Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science & Engineering

Final Examination, 2023 — **4th Year 2nd Semester**
Course No: CSE 805 — **Course Title: Digital Signal Processing**
Time: 03 (Three) hours — **Full Marks: 60**

N.B: (i) Answer any three questions from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

PART-A
(Answer any three questions)

1. (a) Describe the sampling theorem. 03

   (b) Consider an analog signal, $x_a(t) = 3\cos 2000\pi t + 5\sin 6000\pi t + 10\cos 12000\pi t$ 1+1+3+2
   - (i) What is the Nyquist rate of this signal?
   - (ii) What is the folding frequency of this signal?
   - (iii) If the signal is sampled at a rate $F_s = 5000\ samples/s$ then find the discrete time signal which is obtained after sampling.
   - (iv) What is the analog signal $y_a(t)$ that we can reconstruct from the samples if we use ideal interpolation?

2. (a) Determine if the system $y(n) = nx(n)$ is a time invariant system or not. 02

   (b) Determine whether the given discrete-time system is linear or not: $y(n) = n^2x(n-1)$ 02

   (c) Determine if the system $y(n) = x(-n)$ is a causal system or not. 02

   (d) Determine the even and the odd components of the signal, $x(n) = e^{jwn}$. 02

   (e) Determine the power and the energy of the signal, $x(n) = u(n)$. 02

3. (a) The impulse response of a linear time invariant system is $h(n) = \{\underset{\uparrow}{1}, 0, -1, -1\}$. Determine the response of the system to the input signal $x(n) = \{\underset{\uparrow}{0}, 1, 4, -3\}$. 04

   (b) Determine if the recursive system defined by the difference equation $y(n) = ay(n-1) + x(n)$ is linear. What is the condition of stability for this system? 2+2

   (c) Determine the homogeneous solution of the system described by the first order difference equation given in question 3(b). 02

4. (a) Determine the impulse response $h(n)$ for the system described by the second order difference equation, $y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1)$. 03

   (b) Determine the response $y(n), n \geq 0$ for the system described in question 4(a) when the input sequence is $x(n) = 4^n u(n)$. 03

   (c) Find and sketch the Direct Form I and Direct Form II realization of the system described in question 4(a). 04

PART-B
(Answer any three questions)

5. (a) Determine the z-transform of the signal: i) $x(n) = (\frac{1}{2})^n u(n)$ ii) $x(n) = [3(2^n) - 4(3^n)]\, u(n)$ 04

   (b) A linear time invariant system is characterized by the system function 2+2+2
   $H(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$
   Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions:
   - (i) The system is stable.
   - (ii) The system is causal.
   - (iii) The system is anti-causal.

6. (a) Determine and sketch the energy density spectrum $S_{xx}(\omega)$ of the signal $x(n) = a^n u(n), -1 < a < 1$. 03

   (b) Determine and sketch $X_R(\omega), X_I(\omega), |X(\omega)|, \measuredangle X(\omega)$ for the Fourier transform of the signal given in question 6(a). 03

   (c) Determine the Fourier series coefficients and the power density spectrum of the periodic signal $x(n) = A[u(n) - u(n-L)]$, given, $x(n) = x(n+N)$. Sketch the power density spectrum for $L = 2, N = 10$ & $A = 1$. 04

7. (a) Perform the circular convolution of the following two sequences, $x_1(n) = \left\{\underset{\uparrow}{1}, 2,3,1\right\}, x_2(n) = \left\{\underset{\uparrow}{4}, 3,2,2\right\}$. 04

(b) By means of 4-point DFT and IDFT find the sequence $x_3(n)$ corresponding to the circular convolution of the sequences $x_1(n)$ and $x_2(n)$ given in question 7(a). 04

(c) The impulse response of a relaxed LTI system is $h(n) = a^n u(n), -1 < a < 1$. Determine the value of the step response of the system as $n \to \infty$. 02

8. (a) What do you mean by cross-correlation and auto-correlation? 02

(b) Differentiate between Hanning and Hamming window for FIR filter design. 03

(c) Describe the two algorithms for Divide-and-Conquer approach to computation of the DFT. How is this approach better than direct computation of the DFT? 4+1

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science& Engineering

Final Examination, 2023 — **4th Year 2nd Semester**

Course No: CSE 817 — **Course Title: Introduction to Distributed Computing**

Time: 03 (Three) hours — **Full Marks: 60**

N.B.: (i) Answer any three questions from each PART (ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

PART-A
(Answer any three questions)

1.	(a)	What is Distributed Shared Memory (DSM)? What are the benefits of DSM in terms of shared memory?	03
	(b)	Describe the components and working of the DSM model with a neat diagram.	03
	(c)	What is Peer to Peer model? Show the full working of a Peer to Peer model with an example diagram.	04
2.	(a)	What is replication in distributed systems? What are the two main reasons for replication?	03
	(b)	Explain different design approaches used in replication.	03
	(c)	Describe the benefits and challenges of using replication in a distributed environment.	04
3.	(a)	Define Network Security. Briefly describe the network security model.	05
	(b)	Differentiate between partial failure and full failure with suitable examples.	03
	(c)	Define fault tolerance. Explain fault tolerance techniques used in distributed systems.	02
4.	(a)	Illustrate the Two-Army Problem and explain how it demonstrates the challenge of reliable communication.	04
	(b)	What is a cryptographic algorithm? Explain how the RSA algorithm works	04
	(c)	Write a short note on the difference between remote write and local write protocols.	02

