

Logic and Computability SS21, Assignment 2

Deadline: 2021-04-30 3:59am

For the following exercises use the DPLL algorithm (including Boolean Constraint Propagation (BCP), pure literals, and conflict-driven clause learning) to check on paper, if the following CNF formulas are satisfiable.

If the formula is satisfiable, give a satisfying model, else show a complete resolution proof for the formula's unsatisfiability.

- Write down all the steps of the DPLL algorithm,
- draw the conflict graphs,
- and state the resolution proofs for all learned clauses

Rules:

- When resolving a conflict, backtrack to the earliest level where conflict clause is a unit clause.
- Choose variables for decisions, BCP and pure literals in alphabetical order, starting with the negative phase ($\neg a > a > \neg b > b \dots$).
- Always try to perform BCP first, before checking for pure literals, before making a decision.

11. [1 Points]

$$c1 = \{\neg c, e\}$$

$$c2 = \{\neg a, c\}$$

$$c3 = \{\neg c, d\}$$

$$c4 = \{a, \neg d\}$$

$$c5 = \{\neg b, c\}$$

$$c6 = \{d, \neg e\}$$

$$c7 = \{a, b\}$$

12. [1 Point]

$$c1 = \{\neg a, \neg b\}$$

$$c2 = \{\neg c, \neg d\}$$

$$c3 = \{c, \neg e\}$$

$$c4 = \{a, c\}$$

$$c5 = \{\neg b, d\}$$

$$c6 = \{b, \neg c\}$$

$$c7 = \{c, e\}$$

13. [1 Point]

$$c1 = \{\neg a, \neg b\}$$

$$c2 = \{a, d, e\}$$

$$c3 = \{b, \neg c\}$$

$$c4 = \{c, \neg d, e\}$$

$$c5 = \{\neg c, e\}$$

$$c6 = \{\neg a, b\}$$

$$c7 = \{a, c, \neg e\}$$

14. [2 Points]

$$c1 = \{\neg b, c, d\}$$

$$c2 = \{\neg b, \neg d\}$$

$$c3 = \{a, \neg c\}$$

$$c4 = \{\neg c, e\}$$

$$c5 = \{b, c\}$$

$$c6 = \{\neg a, \neg e\}$$

15. [2 Points]

$$c1 = \{\neg c, \neg e\}$$

$$c2 = \{\neg d, e\}$$

$$c3 = \{a, b, c\}$$

$$c4 = \{\neg a, \neg d\}$$

$$c5 = \{d, e\}$$

$$c6 = \{a, \neg c, \neg d\}$$

$$c7 = \{\neg b, c\}$$

16. [3 Points]

$$c1 = \{\neg b, d, e\}$$

$$c2 = \{c, d\}$$

$$c3 = \{\neg a, \neg e\}$$

$$c4 = \{a, \neg c, \neg e\}$$

$$c5 = \{c, \neg d\}$$

$$c6 = \{\neg b, \neg d\}$$

$$c7 = \{b, e\}$$