2

(b)   Draw the flowchart of steps in a simulation study. Define state and event.   3+2

Q.7   (a)   Compare between random numbers and random variates.   2

(b)   Why PERT and CPM network is used?   3

(c)   In a railway station, passengers arrive at afternoon from one to eight groups. The numbers of passengers per groups are 300, 110, 405, 271, 312, 113, 307, and 212 respectively.   5
Find out the value and demonstrate the graphical representation of probability distribution and cumulative probability distribution for each group.

Q.8   (a)   Demonstrate the step-by-step procedure for generating random variates for exponential distribution, using the inverse-transform technique.   5

(b)   Generate three Poisson variates with mean $\alpha = 0.25$, using the following sequence of random numbers: 5
0.4357, 0.4146, 0.8353, 0.9952, 0.8004, 0.7471, 0.7161, 0.8682, 0.9056, 0.8225

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4th Year 1st Semester B.Sc. Engineering Examination-2020

Course No: CSE405
Full Marks: 60

Course Title: **Digital Signal Processing**
Time: 03 hours

N.B. i) Answer **Six** questions, taking **Three** questions from each section.
ii) All questions are of equal values

Section A

Q.1 (a) How you can differentiate among unit step function, unit impulse and ramp function with mathematically and graphically.   5

(b) The product of two even signals or two odd signals is even and the product of one even signal and one odd signal is odd, justify it with example.   5

Q.2 (a) Compare energy signal and power signal. Define reflection of a signal.   4

(b) The continuous-time signal $x(t) = 5\sin(\pi t)$ for the interval $13 \geq t \geq 0$. Plot the corresponding discrete-time signal with a sampling period T=0.1s   6

Q.3 (a) Check whether $y(t) = \dfrac{dx(t)}{dt}$ is causal or not.   2

(b) Find $(2t+3)$ and $(-t+0.5)$ for the given signal $x(t)$ using graphical representation.   8
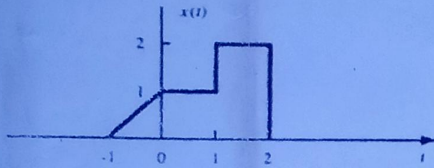
Q.4 (a) Distinguish between auto-correlation and cross-correlation. Perform linear convolution using matrix method for the given data sets.   6
$x(n)=\{2, 4, 6, 8, 10\}$ and $h(n)=\{1, 2, 3\}$

(b) Perform circular convolution for the given data sets graphically.   4
$x(n)=\{2, 4, 8, 10, 12, 14\}$ and $h(n)=\{2, 3, 4\}$

Section B

Q.5 (a) Find the Z-transform and ROC of the sequence $x(n) = \{8, 7, 4, 3, 7, 8, 6, 9, 5\}$.   4

(b) Using long division, determine the inverse Z-transform of   6
$$X(z) = \frac{z^2 + 2z}{z^3 - 3z^2 + 4z + 1}; ROC; |z| > 1$$

Q.6 (a) Show the advantages of digital filter over analog filter. For stability and causality what requirements are followed by analog filter and digital filter?   5

(b) Compute 4-point DFT of a sequence $x(n)=\{0,1,2,3\}$ using DIT algorithm   5

Q.7 (a) In what condition DTFT is exist? Determine the DTFT of two sequences   8
(i) $a^n u(n-3)$ and   (ii) $\delta(m-4)+\delta(m.)$

(b) What is FFT? Why FFT is needed?   2

Q.8 (a) Explain with a suitable example the steps for design of linear phase filters using hamming window   7

(b) Draw the ideal and real circumstances of low pass filter, high pass filter, bandpass filter and band stop filter.   3

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4th Year 1st Semester B.Sc. Engineering Examination-2020

Course No: CSE407

Course Title: Digital System Design

Full Marks: 60

Time: 3 hours:

N.B.
i) Answer Three questions from each section
ii) All questions are of equal values.

Section A

Q.1   Suppose a number system is like bellow and we named it bsmrstu number.
1st digit is contains 2 symbol $\{0,1\}$ 10
2nd digit contains   3 symbol $\{0,1,2\}$
(a) Nth digit contain   n+1 symbols.
Convert 2345 bsmrstu number to decimal number.   2120
And convert 105 decimal to bsmrstu number.

Q.2   A B C S Co   5
0 0 0 0 0
0 0 1 1 0
0 1 0 1 0
(a)
0 1 1 0 1
1 0 0 1 0
1 0 1 0 1
1 1 0 0 1
1 1 1 1 1
Implement this truth table with minimum logic gates.

(b) **What are Minterm and Maxterm?** explain with an example.   5

Q.3 (a) How delays in carry of multiple bit adder can be minimized.   4
(b) Illustrate the Shift and Adder Multiplier Architecture.   6

Q.4 (a) Discuss floating point number representation in a digital system.   5
(b) Discuss on the block diagram of IEEE compliant floating point addition.   5

Section B

Q.5 (a) Design a 4-bit adder can be designed by dividing the adder into 4 single bit adder,   7
and an adder can be designed using 2 half adders?
(b) Describe fan in and fan out with examples.   3

Q.6 (a) Explain the Laws of Boolean Algebra with examples.   5
(b) Simplify $F(P,Q,R,S)=\sum(0,2,5,7,8,10,13,15)+d\sum(6,4)$ using k-map and draw the circuit using minimum   5
logic gate.

Q.7 (a) Discuss different types of arithmetic operations. How those can be implemented in a digital system.   6
(b) Discuss rules of k-map.   4

Q.8 (a) Why binary is preferred for designing digital system? Explain your answer with proof.   4
(b) Illustrate the Floating Point Adder Architecture.   6