

1. Explain the terms conjunctive normal form and disjunctive normal form.
2. Convert the following expressions to Conjunctive Normal Form.
  - (a)  $a \vee b$
  - (b)  $a \wedge b$
  - (c)  $((a \wedge b) \vee (\neg b \wedge c)) \vee \neg d$
  - (d)  $(a \wedge b) \vee (c \wedge d)$
  - (e)  $(a \vee b) \wedge (c \vee d)$
3. Convert the following proposition to Disjunctive Normal Form.
  - (a)  $a \vee b$
  - (b)  $a \wedge b$
  - (c)  $((a \wedge b) \vee (\neg b \wedge c)) \vee \neg d$
  - (d)  $(a \wedge b) \vee (c \wedge d)$
  - (e)  $(a \vee b) \wedge (c \vee d)$
4. Determine if there is a realisation of the following proposition that makes the clause true.
  - (a)  $a \vee b$
  - (b)  $a \wedge b$
  - (c)  $((a \wedge b) \vee (\neg b \wedge c)) \vee \neg d$
  - (d)  $(a \wedge b) \vee (c \wedge d)$
  - (e)  $(a \vee b) \wedge (c \vee d)$
5. Explain the SAT problem.
6. Explain the 3-SAT problem.
7. Explain how to prove that a problem is NP-complete.
8. Prove that 3-SAT is NP-complete. You may assume that SAT is NP-complete.