TAMPERE UNIVERSITY OF TECHNOLOGY
Department of Software Systems

OHJ-2556 **Artificial Intelligence** Examination
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You may use a calculator in this exam, but all other extra material is prohibited.

Answer questions 1 and 2, as well as two of questions 3–6. The maximum amount of points for questions 1 and 2 is 8 points and that of questions 3–6 is 7 points. Hence, altogether up to 30 points may be obtained from this exam.

Give careful answers to all questions!

ANSWER QUESTIONS 1 AND 2

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1. Model checking and other inference methods for propositional logic. You should recall two other methods for proving the truth of propositional logic sentences. Are these methods sound and complete? What is the computational complexity of each method?

2. Explain the Bayes' rule and its background. How does it help in probabilistic inference? Exemplify the use of the Bayes' rule with the following figures: $P(a) = 1/25$, $P(b) = 1/20000$, and $P(a \mid b) = 0.4$. How does Bayes' rule cope with multiple dependent evidence variables?

ANSWER TWO OF QUESTIONS 3–6

3. Prove that, if the 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.

4. There are n gold digging claims to be sold in Lapland. It is known that only one lot contains a gold nugget worth G euros. One claim costs G/n. Since our social media start-up is doing poorly, we decide to take up gold digging. Unfortunately, our knowledge and talents do not extend to the new field. Luckily, though, a trustworthy Laplander is willing to sell his infallible assessment of claim number n at the price of $G/(2n)$. As the executive president of our company, you have to calculate whether it is good business to buy the Laplander's assessment or should we continue without his knowledge.

5. Explain the methods for approximate inference in Bayesian networks; *direct sampling*, *rejection sampling*, and *likelihood weighting*. For each method, show the consistency of the approach.

6. Ensemble learning and boosting of weak learners (AdaBoost).