AI exam, 2015. 01. 07. NAME:

TOTAL POINTS:60 (minimum to pass: 24) NEPTUN ID:

1, Define the differences between search in a single-state problem and optimization. What are the problems with local search (optimization) methods? Is there any global optimization method? How could you apply a global optimization in an informative search?
10p

2. What is the type of the next statement: valid, satisfiable, not satisfiable, none of these. Prove your answer with truth tables. (5 points)

$$(A \rightarrow \neg B) \rightarrow (C \rightarrow B).$$

3. What does semi-decidability of proof methods mean in first-order logic? Explain and illustrate it with considering a true and a false statement. (5p)

4. Consider the naive Bayesian network in Fig.2 with discrete variables (number of values are indicated in parentheses). Calculate the necessary parameters from the examples in Table 1. and calculate P(D=1|E=1,G=1) using these parameters from the network. Do we need all the edges indicated in the model? (15 p)

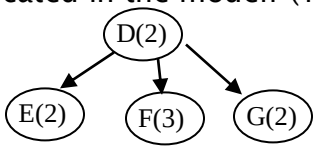

Fig.1. Naive Bayesian network with discrete variables (number of values are indicated in parentheses).

Table 1.

CaseID.	D	E	F	G
X1	1	1	1	1
X2	1	1	3	1
X3	0	0	1	1
X4	0	1	0	1
X5	0	0	0	0
X6	1	0	3	1

5. Define a decision tree with PopularDog as an outcome variable for the following observations:

Table 2.

CaseID.	Small	White	Barking	PopularDog
X1	Yes	Yes	Yes	No
X2	Yes	Yes	No	Yes
X3	No	No	Yes	No
X4	No	No	No	Yes
X5	No	Yes	No	No
X6	Yes	No	No	Yes

in which Small, White, and Barking are the predictor variables. Define a Booleanl expression for PopularDog using these variables both in a conjunctive and disjunctive normal forms.
(15 points)

6. What is the sample complexity? How is the model complexity quantified in this learning framework? What is the cardinality of decision trees (as logical functions) over n binary attributes and what is the cardinality of the set of clauses (as logical functions)?
(10 p)