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Fachrichtung 6.2 – Informatik
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4th Theoretical Assignment in Artificial Intelligence (SS 2005)

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Exercise 4.1: **30 P**

1. Define an admissible heuristic function h for the *Missionaries and Cannibals*-problem (Exercise 2.4 in the 2nd theoretical assignment). Explain why you have chosen this function. (10 P)
2. Show that your function h fulfils the triangle inequality (Russell/Norvig, p. 99). (10 P)
3. Explain graphically how an A*-search procedure traverses the search-space. (10 P)

Exercise 4.2: **20 P**

Use truth-tables to show that the following formulas of propositional logic are valid.

- $P \wedge (Q \wedge R) \Leftrightarrow (P \wedge Q) \wedge R$ associativity of $\wedge$ (5 P)
- $P \vee (Q \vee R) \Leftrightarrow (P \vee Q) \vee R$ associativity of $\vee$ (5 P)
- $P \wedge (Q \vee R) \Leftrightarrow (P \wedge Q) \vee (P \wedge R)$ distributivity of $\wedge$ on $\vee$ (5 P)
- $P \vee (Q \wedge R) \Leftrightarrow (P \vee Q) \wedge (P \vee R)$ distributivity of $\vee$ on $\wedge$ (5 P)

Exercise 4.3: **30 P**

Assume that A, B and C are propositional constants.

1. Use truth tables to show that $\{A \vee B, \neg A \vee C\} \models B \vee C$ (10 P)
2. Does also $\{B \vee C\} \models (A \vee B) \wedge (\neg A \vee C)$ hold? Justify your answer. (5 P)
3. Does $\{\neg(B \vee C)\} \models \neg((A \vee B) \wedge (\neg A \vee C))$ hold? Justify your answer. (5 P)
4. Explain why the resolution rule preserves satisfiability. (5 P)
5. Let F be a propositional formula and KB be a finite set of propositional formulas. Assume we can derive the empty clause from $KB \cup \{\neg F\}$. Explain why we can conclude $KB \models F$ (5 P)

Exercise 4.4: **20 P**

The unicorn is a mammal if it is horned. If the unicorn is either immortal or a mammal, then it is horned. If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal.

1. Encode these statements in propositional logic (5 P).
2. Use resolution to prove that the unicorn is a mammal (15 P).