

Logic—Sample Test C3 with Answers

NAME _____

1. Define ‘counterexample’. (10 points)

A counterexample is a possible situation where all the premises are true and the conclusion is false.

2. Define ‘valid’. (20 points)

An argument is valid if and only if it has no counterexamples.

Translate the following sentences into the language of quantifier logic using the given abbreviations. Remember that you do not need to worry about tense. (These problems are worth 2 points each.)

$Lx = x$ lounges.

$Px = x$ is a person.

$Tx = x$ is thirsty.

$e =$ Emelda

$k =$ Kelly

$d =$ Dave

3. “Kelly is not thirsty.”

$\sim Tk$

4. “If Emelda isn’t thirsty, no one is.”

$\sim Te \supset \sim \exists x(Px \ \& \ Tx)$

5. “No one is thirsty.”

$\sim \exists x(Px \ \& \ Tx)$

6. “Someone who isn’t thirsty is lounging.”

$\exists x((Px \ \& \ \sim Tx) \ \& \ Lx)$

7. “Kelly and Emelda are not both thirsty.”

$\sim(Tk \ \& \ Te)$

8. “Dave will only lounge if he’s not thirsty.”

$Ld \supset \sim Td$

9. “Everyone who isn’t thirsty is lounging.”

$\forall x((Px \ \& \ \sim Tx) \supset Lx)$

10. “No one who is thirsty will lounge.”

$\sim \exists x((Px \ \& \ Tx) \ \& \ Lx)$

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11. "Everybody racing is thirsty."

$$\forall x((Px \ \& \ Rx) \supset Tx)$$

12. "If Dave is thirsty, no one will be racing."

$$Td \supset \sim \exists y(Py \ \& \ Ry)$$

13. "If someone thirsty is racing, he or she will not be lounging."

$$\forall y((Py \ \& \ (Tx \ \& \ Rx)) \supset \sim Lx)$$

14. "Only a person who is racing, will be thirsty."

$$\forall y((Py \ \& \ Tx) \supset Rx)$$

Use the truth tree method to determine whether the arguments are valid. Number all lines. Label all derived lines with the rule and the line from which they were derived. (8 points each)

15. $\forall x((Dx \ \& \ Bx) \supset \sim Lx)$

$$\underline{Dp \ \& \ \sim Lp}$$

$$\exists x Bx$$

- ✓1. $\forall x((Dx \ \& \ Bx) \supset \sim Lx)$
2. ~~$Dp \ \& \ \sim Lp$~~
3. ~~$\exists x Bx$~~
4. Dp 2, &
5. $\sim Lp$ 2, &
- ✓6. $\forall x \sim Bx$ 3, $\sim \exists$
7. $\sim Bp$ 6, \forall
8. ~~$(Dp \ \& \ Bp) \supset \sim Lp$~~ 1, \forall
9. ~~$\sim(Dp \ \& \ Bp)$~~ $\sim Lp$ 8, \supset
10. $\sim Dp$ $\sim Bp$ 9, $\sim \&$

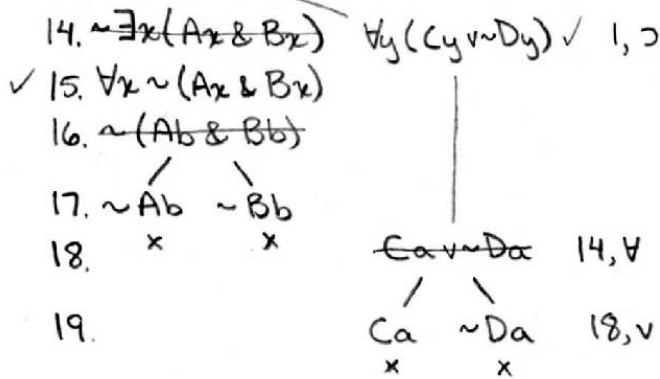
x
Invalid

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Use the truth tree method to determine whether the sentences are consistent. Number all lines. Label all derived lines with the rule and the line from which they were derived. (8 points)

18. $\{ \exists x(Ax \ \& \ Bx) \supset \forall y(Cy \vee \sim Dy), \sim \forall x(\sim Ax \vee \sim Bx), \sim \exists x Cx, \exists x Dx \}$

1. ~~$\exists x(Ax \ \& \ Bx) \supset \forall y(Cy \vee \sim Dy)$~~
2. ~~$\sim \forall x(\sim Ax \vee \sim Bx)$~~
3. ~~$\sim \exists x Cx$~~
4. ~~$\exists x Dx$~~
5. Da 4, \exists
- ✓ 6. $\forall x \sim Cx$ 3, $\sim \exists$
7. $\sim Ca$ 6, \forall
8. ~~$\exists x \sim (\sim Ax \vee \sim Bx)$~~ 2, $\sim \forall$
9. ~~$\sim (\sim Ab \vee \sim Bb)$~~ 8, \exists
10. ~~$\sim \sim Ab$~~ 9, $\sim \vee$
11. ~~$\sim \sim Bb$~~ 9, $\sim \vee$
12. Ab 10, $\sim \sim$
13. Bb 11, $\sim \sim$



Inconsistent