

(b) Suppose there are three chairs in a row, labeled L(ef), M(iddle), R(ight) and three persons A, B, and C. Everyone has to sit down but, unfortunately,

- A doesn't want to sit next to B
- A doesn't want to sit in the left chair
- C doesn't want to sit to the right of B

We will formulate these constraints in propositional logic using only variable  $X_{p,c}$  to mean that person  $p$  sits in chair  $c$ . **Please express the constraints in CNF.**

(i) [2 pts] A doesn't want to sit next to B.

(ii) [1 pt] A doesn't want to sit in the left chair.

(iii) [1 pt] C doesn't want to sit to the right of B.

(iv) [4 pts] Are there other constraints? If yes, express them in propositional logic.

(v) [2 pts] Lastly, can we satisfy these constraints? (A yes/no answer with some justification is sufficient for the problem. You do not need a formal proof.)

**(c) Logical Inference**

Given

$$KB = (A, A \Rightarrow B, A \Rightarrow C, B \wedge C \Rightarrow D)$$

(i) [4 pts] Show the steps in a forward chaining algorithm for proving  $KB \models D$ .

(ii) [2 pts] How do we prove  $KB \models D$  using a SAT solver?

(iii) [4 pts] Write out the necessary clauses in CNF representation of the sentence required for (b).

(iv) [10 pts] Show the steps in the operation of DPLL, assuming a fixed variable ordering (A, B, C, D) and a fixed value ordering (true before false). Remember to apply early termination, pure literals (repeatedly), and unit clauses (repeatedly), keeping track of which clauses have already been satisfied in the process.