

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B. Sc. Engg. Part-4 Even Semester, Examination-2022**  
**CSE-4211 (Artificial Intelligence)**

**Time: 3 Hours**

**Full Marks: 52.5**

[Answer any six questions taking at least three from each Section]

**Section-A**

1. (a) Define artificial intelligence and describe its main goals. 3  
(b) Explain the difference between strong AI and weak AI. Provide an example of each. 2.75  
(c) Define a knowledge-based system and describe its main components. 3
  
2. (a) Define predicate logic. What are the logical notions of predicate logic? 3.5  
(b) Explain first order predicate logic (FOPL). Describe the semantics of FOPL. 3.25  
(c) Convert the following English sentences in FOPL: 2
  - i. Some student in this class has visited Saint Martin's Island.
  - ii. Every student likes gossiping.
  - iii. None of friends are perfect.
  - iv. All Romans were either loyal to Caesar or hated him.
  
3. a) Discuss the basic steps of resolution in AI. 3  
b) Consider the following facts: 3.75
  - i. Bread is a food.
  - ii. Mango is a food.
  - iii. Salma eats Burger.
  - iv. Anything anyone eats is called food.
  - v. Mili likes all kind of food.
  - vi. Salma eats everything that Mili eats.
  - vii. Does Mili likes Burger? Prove it by resolution.  
c) Write the basic steps for conversion to clausal form. 2
  
4. a) Distinguish between blind search and directed search techniques. 2  
b) Consider the 8-puzzle Problem. 2.75

**Start State**

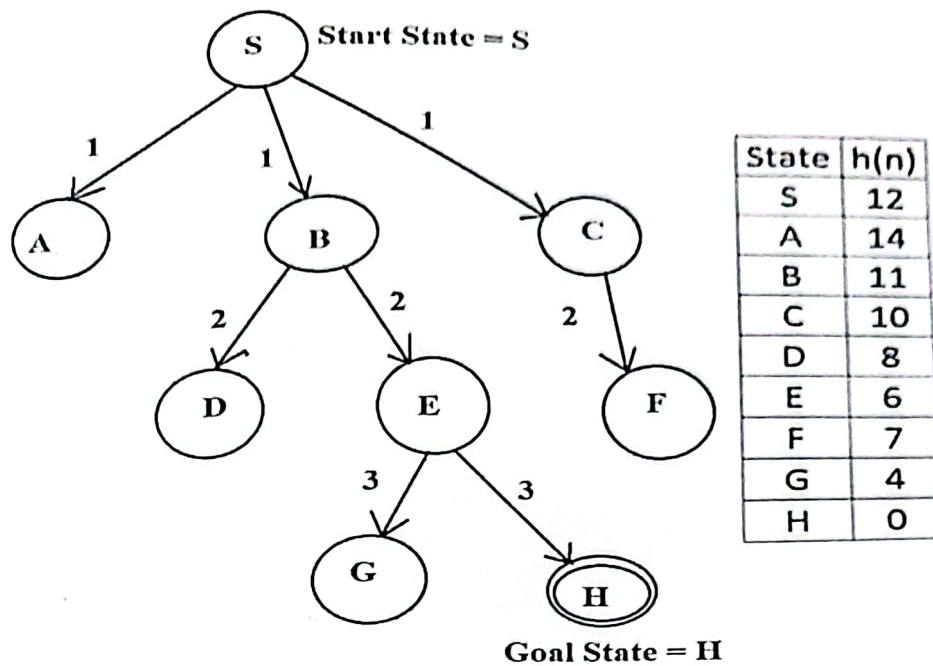
2	8	3
1		4
7	6	5

**Goal State**

1	2	3
7	8	4
	6	5

Find out the goal of above example using Heuristic search technique.

