

Premier University, Department of CSE
Fall 2024, 6th Semester, Assignment, Deadline: March 12, 2025
Course Title: Artificial Intelligence, Course Code: CSE 3317
Course Outcome: CO2, Total Marks: 10

Assignment: AI-Controlled Smart Traffic Management System

Problem Statement:

The city of Metropolis has implemented an AI-based traffic management system designed to regulate traffic flow, reroute vehicles in case of road closures, and ensure emergency responders reach their destinations without delay. Recently, the system has encountered unforeseen disruptions, including road closures, malfunctioning traffic signals, and congestion at major intersections. The AI must decide on the most efficient response strategy.

Background:

In the current scenario, several issues complicate traffic management:

- Road R1 is unexpectedly closed due to an incident.
- Traffic signal T1, which controls road R1, is affected, thereby impacting Intersection I1.
- Increased congestion is being reported around I1.
- Emergency vehicle E1 is trying to reach the downtown hospital via I1.

Traffic Management Rules:

1. Traffic signals operate correctly only if the controlled road is open.
2. If a road is closed, vehicles must be rerouted when an alternative exists.
3. A non-functional traffic signal causes its controlled intersection to become congested.
4. Roads connected to a congested intersection also experience congestion.
5. Emergency vehicles must have an unobstructed route.
6. If no alternative route exists, manual traffic control must be activated at the intersection.

Traffic Incident in Metropolis:

- **Road R1:** Closed due to an unexpected incident.
- **Traffic Signal T1:** Controls R1 and affects Intersection I1.
- **Emergency Vehicle E1:** Requires a clear path to the downtown hospital.
- **Driver Reports:** Indicate increased congestion near I1.
- **City Engineers Confirm:**
 - Some roads have available alternative routes.
 - Some intersections may require manual intervention.
 - An alternative route (R2) exists, which can bypass the closed road.

- The AI system is capable of rerouting traffic through R2.
- The efficiency of rerouting determines whether E1 reaches its destination in time.

Objectives:

Students are required to answer the following:

- Will traffic signal T1 remain functional or fail due to the road closure?
- Will Intersection I1 become congested?
- Can emergency vehicle E1 reach the hospital in time?
- Will vehicles be effectively rerouted, or is manual traffic control required?
- How does the presence or absence of an alternative route impact the overall outcome?

Investigation & Analysis:

Students should analyze the problem using First-Order Logic (FOL) to:

- Formally model the traffic management rules and incident conditions.
- Deduce the logical consequences of road closures and signal failures.
- Provide a detailed explain how the AI should respond under the given circumstances.

Deliverables:

A printed assignment report that includes:

- A structured logical analysis of the problem using FOL.
- A step-by-step explanation of the AI's decision-making process.
- Answers to the specified objectives with justifications based on the logical framework developed.

Rubrics for Assignment marking:

Task	Criteria	Good (4-5)	Moderate (2-3)	Poor (1)
i.	Problem solution	Properly or near appropriately reasoned solution	Appropriate solution for some cases	Inappropriate or no solution
ii.	Problem analysis	In-depth analysis	Shallow analysis	Incomplete analysis