Artificial Intelligence

Assignment 1

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GROUP HOLLERITH - SOLUTION

Group Members:

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1 Propositional logic (50 Points)

Assume the following propositions:

- A = "Alice visits the party"
- B = "Bob visits the party"
- C = "Charlie visits the party"
- D = "Daniel visits the party"

Formulate the following sentences in propositional logic over the signature $\mathsf{At} = \{A, B, C, D\}$:

a) Bob visits the party and Alice doesn't.

b) Daniel and Bob visit the party if and only if Charlie also visits the party.

c) If Alice and Bob visit the party, then Charlie does as well—but only if Daniel is not visiting the party.

d) Charlie visits the party if and only if not both Bob and Alice visit the party, or at least Daniel visits the party.

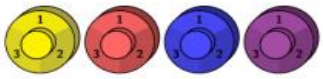
e) If Alice visits the party, then Bob and Charlie do as well—if Alice does not visit the party, then Charlie and Daniel visit the party.

SOLUTION:

1. a) $B \wedge (\neg A)$
   b) $(D \wedge B) \leftrightarrow C$
   c) $(A \wedge B) \rightarrow (C \leftrightarrow (\neg D))$
   d) $C \leftrightarrow ((\neg B \wedge \neg A) \vee D)$
   e) $(A \rightarrow (B \wedge C)) \vee (\neg A \rightarrow (C \wedge D))$

2 Propositional logic (50 Points)

Assume a safe that has four combination locks represented through the colors yellow, red, blue and violet. Each combination lock can represent one number ranging from 1 to 3.



Formulate the following sentences in propositional logic over the signature

$$\mathsf{At} = \{y_1, y_2, y_3, r_1, r_2, r_3, b_1, b_2, b_3, v_1, v_2, v_3\}$$

whereas x_i is true if the lock with color x (where y stands for yellow, r for red, b for blue and v for violet) is set to number i:

Example: The yellow lock is either set to 1 or 2.
Formula: $y_1 \vee y_2$

a) If the red lock is set to 3, then the yellow and the blue lock are set to the same number.

b) At least one lock must be set to 3.

c) If the yellow lock is not set to 3, then the red one cannot be set to 2.

d) If the red lock is set to 1, then the blue one must be set to 2.

e) If the blue lock is set to 2, there must be at least two other locks be set to 1.

SOLUTION:

2. a) $r_3 \rightarrow ((y_1 \wedge b_1) \vee (y_2 \wedge b_2) \vee (y_3 \wedge b_3))$
   b) $y_3 \vee r_3 \vee b_3 \vee v_3$
   c) $(\neg y_3) \rightarrow (\neg r_2)$
   d) $r_1 \rightarrow b_2$
   e) $b_2 \rightarrow ((y_1 \wedge r_1) \vee (y_1 \wedge v_1) \vee (r_1 \wedge v_1))$