PL Problems for practise

1 message

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Propositional Logic-Based Equivalence Formulas

1. Simplify $\neg(\neg P \vee Q)$.
2. Prove $(P \vee Q) \wedge (\neg P \vee Q) \equiv Q$.
3. Convert $\neg(P \Longrightarrow Q) \vee R$ to conjunctive normal form (CNF).
4. Verify if $P \Longrightarrow (Q \wedge R)$ is equivalent to $(P \Longrightarrow Q) \wedge (P \Longrightarrow R)$.
5. Simplify $(P \vee Q) \wedge (\neg P \vee R)$.

Modus Ponens

6. Given $P \Longrightarrow Q$ and PP, derive QQ.
7. If $A \Longrightarrow (B \vee C)$ and A, what can you infer?
8. Prove $(P \wedge (P \Longrightarrow Q)) \Longrightarrow Q$ using Modus Ponens.
9. Show that $(A \Longrightarrow B) \wedge A \Longrightarrow B$ is valid.
10. Derive the conclusion from $(X \Longrightarrow Y) \wedge (Y \Longrightarrow Z)$ and X

And Eliminations

11. Derive P and Q from $P \wedge Q$.
12. From $(P \wedge Q) \wedge R$, infer P and R.
13. Show that $A \wedge (B \vee C)$ implies A.
14. Prove that $(X \wedge Y) \Longrightarrow X$.
15. Simplify $((A \wedge B) \vee C) \wedge A$.

Forward Chaining

16. In a knowledge base $P \Longrightarrow Q$, $Q \Longrightarrow R$, and P, derive R.
17. Use forward chaining to derive Z from $X \Longrightarrow Y$, $Y \Longrightarrow Z$, X.
18. Given $A \Longrightarrow B$, $B \Longrightarrow C$, and A, determine C.
19. In a rule-based system $P \Longrightarrow (Q \wedge R)$ and P, derive Q and R.
20. Show how forward chaining works with $A \Longrightarrow B, B \Longrightarrow C, A$.

Backward Chaining

21. Prove R from $P \Longrightarrow Q$, $Q \Longrightarrow R$ using backward chaining.
22. Verify Q in a system where $A \Longrightarrow Q$ and A are true.
23. Show how backward chaining can derive Z from $X \Longrightarrow Y$ and $Y \Longrightarrow Z$.
24. Prove S using backward chaining in $S \vee T$, $T \Longrightarrow F$, and F.
25. Use backward chaining to verify R from $A \Longrightarrow R$ and $A \vee B$.

Resolution

26. Resolve $P \lor Q$ and $\neg Q \lor R$.
27. Show RR is derived from $(P \lor R) \land (\neg P \lor Q)$ and $\neg Q$.
28. Prove $P \lor R$ using $P \lor Q$ and $\neg Q \lor R$.
29. Resolve $(A \lor \neg B)$ and $(B \lor \neg C)$.
30. Derive Q from $P \lor Q$, $\neg P$, and $Q \lor R$.

Mixed and Complex Problems

31. Simplify $(\neg P \lor Q) \land (P \lor \neg Q)$.
32. Prove $P \lor Q \lor \neg P \lor \neg Q$ is a tautology.
33. Use forward chaining to infer Z from a chain of implications $X \Longrightarrow Y$, $Y \Longrightarrow Z$, and X.
34. Show that $P \Longrightarrow Q \land R \equiv (P \Longrightarrow Q) \land (P \Longrightarrow R)$.
35. Derive P using backward chaining from $(P \lor Q) \land \neg Q$.
36. Use resolution to prove $Q \lor R$ from $P \lor Q, \neg P \lor R, \neg Q$.
37. Prove $\neg(P \land Q) \equiv \neg P \lor \neg Q$.
38. Show that $A \Longrightarrow (B \lor C)$ is valid if $A \Longrightarrow B$ and $A \Longrightarrow C$ are true.
39. Use backward chaining to verify S in a rule-based system $A \Longrightarrow S, B \Longrightarrow S, A \lor B$.
40. Derive Z from $(X \lor Y) \land (\neg X \lor Z) \land Y$.

Advanced Problems

41. Convert $(P \Longrightarrow Q) \land (\neg P \lor R)$ into CNF.
42. Resolve $(A \lor B)$ and $(\neg A \lor C)$ to derive $B \lor C$.
43. Show that $(A \land \neg A) \lor B$ simplifies to B.
44. Prove $P \lor \neg P$ using the Law of Excluded Middle.
45. Derive $Q \land R$ from $(P \Longrightarrow Q) \land (P \Longrightarrow R)$ and P.
46. Use forward chaining to derive conclusions from a rule base with three levels of implications.
47. Resolve $(X \lor Y)$ and $(\neg X \lor \neg Y)$ to derive a contradiction.
48. Show that $(P \land Q) \lor \neg P \lor R$ simplifies to $Q \lor R$.
49. Prove $P \land (P \Longrightarrow Q) \Longrightarrow Q$ using Modus Ponens and Resolution.
50. Use backward chaining to verify R in a complex rule-based system with nested implications.

DPLL-Based Problems

51. Determine satisfiability of the formula:$(P \lor Q) \land (\neg P \lor R) \land (\neg Q \lor \neg R)$. Hint: Use the DPLL algorithm's steps: unit propagation, pure literal elimination, and recursive search.
52. Solve the formula for satisfiability:$(A \lor B) \land (\neg A \lor \neg B) \land (\neg B \lor C)$.. Hint: Simplify using pure literals, then apply backtracking.
53. Prove Unsatisfiability for: $(P \lor Q) \land (\neg P \lor \neg Q) \land (\neg P \lor Q) \land (\neg Q \lor P)$. Hint: Use DPLL to show no satisfying assignment exists.
54. Check satisfiability for: $(X \lor Y \lor Z) \land (\neg X \lor \neg Y) \land (\neg Y \lor \neg Z)$. Hint: Apply DPLL's unit propagation and branching rules.
55. Solve the formula: $(\neg P \lor Q) \land (\neg Q \lor R) \land (P \lor \neg R)$. Hint: Start with pure literal P.

Hill Climbing-Based Problems

56. Use Hill Climbing to find a satisfying assignment for: $(A \lor B) \land (\neg A \lor C) \land (\neg B \lor C)$.Hint: Assign values to maximize clause satisfaction, iterating for local improvement.
57. Find the optimal assignment for: $(\neg P \lor Q) \land (\neg Q \lor R) \land (P \lor \neg R) \land (\neg P \lor \neg Q)$.Hint: Start with a random assignment and improve iteratively.
58. Apply Hill Climbing to maximize satisfied clauses for: $(X \lor Y) \land (\neg X \lor \neg Y) \land (\neg X \lor Z) \land (\neg Z \lor Y)$. Hint: Use random restarts if stuck in a local maximum.
59. Solve the formula: $(\neg A \lor \neg B) \land (B \lor C) \land (\neg C \lor A) \land (A \lor \neg B)$. Hint: Count satisfied clauses and iteratively improve the assignment.
60. Use Hill Climbing to resolve: $(P \lor Q \lor R) \land (\neg P \lor \neg Q) \land (\neg Q \lor \neg R) \land (P \lor \neg R)$. Hint: Iterate through assignments while ensuring maximum clause satisfaction.

Thanks & Regards

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