Final Exam 2013

ARTIFICIAL INTELLIGENCE

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

**Question 1 (3 marks)**: Consider the following statements for the AI course at HCMUT:
- Every student obtains good final results if performing well in both of the tutorials and the assignments.
- If a student attends all classes of the course, then he/she performs well in the tutorials.
- Every student does the assignments well if he/she has sufficient programming skills and attends all classes of the course.
- John does not have good final results.
- Mary has sufficient programming skills and attends all classes of the course.

(a) Represent these statements using predicate logic. (1 m)
(b) Use the refutation-resolution method to:
   - Find out who obtains good final results. (1 m)
   - Prove that John does not have sufficient programming skills or is absent from some classes. (1 m)

**Question 2 (4 marks)**: For the AI course at HCMUT, the final course result of a student depends on whether or not he/she performs well in both of the tutorials and the assignments. Statistics shows that 90% of those students who perform well in both of the tutorials and the assignments obtain good final results, while the percentage is only 20% for those who perform well in only the tutorials or the assignments, and it drops to 5% for those who badly perform in both of the activities. Also, a student cannot do well the assignments if he/she lacks of programming skills, and the chance is 90% or 50% otherwise depending on whether he/she attends all classes of the course or not. Meanwhile, if a student attends all classes of the course, then it is likely to the degree of 0.9 that he/she performs well in the tutorials, and that degree drops to 0.3 otherwise. It is recorded that 85% of students attend all classes of the course and 95% of them have sufficient programming skills.

(a) Construct a Bayesian network from these statistical data. (1 m)
(b) How likely does a student do well the assignments? (1 m)
(c) What is the probability that a student performs well in the tutorials given his/her good final results? (1 m)
(d) Prove that having sufficient programming skills and doing well in the tutorials are independent from each other. (1 m)

**Question 3 (1 mark)**: Propose a voting model of 10 voters for the fuzzy number “about 5” and derive the corresponding fuzzy set. Assume that the domain of the fuzzy set is the discrete value set \{0, 1, 2, ..., 10\}. Then draw its linear diagram using interpolation between data points.

**Question 4 (2 marks)**: As shown in the table below, the four factors that determine the vehicle type a person uses for transportation are: gender, number of cars own, transportation cost with chosen vehicle, and income. Assume the possible attribute values are all given in the table.

<table>
<thead>
<tr>
<th>No.</th>
<th>ATTRIBUTES</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gender</td>
<td>Number of Cars Own</td>
</tr>
<tr>
<td>1</td>
<td>Male</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>2</td>
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<tr>
<td>5</td>
<td>Female</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>1</td>
</tr>
</tbody>
</table>

Use the following algorithms to learn the concept “Car as transportation means”:
(a) FIND-S. (1 m)
(b) Candidate-Elimination. Classify instance <Female, 0, Normal, Average> according to the learned hypotheses. (1 m)

**** End ****