TAMPERE UNIVERSITY OF TECHNOLOGY
Department of Mathematics

MAT-75006 **Artificial Intelligence** Examination
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All extra material is prohibited in this exam. Give careful and detailed answers to all questions.

Answer questions 1 and 2, as well as two of questions 3–7. Do not answer more than four questions altogether. The maximum amount of points for questions 1 and 2 is 8 points and that of questions 3–7 is 7 points. Hence, altogether up to 30 points may be obtained from this exam.

• • • ANSWER QUESTIONS 1 AND 2

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1. Explain the following concepts:
   (a) An entry in the full joint probability distribution over (random) variables $X_1, \ldots, X_n$.
   (b) The value of such an entry in a Bayesian network.
   (c) Likelihood weighting.
   (d) Markov blanket.
2. Describe and explain the following.
   (a) The basic algorithm for top-down induction of (consistent) decision trees.
   (b) (Shannon) Entropy function.
   (c) Information gain function for assessing attribute tests.
   (d) The meaning and intention of decision tree pruning.

• • • ANSWER TWO OF QUESTIONS 3–7

3. **Multivariate linear regression.**

4. Explain and illustrate **Bayesian learning and its approximations** using the surprise candy example from the lectures, where there are five different large bags of candy flavor mixes:

h_1: 100% cherry,
h_2: 75% cherry + 25% lime,
h_3: 50% cherry + 50% lime,
h_4: 25% cherry + 75% lime,
h_5: 100% lime.

5. **Strategies for uninformed search.**
In particular, explain about the advantages and limitations of the search strategies from the point of view of resource consumption. Are the algorithms that you describe complete and optimal?

6. Which are the **inference possibilities for propositional logic?**
How efficient are the logical inference procedures? Are they sound and complete?

7. Prove that, if a heuristic function h never overestimates by more than c, A* using h returns a solution whose cost exceeds that of the optimal solution by no more than c.