- c) Consider the following figure. Find out the goal path using Best First Search algorithm with necessary explanation [ $h(n)$  = the heuristic value,  $g(n)$  = cost of reaching state  $n$  from the start state]. 4



### Section-B

5.
  - a) Describe monotonic system and non-monotonic system with examples. 2.5
  - b) Define inference Engine. Explain forward chaining and backward chaining with examples. 3.75
  - c) Explain Knowledge acquisition process in expert system with example. 2.5
6.
  - a) Why activation function is used in neural network? Explain the following activation functions (i). ReLU activation function, (ii). Softmax activation function and (iii). Sigmoid activation function. 3
  - b) Draw and explain fully connected neural network 8-16-8-4 (Input layer – Hidden layer-1- Hidden layer-2 – Output layer). Describe how many objects can be classified with this neural network. 3
  - c) Differentiate between overfitting and underfitting in deep neural network (DNN). 2.75
7.
  - a) Describe the importance of data augmentation and regularization techniques in training CNNs to improve generalization performance. 2.75
  - b) Numerical Problem: Consider using a pre-trained VGG-16 model for a classification task with 10 classes. Assuming the last fully connected layer of the VGG-16 model has been replaced with a new fully connected layer for the task, compute the number of parameters in the new fully connected layer. 3
  - c) Consider training a CNN for image classification using data augmentation with rotation, flipping, and scaling. If the original training dataset contains 1000 images and each image is augmented to create 5 additional variations, calculate the total number of augmented images in the dataset. 3
8.
  - a) Explain crisp and non-crisp fuzzy logic. Write the applications of fuzzy logic. 3
  - b) Discuss different types of Loss Functions for Artificial neural networks. 3.75
  - c) Explain Reinforcement learning algorithm with diagram. 2



University of Rajshahi  
Department of Computer Science and Engineering  
B. Sc. Engg. Part-4 Even Semester, Examination-2022  
CSE-4231 (Cryptography and Network Security)

Full Marks: 52.5

Time: 3 Hours

[Answer any six questions taking at least three from each Section]

Section-A

1. (a) What is restricted algorithm? What are the drawbacks of restricted algorithm? 2.75  
(b) The famous Caesar Cipher replace each character by the character three to the right modulo 26. Perform Caesar cipher then transposition cipher (width=5) on the plaintext m="COMPUTER SCIENCE AND ENGINEERING". Leave the space as it is. 4  
(c) Differentiate between symmetric and asymmetric encryption. 2
2. (a) What is birthday attack? Discuss the birthday attack against one-way hash function. 3  
(b) Mr. Bob uses 6byte alphanumeric characters to encrypt using DES. Calculate in detail the time required to break the password using a 1 billion attempts/s machine. 4  
(c) Discuss prime numbers generation technique in real world. 1.75
3. a) If someone creates a database of all primes, won't he be able to use that database to break public key? 2  
b) How is S-box substitutions used to convert a 48-bit input to 32-bit output. Discuss with necessary figure and data. 4  
c) Briefly discuss the variants of DES. 2.75
4. a) What is digital signature? Explain hash functions and digital signatures. 2.5  
b) Write down the properties of digital signature. 2.25  
c) Suppose  $n=3337$ ,  $e=79$  and  $d=1019$ . Encrypt the message  $m=1010567890987$  using RSA public key algorithm and hence decrypt the encrypted message and show that it is equal to the original message  $m$ . 4

Section-B

5. a) What is Kerberos? Briefly discuss Kerberos's credentials. 3  
b) Briefly discuss public-key authority technique to distribute public key. 2.75  
c) Suppose  $q=353$ , primitive root  $\alpha=3$ , A's secret key  $X_A=97$  and B's secret  $X_B=233$ . Use Diffie-Hellman key exchange algorithm to calculate the key. 3
6. a) What is PGP? 1  
b) With a neat diagram explain how to get both the confidentiality and authentication service of PGP. 4.75  
c) What are the applications of IPSec? 3
7. a) Compare between Message Digest (MD5) and Secure Hash Algorithm (SHA). 2.75  
b) What is firewall? Explain the limitations of firewalls? 3  
c) What is IP security? Explain the role of IPSec in the routing architecture 3
8. a) To make sure your system is protected there are some actionable guides in 11 simple steps. Explain these steps. 3  
b) Data protection is very important. Discuss some encryption software tools available to protect your data. 3  
c) Differentiate among Trap doors, Logic bomb and Trojan horse. 2.75



