


## National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Artificial Intelligence	Course Code:	AI2002
	Program:	BS Computer Science, BS Data Sciences	Semester:	Sp 2024
	Section	ALL	Total Marks:	40
	Due Date:		Weightage:	
	Exam Type:	Assignment 1	Page(s):	1

### Instructions:

- Do the work by yourself, this is an individual assignment.
- Plagiarism cases will be dealt with strictly.
- In class submission (late submissions will not be acceptable).

### Question #1:

Imagine you are a delivery driver for a package delivery company. Your job is to deliver packages to several cities in a region as quickly and efficiently as possible. The travel time is the cost used for traveling from one city to another.

**Start: A: Lahore (LHE)**, the bustling capital of Punjab province, known for its Mughal-era monuments like the Badshahi Mosque and Lahore Fort.

**B: Peshawar (PEW)**, an ancient city steeped in history, famous for its bazaars and traditional cuisine. **(Travel time from Lahore: 10 hours)**

**C: Swat Valley (SWT)**, a scenic valley nestled in the Hindu Kush mountains, known for its natural beauty, historical sites like the White Palace, and traditional handicrafts. **(Travel time from Peshawar: 15 hours, Travel time from Skardu: 20 hours)**

**Goal: D: Hunza Valley (HUN)**, a remote valley bordering China, renowned for its breathtaking mountain scenery, unique culture, and historical sites like the Altit Fort. **(Travel time from Swat Valley: 5 hours)**

**E: Skardu (SKD)**, a town nestled in the Karakoram Mountain range, popular for trekking, mountaineering, and exploring historical sites like the Skardu Fort. **(Travel time from Lahore: 12 hours)**

**F: Naran (NAR)**, a scenic town located in the Kaghan Valley, offering stunning views of the Himalayas and opportunities for camping, hiking, and white-water rafting. **(Travel time from Peshawar: 8 hours, Travel time from Swat: 4 hours)**

Consider the search space. Costs are undirected. The number next to each edge is the cost of performing the action corresponding to that edge. You start from A and your goal is to get to D. List the order in which nodes are expanded, which nodes are added to the fringe and which states are added to the closed set when performing Graph Search using:

- breadth-first search.
- depth-first search.
- iterative deepening search.
- uniform cost search.

- A\*

For each of the following heuristics, determine if it is admissible or not. For non-admissible heuristics, modify their values as needed to make them admissible.

**Heuristic 1:**

$$h(A) = 5$$

$$h(B) = 20$$

$$h(C) = 15$$

$$h(D) = 0$$

$$h(E) = 10$$

$$h(F) = 0$$

**Heuristic 2:**

$$h(A) = 45$$

$$h(B) = 45$$

$$h(C) = 45$$

$$h(D) = 45$$

$$h(E) = 45$$

$$h(F) = 45$$

**Heuristic 3:**

$$h(A) = 10$$

$$h(B) = 15$$

$$h(C) = 0$$

$$h(D) = 0$$

$$h(E) = 25$$

$$h(F) = 5$$

**Heuristic 4:**

$$h(A) = 0$$

$$h(B) = 0$$

$$h(C) = 0$$

$$h(D) = 0$$

$$h(E) = 0$$

$$h(F) = 0$$

**Question #2:**

Assume that the nodes of the following game tree are processed from left to right by minimax implementation. Which nodes will be pruned by the alpha-beta pruning strategy when used for this game tree? Clearly show the values of alpha and beta along each node of the tree and mark the parts of the tree that will be pruned.