PART-B
(Answer any three questions)

5.	(a)	Why do we use DSM in distributed systems? Write the application areas of DSM.	03
	(b)	What are the fundamental failure models in distributed systems? Explain each with an example.	05
	(c)	Discuss the role of redundancy in fault tolerance.	02
6.	(a)	Explain system-level names vs user-level (human-readable) names in distributed systems.	03
	(b)	Define cloud computing. Why is the term "cloud" used to describe it?	03
	(c)	List the four main categories of cloud computing and explain the benefits of using cloud services.	04
7.	(a)	What are the key consistency issues in DSM systems?	02
	(b)	How can firewalls be configured?	03
	(c)	How do failure prevention and detection contribute to fault tolerance in distributed systems?	05
8.	(a)	What is Message tampering? Explain briefly the main security techniques.	04
	(b)	Explain the concept of total and partial failure in distributed computing with an example.	03
	(c)	Write briefly about error, fault, and failure and how they are related.	03

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science & Engineering

Final Examination, 2023 — **4th Year 2nd Semester**
Course No: CSE 803 — **Course Title: Machine Learning**
Time: 03 (Three) hours — **Full Marks: 60**

N.B: (i) Answer any three questions from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

PART-A
(Answer any three questions)

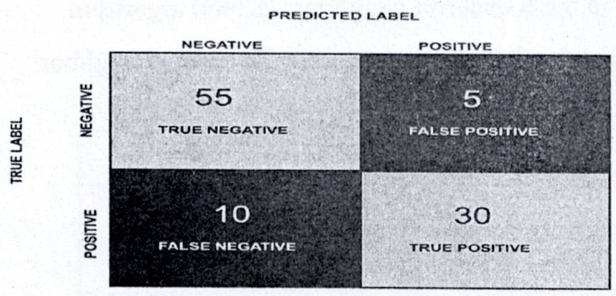
1. (a) Explain Underfitting in Machine Learning. 02

   (b) Define Cross-Validation. Why is it important in model building? 02

   (c) Compare Supervised, Unsupervised, and Reinforcement Learning with examples and mention use-cases where each is effective. 06

2. (a) Define Normalization & Standardization. When is Normalization preferred to Standardization? 04

   (b) 06



   Calculate Precision, Recall, and F1 Score from the above matrix.

3. (a) Define Multiple Linear Regression. Explain the equation with proper examples. 05

   (b) Build a Salary estimator in terms of Experience from the following data: 05
   The regression equation will be, $salary = \boldsymbol{b_0} + \boldsymbol{b_1} * experiences$

Experiences	Salary
1.1	39.21
1.5	43.14
2.3	44.78
3.1	53.32
3.5	62.63

   Find $\boldsymbol{b_0}$ and $\boldsymbol{b_1}$ and rewrite the regression equation.

4. (a) Explain the most common ways of treating outliers in Machine learning. 03

   (b) How does the learning rate affect the performance of a Gradient Descent algorithm? 02

   (c) A Machine Learning model predicts the **performance score** of students based on the number of hours they study daily. The expert panel has also provided their actual evaluated scores. Using the following data, calculate the **Mean Squared Error (MSE)** and **Root Mean Squared Error (RMSE)** of the model: 06

Student	Study Hours per Day	Expert Score (Actual)	Predicted Score
A	2.0	60	58
B	3.5	75	78
C	4.0	80	76
D	5.0	88	85
E	1.5	50	52

PART-B

(Answer any three questions)

5. (a) Justify - "*Support Vector Machine is a large margin classifier*". 04

(b) 06

SL	Income	Lot_Size	Ownership
1	60.0	18.4	?
2	64.8	21.6	?
3	84.0	17.6	?
4	59.4	16.0	?
5	108.0	17.6	?
6	75	19.6	?

Consider, $b_0 = -25.9382$, $b_1 = 0.1109$, $b_2 = 0.9638$,
where b_1 *and* b_2 are for the "Income" and "Lot_Size" variables, respectively.
Construct a Logistic Regression model with Threshold = 0.75, classify the 6 customers as "Owner" or "Nonowner": if p>=0.75 then the case will be classified as "Owner".

Fill the "Ownership" column of the given table.

6. (a) Define Feature Scaling in Machine Learning. Why is it important? 02

(b) Explain how to choose the "k" value in the K-Nearest Neighbors (KNN) algorithm. 03

(c) Consider the following dataset. Predict the diabetic patient using K-nearest neighbor classifier. (Assume K=3) 05

BMI	Age	Sugar
33.6	50	1
26.6	30	0
23.4	40	0
43.1	67	0
35.3	23	1
35.9	67	1
36.7	45	1
25.7	46	0
23.3	29	0
31	56	1

7. (a) Write Bayes Theorem. 02

(b) Consider the following table and construct a naïve bayes classifier to decide if the weather is overcast, then the Player should play or not? 08

Day	Outlook	Play
1	Rainy	Yes
2	Sunny	Yes
3	Overcast	Yes
4	Overcast	Yes
5	Sunny	No
6	Rainy	Yes
7	Sunny	Yes
8	Overcast	Yes
9	Rainy	No
10	Sunny	No
11	Sunny	Yes

8. (a) Define Artificial Neural Network. Describe the structure of ANN. 04

(b) Why Deep Learning is used instead of Machine Learning? 03

(c) What is Perceptron? How does a Multilayer Perceptron Work? 03