**University of Rajshahi**  
**Dept. of Computer Science and Engineering**  
**B. Sc. Engineering Part-4 (Even Semester) Examination 2022**  
**Course: CSE 4221 (Web Engineering)**

Full Mark: 52.5

Duration: 3 hours

(Answer 3 questions from each Section)

**Section -A**

1. a) What are the key differences between traditional software engineering and web engineering? Provide examples to illustrate these differences. 2.75
- b) What are the main components of a web-based system architecture, and how do they interact to deliver a web application? 3
- c) Discuss the importance of security in web-based systems and identify common security threats along with strategies to mitigate them. 3
2. a) What tasks are performed during the communication activity of the web engineering framework? 4
- b) Write a use case scenario for 'User Registration' functionality for a web application. 3
- c) How does 'priority point' method can be used to identify the relative importance of each of the user requirements? 1.75
3. Suppose you are tasked with creating a news website for a leading print newspaper in Bangladesh. The goal is to deploy a significant web application within 6 months, aiming to reach more readers and increase overall revenue. After initial communication, you have decided to deliver the web application in four increments. Following some discussions, you have outlined a set of requirements that you believe will meet their needs.
- a) Use your imagination to come up with a set of functionalities, and then break down these functionalities into each increment. 4
- b) Create a macroscopic schedule for the web app based on the increments you have planned. 3
- c) Define the different user categories for the news site. 1.75
4. a) What are Cross-Site Request Forgery (CSRF) attacks, and what mechanisms can be implemented to defend against them? 6
- b) What is the principle of least privilege, and how does it contribute to the mitigation of injection attacks in web applications? 2.75

**Section -B**

5. a) Briefly describe the rendering pipeline of a web Browser. 4
- b) Explain how a webserver serves dynamic resources. 4.75
6. a) What are the intents of performance testing for web apps? Briefly discuss different performance testing methods. 4
- b) How do we build a successful WebE Team? 3
- c) What are the umbrella activities of WebE framework? 1.75

7. a) What is meant by "compromising authentication" in web security? Provide examples of common techniques that attackers use to compromise authentication mechanisms. 3
- b) Discuss the role of multi-factor authentication (MFA) in preventing authentication compromises. What are the strengths and potential limitations of using MFA? 3
- c) What are the best practices for storing and managing user passwords to prevent authentication compromise? Describe the steps involved in securely handling passwords. 2.75
8. a) What are the main functions of Cascading Style Sheets (CSS)? Provide a brief overview of CSS attribute selectors, class selectors, and ID selectors with examples. 3
- b) How do sessions differ from cookies? 2
- c) What is the difference between using `<script src="path/to.js" async></script>` and `<script src="path/to.js" defer></script>` in HTML? 1.75
- d) Compare the GET and POST methods for submitting user data from a web client to a web server. 2





