Department of Computer Science and Engineering
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CSE 317: Artificial Intelligence

Title: Lab Final Report

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Remarks

① Logical Analysis using First Order logic:

Predicates:

- RoadClosed (R): Road R is closed
- SignalFunctional (T): Traffic Signal T is functional
- IntersectionCongested (I): Intersection I is Congested.
- EmergencyPathClear (E): Emergency Vehicle E has a clear Path.
- AlternativeRouteExists (R_1, R_2): There exists an alternative route R_2 for road R_1.
- MannualControlRequired (I): Mannual traffic Control is required at intersection I.

Rules:

(1) $\forall R, T, I$ (RoadClosed (R) $\wedge$ controls (T, R) $\rightarrow$ $\neg$ SignalFunctional (T))

(2) $\forall R, R_2$ (RoadClosed (R) $\wedge$ AlternativeRouteExists (R, R_2) $\rightarrow$ Reroute (R, R_2))

(3) $\forall T, I$ ($\neg$ SignalFunctional (T) $\wedge$ Controls (T, I) $\rightarrow$ IntersectionCongested (I))

(4) $\forall I, R$ (IntersectionCongested (I) $\wedge$ Connected (R, I) $\rightarrow$ Congested (R))

(5) $\forall E, I$ (EmergencyPathClear(E) $\rightarrow$ ¬IntersectionCongested(I))

Incident Conditions:

(i) RoadClosed (R_1)

(ii) Controls (T_1, R_1)

(iii) connected (R_1, I_1)

(iv) AlternativeRouteExists (R_1, R_2)

(v) EmergencyPathClear (E_1)

Step-by-Step explanation of AI's decision-Making Process:

(1) Determine Signal Functionality:

From Rule 1, since RoadClosed (R_1) and Controls (T_1, R_1), it follows that ¬SignalFunctional (T_1)

(2) Determine Intersection Congestion:

From Rule 3, since ¬SignalFunctional (T_1) and Controls (T_1, I_1), it follows that IntersectionCongested (I_1)

(3) Ensure Emergency Vehicle Path:

From Rule 5, to ensure EmergencyPathClear(E_1) we must prevent IntersectionCongested (I_1). Using R_2. Congestion at I_1 can be reduced.

(4) Determine Need for Mannual Control:

from Rule 2, Since Road Closed (R_1) and Alternative Router Exists (R_1, R_2), vehicles can be rerouted through R2. mannual control is only required if rerouting fails.

(5) Impact of Alternative Route:

The Presence of R2 ensures efficient rerouting, reducing congestion and guranteeing E1's timely arrival.

Answers to objectives

(1) Will traffic Signal T_1 remain functional or fail?

=> T_1 will fail because R1 is closed. and T_1 Controls R1.

(2) Will Intersection I1 become congested?

=> Yes, I1 will become congested due to the failure of T1.

(3) Can emergency vehicle E1 reach the hospital in time?

=> Yes, E1 can reach the hospital in time if traffic is rerouted through R2.

(4) Will vehicles be effectively rerouted, or is manual traffic control required?

=> Vehicles will be effectively rerouted through R2. Manual control is only required if rerouting fails.

(5) How does the presence or absence of an alternative route impact the overall outcome?

=> The presence of R2 ensures efficient rerouting, reduces congestion, and guarantees E1's timely arrival. Without R2, manual control would be necessary, leading to delays.