National University
of Computer & Emerging Sciences Peshawar Campus

Name: _____   Section: _____   Roll No. _____

Program: Computer Science
Semester: Spring 2022
Time allowed: 2 hrs 30 mins
Course: Artificial Intelligence Lab (AL2002)

Examination: Lab Exam
**Weightage:** 50   **Marks:** 40
Date: 8th June, 2022
Lab Instructor: Muhammad Hamza

Notes:
- Internet and use of mobile phone is not allowed, anyone found in such activities will be straight forward rewarded **zero**.
- Plagiarism will be not tolerated at all.
- Only submit **.py** files.
- It's the part of the exam to understand the question, so take your time.
- Evaluation will be made based on your **viva,** don't miss it.
- Each question carries equal marks i.e **10**.

Q1. Apply K-Means clustering on the wine dataset provided in the attachment. Wine.data file contains actual data whereas wine.names file contains meta data, you can find all the related information about the data in wine.names file. Import the dataset, do preprocessing if needed. Split the dataset into train and test (70/30) respectively. You need to code for K-Means clustering algorithm from scratch. After clustering plot the cluster using relevant plot (scattered plot is recommended). Test your classifier on test dataset and report accuray.

Q2. The graph in the figure below shows the state space of a search problem. States are denoted by letters, and the cost of each action is indicated on the corresponding edge. Note that actions are not reversible, since the graph is directed. The table next to the state space shows the value of some admissible heuristic function, considering G as the goal state (it is easy to verify that such an heuristic never overestimates the true, minimum path cost from any given state to the goal state G).

state space
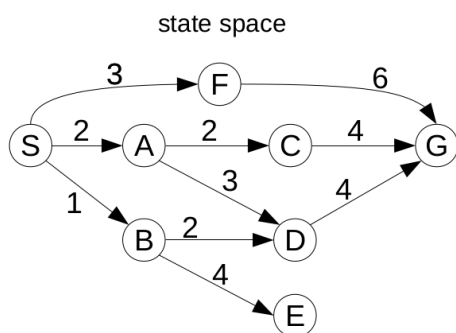
heuristic function (goal state: G)

S	A	B	C	D	E	F	G
6	4	5	2	2	8	4	0

Considering S as the initial state, solve the above search problem using A* search algorithm. You should implement A* from scratch. When drawing the search tree you should clearly indicate: the order of expansion of each node (e.g., by numbering the expanded nodes according to the order of their expansion); the action corresponding to each edge of the tree; the state, the path cost and the value of the heuristic of each node.
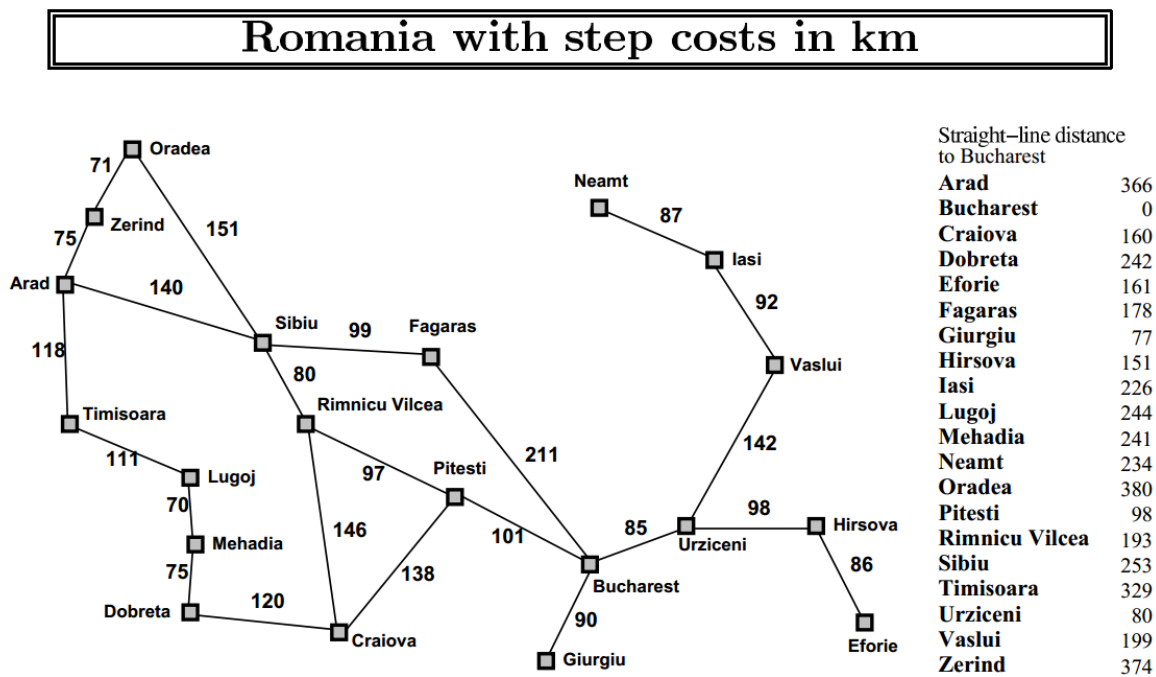
Q3. The dataset "Summary of Weather" contains information on weather conditions recorded on each day at various weather stations around the world during World War 2. Information includes station number, precipitation, snowfall, temperatures, and wind speed. You will find that some values in the precipitation column are missing, almost all the missing values are filled with a "T" character. Your task is to apply Linear Regression using Neuron Algorithm we developed in lab to find the missing precipitation values. You can split the dataset into test and train based on the missing values of precipitation. Report the final result and evaluate your neuron on the basis of the accuracy.

Q4. Following figure illustrates the Traveling map from **Arad** to **Bucharest** with given step costs. Straight line distances are also provided.
Initial state: **Arad**
Goal state: **Bucharest**

Apply **Local Beam Search** algorithm to reach to the goal state. To select the **k** best successor use the straight line distance to bucharest as a heuristic. At each step print the selected successor. Report total number of steps your algorithm has taken to reach the goal state.

Romania with step costs in km

Straight-line distance to Bucharest

Arad	366
Bucharest	0
Craiova	160
Dobreta	242
Eforie	161
Fagaras	178
Giurgiu	77
Hirsova	151
Iasi	226
Lugoj	244
Mehadia	241
Neamt	234
Oradea	380
Pitesti	98
Rimnicu Vilcea	193
Sibiu	253
Timisoara	329
Urziceni	80
Vaslui	199
Zerind	374

GOOD LUCK :)