**SECTION A**

**ANSWER ANY THREE OF THE FOLLOWINGS**

- 1.(a) Define and mention the key characteristics of Distributed Database Management Systems (DDBMS). [2.00]  
(b) What is Parallel Database Design? [1.25]  
(c) How does parallel processing improve database performance? [2.50]  
(d) Discuss Black Box approach for determining the cost of executing queries. [3.00]
- 2.(a) What is Distributed Database Design? What are the key benefits of Distributed Database Design? [2.00]  
(b) How does data partitioning work in Distributed Database Design? What are the differences between Distributed and Parallel Database Design? [2.00]  
(c) Explain the vertical fragmentation algorithm with an example that incorporates the  $use(q_i, A_j)$  and  $aff(A_i, A_j)$  measures. In your explanation, you should cover the following two points: [4.75]
  - i) Define the concepts of  $use(q_i, A_j)$  and  $aff(A_i, A_j)$ .
  - ii) Describe the steps of the vertical fragmentation algorithm.
- ✓3.(a) Discuss the techniques used for incremental view maintenance in distributed databases. [4.00]  
(b) What are the key challenges in managing views in a distributed database environment? [1.75]  
(c) Explain the fundamental outline of a counting algorithm for view management. [3.00]
- ✓4.(a) What are the steps of query decomposition? [2.75]  
(b) Explain how views can be manipulated as base relations, with an appropriate example. [3.00]  
(c) Explain multilevel access controlled by the 'No read up' and 'No write down' rules. [3.00]

**SECTION B**  
**ANSWER ANY THREE OF THE FOLLOWINGS**

- 5.(a) What is query optimization in a Distributed Database Management System (DDBMS), and why is it important? [3.25]  
(b) How does query optimization contribute to improving performance and scalability in a DDBMS? [3.50]  
(c) What are the objectives of query processing? [2.00]
- ✓6.(a) What is Primary Horizontal Fragmentation (PHF)? Explain the key concepts of PHF. [4.00]  
(b) Between linear and bushy trees, which one is better for a Distributed Database Management System (DDBMS), and why? [4.75]
- ✓7.(a) What is a transaction in DDBMS? [1.25]  
(b) Describe the key components of Distributed Transaction Management (TM) architecture. [4.50]  
(c) What is Distributed Two-Phase Locking (2PL) and how does it ensure serializability in a distributed database environment? [3.00]
- ✓8.(a) Explain the Two-Phase Commit (2PC) protocol used in distributed database systems. What are the main steps involved in the protocol, and how does it ensure atomicity and consistency of transactions across multiple databases? [3.75]  
(b) Discuss the potential problems and limitations of the Two-Phase Commit (2PC) protocol in distributed database systems. [2.00]  
(c) How does the 3PC protocol overcome the problem of the 2PC protocol? [3.00]

Group-3 (Affiliated College)

Create a **Books Management System** using the Laravel web framework. You can find the initial project in the following GitHub repository.

[https://github.com/m-r-kushal/cse4222\\_g3.git](https://github.com/m-r-kushal/cse4222_g3.git)

**Objective 1:**

Clone the repository to your computer. Take necessary steps to make the initial application up and running. (E.g., create a MySQL database for the application, create .env file and update configuration info in it, install project dependencies, generate app\_key etc.).

Finally, run the Laravel application and show the home page.

**Objective 2:**

Create **migration** to generate a table for book information following the table naming convention for Laravel and use **Model factory** and **seeder** classes to insert 200 test records in the table.

Table attributes:

- id [primary key]
- title [string:255]
- author [string:255]
- isbn [string:13]
- stock [int, default:0]
- price [float]

**Objective 3:**

Write necessary model, views, and controller methods to perform the following actions

1. show all books with pagination
2. create a form to Insert new book record
3. Delete a book record.

During the insert and operation, you should perform server-side validation on user inputs, and your application should show proper warning messages in case validation fails.

**NB:** A sample file named **create.blade.php** is given in the "resources/views/books/" folder. You may use this file as the starting point for building book insert form.



done



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
University of Rajshahi

B. Sc. Engineering Part IV Even Semester Exam-2022

Course Title: Distributed Database Management System Lab Code: CSE-4262

Time: 3 Hours

Full Marks: 15

### Q1: MapReduce Word Count Program

In this program, you have to find out the frequency of each word. Here, the role of Mapper is to map the keys to the existing values and the role of Reducer is to aggregate the keys of common values. So, everything is represented in the form of key-value pair.

