

Course outline

How does an NPTEL online course work?

Propositional Logic

- Introduction to Mathematical Logic
- Logical Equivalence
- SAT Problem
- Rules of Inference
- Resolution
- Tutorial 1: Part I
- Tutorial 1: Part II
- Quiz : Week 1 Assignment**
- Tutorial problem

Predicate Logic, Proof Strategies and Induction

Sets and Relations

Equivalence Relations, Partitions, Partial Orderings and Functions

Theory of Countability

Combinatorics Part I

Combinatorics Part II

Graph Theory Part I

Graph Theory Part II

Number theory

Abstract Algebra : Part I

Abstract Algebra : Part II

Video download

Live Session

Text transcripts

Week 1 Assignment

The due date for submitting this assignment has passed.

Due on 2021-02-03, 23:59 IST.

As per our records you have not submitted this assignment.

Propositional logic: Compound propositions and logical operators, logical equivalence, satisfiability, CNF, rules of inference, resolution

1) Select the correct option(s)

1 point

 $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (q \rightarrow r)]$ is a tautology where p,q,r are primitive statements

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 $X + 50 = 2$ where X is an integer, is an example of a contingency

 None of the given options

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology where p,q,r are primitive statements

2) Which of the following is/are true?

1 point
 Consider a form of ternary logic where each of the input variables can take three values (0,1,2) and the output will be either a T or F. In this logic, there are a total of 512 different logical operators that are possible.

 $(p \rightarrow q) \rightarrow (\neg p \rightarrow \neg q)$ is a contradiction, where p,q are primitive statements

The statement "I will go to Church only on Sundays" is equivalent to the statement "Every Sunday I will go to Church".

None of the given options

No, the answer is incorrect.
Score: 0
Accepted Answers:

Consider a form of ternary logic where each of the input variables can take three values (0,1,2) and the output will be either a T or F. In this logic, there are a total of 512 different logical operators that are possible.

3) Which of the following statements is/are satisfiable?

1 point

 $(p \rightarrow q) \leftrightarrow (\neg p \vee q)$

 $((p \rightarrow q) \wedge (q \rightarrow r)) \leftrightarrow (p \rightarrow r)$

 $(p \rightarrow q) \wedge (p \wedge \neg q)$

 $((p \vee q) \wedge \neg p) \rightarrow \neg q$
No, the answer is incorrect.
Score: 0
Accepted Answers:
 $(p \rightarrow q) \leftrightarrow (\neg p \vee q)$
 $((p \rightarrow q) \wedge (q \rightarrow r)) \leftrightarrow (p \rightarrow r)$
 $((p \vee q) \wedge \neg p) \rightarrow \neg q$

 4) How many satisfiable assignments the following compound statement has? $((p \rightarrow q) \wedge (\neg q \vee r) \wedge (\neg s \rightarrow \neg r)) \rightarrow (\neg p \vee s)$
1 point
 12

 16

 0

 10

No, the answer is incorrect.
Score: 0
Accepted Answers:

16

5) If X = number of satisfiable statements in a tautology that involves 5 variables and Y = number of satisfiable statements in a contradiction that involves 6 variables which of the following = X * Y.

1 point
 32

 5

 30

 None of the given options

No, the answer is incorrect.
Score: 0
Accepted Answers:

None of the given options

6) Which of the following is/are true?

1 point
 Logic can be used for automatic verification of theorems

 Truth table method is infeasible to show the logical equivalence of statements with large number of variables

 If X and Y are logically equivalent statements, then $X \rightarrow Y$ is a tautology

 In a conditional statement, hypothesis is a necessary and sufficient condition for the conclusion to be true

No, the answer is incorrect.
Score: 0
Accepted Answers:

Logic can be used for automatic verification of theorems

Truth table method is infeasible to show the logical equivalence of statements with large number of variables

 If X and Y are logically equivalent statements, then $X \rightarrow Y$ is a tautology

7) Choose the false statement(s) from the following:

1 point
 Any given proposition can be converted into its equivalent CNF form

 A contingency statement is unsatisfiable

 SAT problem is proved to be a hard problem

 $(\neg p \vee q) \wedge r$ is in its CNF form

No, the answer is incorrect.
Score: 0
Accepted Answers:

A contingency statement is unsatisfiable

SAT problem is proved to be a hard problem

 8) Choose CNF (Conjunctive Normal Formula) equivalent of the following compound statement: $(\neg p \vee \neg q \vee \neg r) \rightarrow \neg((a \rightarrow \neg b) \vee q)$
1 point

 $(p \wedge \neg r) \vee (a \wedge b)$

 $(p \wedge q \wedge r) \vee (\neg a \wedge b \wedge q)$

 $(p \wedge q \wedge r) \vee (a \wedge b \wedge \neg q)$
 None of the given options

No, the answer is incorrect.
Score: 0
Accepted Answers:

None of the given options

9) Choose the valid conclusions given the premises.

1 point
 $\neg(p \wedge \neg q) \vee \neg(\neg s \wedge \neg t), u \rightarrow (\neg t \rightarrow (\neg s \wedge p)), \neg(t \vee q)$

 $\neg t$

 $\neg q$

 $(\neg s \wedge p)$

 $\neg u$
No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\neg t$
 $\neg q$
 $\neg u$

 10) Given 10 elements, let $x_i, 1 \leq i \leq 10$, be the propositional variable which is true if the i-th element is in the set X. Which of the following expresses the statement "There are at most 3 elements in X"

1 point
 $\bigwedge_{i=1}^7 \bigwedge_{i_2=i+1}^8 \bigwedge_{i_3=i_2+1}^9 \bigwedge_{i_4=i_3+1}^{10} \neg(x_{i_1} \wedge x_{i_2} \wedge x_{i_3} \wedge x_{i_4})$
 $\bigwedge_{i=1}^{10} \bigwedge_{i_2=1}^{10} \bigwedge_{i_3=1}^{10} (x_{i_1} \wedge x_{i_2} \wedge x_{i_3})$
 $\bigwedge_{i=1}^7 \bigwedge_{i_2=i+1}^8 \bigwedge_{i_3=i_2+1}^9 \bigwedge_{i_4=i_3+1}^{10} (x_{i_1} \wedge x_{i_2} \wedge x_{i_3}) \rightarrow \neg x_{i_4}$
 $\bigvee_{i=1}^{10} \bigvee_{i_2=1}^{10} \bigvee_{i_3=1}^{10} (x_{i_1} \wedge x_{i_2} \wedge x_{i_3})$
No, the answer is incorrect.
Score: 0
Accepted Answers:
 $\bigwedge_{i=1}^7 \bigwedge_{i_2=i+1}^8 \bigwedge_{i_3=i_2+1}^9 \bigwedge_{i_4=i_3+1}^{10} \neg(x_{i_1} \wedge x_{i_2} \wedge x_{i_3} \wedge x_{i_4})$
 $\bigwedge_{i=1}^7 \bigwedge_{i_2=i+1}^8 \bigwedge_{i_3=i_2+1}^9 \bigwedge_{i_4=i_3+1}^{10} (x_{i_1} \wedge x_{i_2} \wedge x_{i_3}) \rightarrow \neg x_{i_4}$

11) Select the correct option(s) from the following statements:

0 points
 A bijection between two sets implies that they have the same cardinality

 A one-to-one (injective) function between two sets implies that they have same number of elements

 If the elements of a set can be mapped uniquely to the set of integers, then it is a countable set

 None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:

A bijection between two sets implies that they have the same cardinality

If the elements of a set can be mapped uniquely to the set of integers, then it is a countable set