National University of Computer and Emerging Sciences, Lahore Campus

Course:	Artificial Intelligence Lab	Course Code:	CL218
Program:	BS(Data Science)	Semester:	Spring 2024
Duration:	2 hours + 10 minutes	Total Marks:	50
Paper Date:	19-Mar-2024	Weight	25%
Section:	ALL	Page(s):	2
Exam:	Midterm	Roll No:	

Instruction/Notes:

- **We will check your code for plagiarism.** If plagiarism is found, it will result in **F grade** in lab.
- No cell phones are allowed. Sharing of **USBs** or any other items is **not allowed.**
- You are not allowed to have any helping code with you.
- Submission link is
  \\cactus1\Xeon\Spring 2024\Usman Anwer\AI-LAB\BDS-6A1
  \\cactus1\Xeon\Spring 2024\Usman Anwer\AI-LAB\BDS-6A2
- Submit Paper in respective sections only
- Understanding the questions is also part of it
- Use Jupyter. Internet will be turned off.

Question 1: (Marks = 25)

Connect Four (2 players)

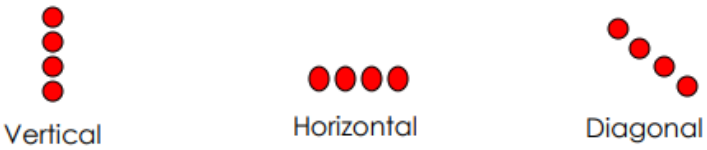
Objective: To be the first player to get 4 checkers in a row.

To play:

1. Players attach the legs to the grid and set it up so that both players can reach it. Make sure the lever at the bottom of the grid is set so the checkers will not fall through.

2. Players decide which color checkers they will use and who will go first.

3. Players take turns placing checkers into the grid until one player has a row of 4 of his or her checkers in a row. The row can be up and down (vertical), across (horizontal), or diagonal.



4. The first player to make a row wins the game. The winner clears the grid by sliding the lever at the bottom of the board to one side, dropping the checkers.

Code is given, you are required to add a minimax algorithm using the Alpha Beta Pruning part.

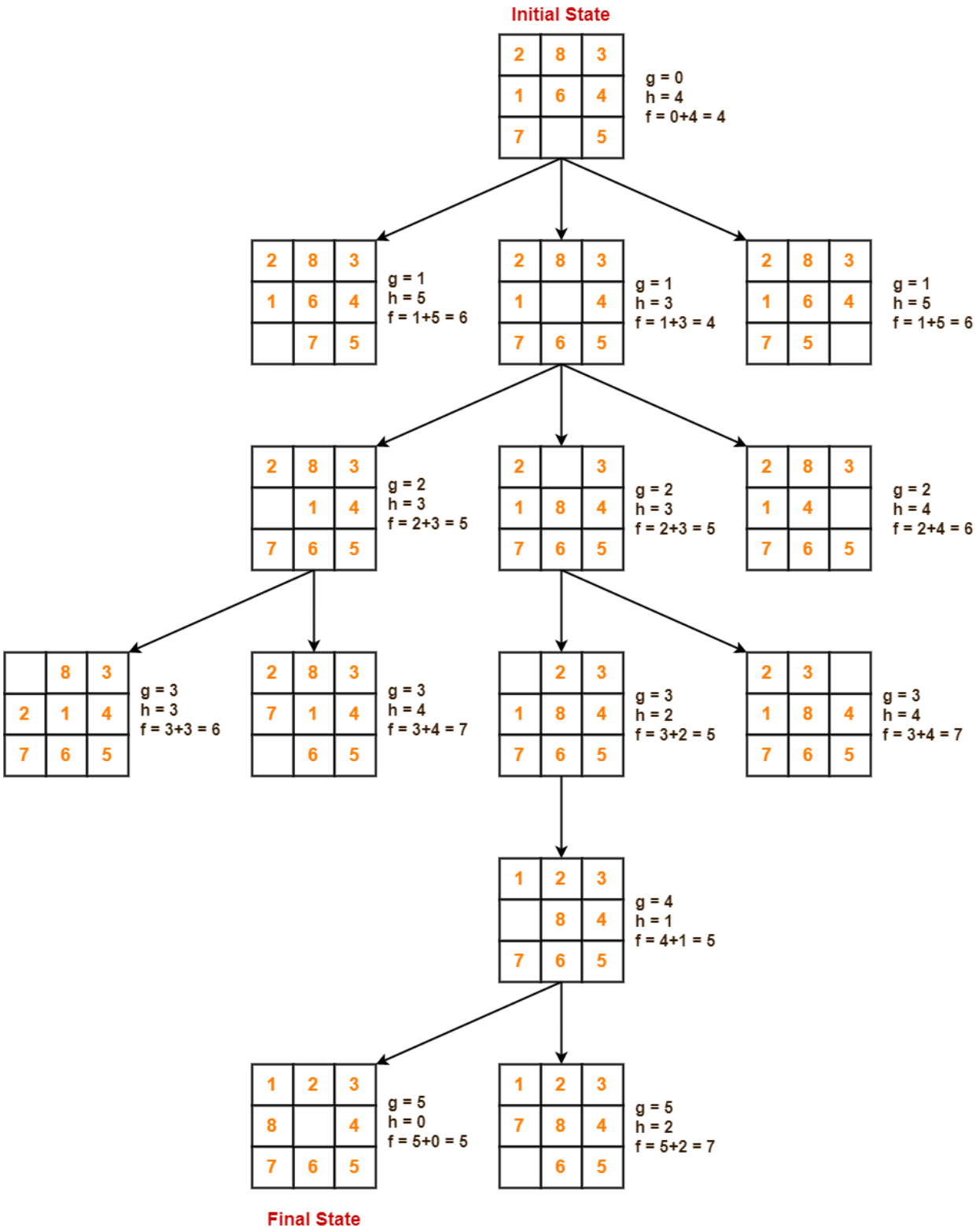
Question 2: (Marks = 25)

Given an initial state of a 8-puzzle problem and final state to be reached-

Initial State

Final State

Find the most cost-effective path to reach the final state from initial state using A* Algorithm.


Initial State
2 8 3
1 6 4
7 5
g = 0
h = 4
f = 0+4 = 4
2 8 3
1 6 4
7 5
g = 1
h = 5
f = 1+5 = 6
2 8 3
1 4
7 6 5
g = 1
h = 3
f = 1+3 = 4
2 8 3
1 6 4
7 5
g = 1
h = 5
f = 1+5 = 6
2 8 3
1 4
7 6 5
g = 2
h = 3
f = 2+3 = 5
2 3
1 8 4
7 6 5
g = 2
h = 3
f = 2+3 = 5
2 8 3
1 4
7 6 5
g = 2
h = 4
f = 2+4 = 6
8 3
2 1 4
7 6 5
g = 3
h = 3
f = 3+3 = 6
2 8 3
7 1 4
6 5
g = 3
h = 4
f = 3+4 = 7
2 3
1 8 4
7 6 5
g = 3
h = 2
f = 3+2 = 5
2 3
1 8 4
7 6 5
g = 3
h = 4
f = 3+4 = 7
1 2 3
8 4
7 6 5
g = 4
h = 1
f = 4+1 = 5
1 2 3
8 4
7 6 5
g = 5
h = 0
f = 5+0 = 5
1 2 3
7 8 4
6 5
g = 5
h = 2
f = 5+2 = 7
Final State