#### Steps to execute MapReduce word count program

- Create a text file named as **ExamData** and last 3-digit of your student id (sid) (ex. ExamData123.txt) in your local machine and write some text into it.
- Create a HDFS directory named as **DataFold** and last 3-digit of your sid (ex. DataFold123) and upload the text file into this HDFS directory.
- Write the MapReduce program.
- Create the jar file and named as **Count** and last 3-digit of sid (ex. Count123.jar)
- Run the jar file
- Now execute the command to see the output.

### Q2: Create tables & extract insights using Hive SQL

**Step 1:** Copy the supplied CSV data to the previous HDFS directory.

**Step 2:** Create a hive database with two external hive tables and load the data into them.

**Hive database:** Put the named of your database as **Exam** and last 3-digit of sid (ex. Exam123)

**External hive tables:** To create those tables, use the following references:

#### *First table:*

**Name:** Info and last 3-digit of your sid (ex. Info123)

**Schema:** Id, Name, Age, Gender

**Partitioned by:** Gender

**Field terminated by:** ,

**Location:** /DataFold123/info/

#### *Second table:*

**Name:** Address and last 3-digit of your sid (ex. Address123)

**Schema:** Id, City

**Partitioned by:** City

**Field terminated by:** ,

**Location:** /DataFold123/address/

#### Step4: Write Hive SQL

- to retrieve data from both tables.
- to retrieve data from both tables where gender partition is **Male** and city partition is **Dallas**.

### Q3: Viva Voce.

## Set # C

### Experiment-1

Marks = 6.0

Design a Customized Convolutional Neural Network (CNN) for Handwritten Digit Classification with the following specifications:

- Generate a CNN model with:
  - Two CNN hidden layers (Conv2D) of sizes 32, 64 followed by
  - ReLU Activation and
  - MaxPooling2D with Kernel size (3, 3), and Stride=(1,1)
- Use Flatten Layers to convert the feature map into 1D with a Dense layer of size 64 followed by an output Dense Layer of size 10 with SoftMax Activation Function.
- Display the generated CNN with the required number of parameters.
- Use the MNIST database for training and testing.
- Adopt Data augmentation (rotation, shift) with the MNIST dataset.
- Train two CNNs using the original MNIST dataset and augmented MNIST dataset.
- Use the test MNIST dataset as well as the augmented test MNIST dataset to predict the accuracy of the two trained CNNs.
- Compare and plot the prediction accuracy of the two CNNs.

### Experiment -2

Marks = 4.0

Implement a simple deep neural network (DNN) for solving the polynomial equation  $y = 5x^3 - 10x^2 - 20x + 10$  with the following specifications:

- Use three hidden-layers of sizes 32, 64, and 128 and display the generated DNN with the required number of parameters.
- Generate training samples within the range of -20 to +20. Use an appropriate method for normalizing the training data in the range of -1 to +1.
- Use 5% of the samples as test data and 5% of the samples as validation data and the rest of the data for training the DNN with an appropriate number of epochs.
- Display the training accuracy vs validation accuracy and training error vs validation error curves.

LAB Viva Marks = 5.0



**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B.Sc. Engg. Part 4, Even Semester, Practical Examination-2022**  
**CSE-4232P (Cryptography and Network Security)**

SET-C

1. Write a program that encrypt a plaintext (containing letters and spaces) using Caesar Cipher followed by Transposition Cipher. Then perform the reverse operation to get the original plaintext.

Example:

Plaintext:	Computer Science
Caesar Cipher:	Frpsxwhu Vflhqfh (Character 3 to the right)
Transposition Cipher:	Fwfhrhlpuhs qxVf (Width is 5)

2. Find out the Polygram Substitution Cipher of a given plaintext (Consider the block size of 3). Then perform the reverse operation to get original plaintext.
3. Encrypt the plaintext message using RSA algorithm. Then perform the reverse operation to get original plaintext.

Example:

Plain Text:  $M=6882326879666683$ ;  $e=79$ ;  $d=1019$ ;  $n=3337$

Encrypted Text:  $C=15702756209122762423158$

