Artificial Intelligence: Exercise 3

Maik Kschischo, Elina Unruh

Week 3

1. Which of the following formulas are tautologies?
   (a) $\neg(a \vee b) \Leftrightarrow \neg a \vee \neg b$
   (b) $(a \Rightarrow b) \Leftrightarrow (\neg b \Rightarrow \neg a)$
   (c) $((a \Rightarrow b) \wedge (b \Rightarrow a)) \Leftrightarrow (a \Leftrightarrow b)$
   (d) $(a \vee b) \wedge (\neg b \vee c) \Rightarrow (a \vee c)$
2. Which of the following formulars are satisfiable, unsatisfiable or logically valid?
   (a) $a \Rightarrow a$
   (b) $a \wedge b \Rightarrow b$
   (c) $a \vee b \wedge \neg a$
3. Describe the following situations as formulas in propositional logic.
   (a) If the graphics card of the computer is defect, the screen output is not readable.
   (b) In a plane there is a valve which can either be shut, open, half open. Describe the fact that two of the three errors 'Open valve blocked.', 'Half open valve blocked' and 'Shut valve blocked' occur simultaneously.
4. Consider a parking lot with four sites named A,B,C and D and the following propositions.

$$a = \text{"Site A is vacant."} \tag{1}$$
$$b = \text{"Site B is vacant."} \tag{2}$$
$$c = \text{"Site C is vacant."} \tag{3}$$
$$d = \text{"Site D is vacant."} \tag{4}$$
$$z = \text{"There are two vacant sites."} \tag{5}$$
$$o = \text{"The parking lot is completely occupied."} \tag{6}$$

   Using these atomic formulas as the signature, provide a formula q which has exactly two models. The formula should represent the two occupations in Figure 1.

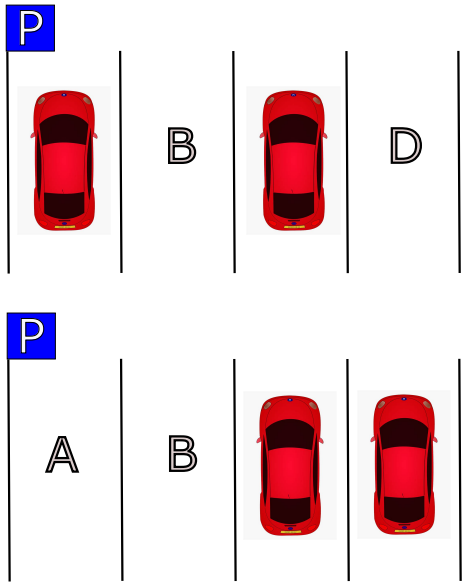

Figure 1: Two different occupation configurations of the parking lot with four sites.