Practical Exam Sample Question: Neural Network and A* Search for Shortest Path

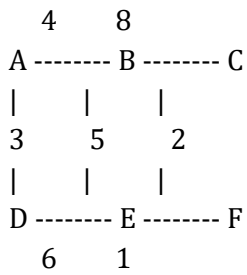
This practical exercise combines a feedforward neural network and the A* search algorithm to find the shortest path in a graph. The neural network predicts heuristic values, which are used to guide the A* algorithm in selecting the optimal path.

Scenario

You are given a weighted graph where nodes represent locations and edges represent paths between them. The goal is to find the shortest path from Node A to Node F using the A* search algorithm. The heuristic values represent the estimated distance to the goal (Node F).

Graph Representation

Consider the following graph:



Heuristic Values

The heuristic values (straight-line distance to the goal, Node F) are as follows:

Manual Heuristic:
- A: 10
- B: 8
- C: 5
- D: 7
- E: 4
- F: 0

Neural Network Predicted Heuristic:
- A: 9.8
- B: 7.9
- C: 5.2
- D: 7.1
- E: 4.3
- F: 0.1

Tasks

1. **Shortest Path Calculation (Manual Heuristic):**

- Use the given graph and manual heuristic values to calculate the shortest path from Node A to Node F. For each node visited, compute the following:
  - Path cost (g(n)) from the starting node.
  - Heuristic value (h(n)) from the table above.
  - Total cost (f(n) = g(n) + h(n)).

Node	Path Cost (g(n))	Heuristic (h_manual)	Total Cost (f(n))

2. **Shortest Path Calculation (NN Predicted Heuristic):**

- Repeat the shortest path calculation using the neural network's predicted heuristic values.

Node	Path Cost (g(n))	Heuristic (h_manual)	Total Cost (f(n))

3. **Comparison:**

- Compare the shortest paths obtained using the manual heuristic and the NN-predicted heuristic.
- Identify if the NN-predicted heuristic resulted in a more efficient path.