Final Exam 2010

ARTIFICIAL INTELLIGENCE

Questions: 4 – Total marks: 10 – Time: 120 minutes – Open book

Question 1 (4 marks): Consider the following statements:

- A car needs gas and ignition to start.
- Both the ignition system and the radio in a car need a working battery to operate.
- The battery in John's car does not work.
- Mary's car can start.

(a) Represent these statements using predicate logic. (2 m)
(b) Convert the obtained formulas into the conjunctive normal form. (1 m)
(c) Use the refutation-resolution method to:
- Prove that John's car cannot start. (1 m)
- Find whose car has the battery still working.

Question 2 (1 mark): Use existential graphs and inference rules on them to prove that the following propositional logic formula is valid:

$$(P \Rightarrow Q) \Rightarrow (\neg Q \Rightarrow \neg P)$$

Question 3 (4 marks): In a province in Indonesia, each house is equipped with an alarm to sound in case of an earthquake or a house fire. Statistical data show that the alarm sounds in 90% of the cases when an earthquake and a fire occur at the same time, 20% of the cases when there is an earthquake but no fire, 90% of the cases when there is a fire but no earthquake, and 1% of the cases when nothing happens. People calls for emergency rescue immediately in 85% of the cases when the alarm sounds, and the local radio broadcasts breaking news in 95% of the cases when an earthquake occurs. The probabilities of an earthquake and a fire in that province are respectively 0.002 and 0.001.

(a) Construct a Bayesian network from these statistical data. (1 m)
(b) How likely does the alarm sound if an earthquake occurs? (1 m)
(c) How is it likely that the local radio broadcasts breaking news and the alarm does not sound? (2 m)

Question 4 (1 mark): A person choosing a transportation mode depends on gender, number of cars owned, travel cost, and income, as shown in the table below. Use the candidate-elimination algorithm to learn the concept Car transportation mode.

No.	ATTRIBUTES				CLASSIFICATION
	Gender	Car Ownership	Travel Cost	Income	Transportation Mode
1	Male	0	Cheap	Low	Bus
2	Male	1	Cheap	Medium	Bus
3	Female	0	Cheap	Low	Bus
4	Male	1	Cheap	Medium	Bus
5	Female	1	Expensive	High	Car
6	Male	2	Expensive	Medium	Car
7	Female	2	Expensive	High	Car
8	Female	1	Cheap	Medium	Train
9	Male	0	Standard	Medium	Train
10	Female	1	Standard	Medium	Train

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