

Logic—Sample Test A4 with Answers

NAME _____

1. Define 'counterexample'. (10 points)

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

2. Define 'valid'. (20 points)

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

Identify the following arguments properly. If the argument is valid, mark it with a V. If it is invalid mark it with an I. (These problems are worth 2 points each)

3. No cubist painters are Portuguese (people).

No Portuguese people are Olympic swimmers.

Thus, no cubist painters are Olympic swimmers.

Which is it: valid or invalid? INVALID (You could have a French cubist Olympic swimmer.)

4. Everything contained in the crate is organic.

Gypsum is inorganic.

Thus, the crate contains no gypsum.

Which is it: valid or invalid? VALID

5. The martin house has three martins in it.

The snake is in the martin house.

Snakes eat martins.

Thus, the martins in the martin house are in danger.

Which is it: valid or invalid? INVALID (The snake might be walled off from the martins.)

6. It's never true that riding is both invigorating and pleasurable.

Riding is sometimes invigorating.

Thus, riding is sometimes not pleasurable.

Which is it: valid or invalid? VALID

7. The hat on Pedro's head is made of felt.

Felt is not made of any animal products.

Thus, there are no animal products on Pedro's head.

Which is it: valid or invalid? INVALID (Pedro could keep a steak under his hat.)

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Translate the following sentences into the language of sentential logic using the abbreviations given to you. (These problems are worth 2 points each.)

B = “Eric bribed the judge.”

L = “Eric’s lawyer lost the case.”

J = “The jury returned a verdict.”

I = “Eric was found innocent.”

G = “Eric was found guilty.”

C = “Eric committed a crime.”

8. Eric bribed the judge and was not found guilty.

$B \ \& \ \sim G$

9. Either Eric committed a crime and was found guilty, or he bribed the judge and was found innocent.

$(C \ \& \ G) \ \vee \ (B \ \& \ I)$

10. If Eric bribed the judge, he committed a crime.

$B \supset C$

11. If the jury returned a verdict, then Eric was found either innocent or guilty.

$(J \ \vee \ G)$

12. Unless his lawyer lost the case, Eric was found innocent.

$\sim L \supset I$

13. It didn’t happen that Eric was found guilty and found innocent.

$\sim(G \ \& \ I)$

14. Only if Eric was found guilty, did Eric’s lawyer lose the case.

$L \supset G$

15. Eric bribed the judge, yet was nevertheless found guilty.

$B \ \& \ G$

16. Even if Eric did not bribe the judge, he still committed a crime and was found guilty.

$C \ \& \ G$

17. If the jury returned the verdict, and Eric was found innocent, then Eric’s lawyer didn’t lose the case.

$(J \ \& \ I) \supset \sim L$

18. Eric’s lawyer didn’t lose the case if the jury didn’t return a verdict or if Eric was found innocent.

$(\sim J \ \vee \ I) \supset \sim L$

19. Eric was found innocent if and only if he was not found guilty.

$(I \supset \sim G) \ \& \ (\sim G \supset I)$

20. Eric was found innocent only if he didn’t commit a crime or his lawyer didn’t lose the case.

$I \supset (\sim C \ \vee \ \sim L)$

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Construct truth tables to test whether these arguments are valid or invalid. *In the case of an invalid argument, indicate the row or rows that show that the argument is invalid by one of them.* (These problems are worth 4 points each.)

$$21. \frac{\sim(O \vee \sim J)}{J \supset O}$$

O	J	$\sim(O \vee \sim J)$	$J \supset O$
T	T	F T T FT	T T T
F	T	T F F FT	T F F
T	F	F T T TF	F T T
F	F	F F T TF	F T F

Which is it: valid or invalid? INVALID
 (If it is invalid, circle any row that proves that it is invalid.)

$$22. \frac{\sim E \supset \sim D}{\sim D \supset E} \\ \sim(E \& D)$$

E	D	$\sim E \supset \sim D$	$\sim D \supset E$	$\sim(E \& D)$
T	T	FT T FT	FT T T	F T T T
F	T	TF F FT	FT T F	T F F T
T	F	FT T TF	TF T T	T T F F
F	F	TF T TF	TF F F	T F F F

Which is it: valid or invalid? INVALID
 (If it is invalid, circle any row that proves that it is invalid.)

Test whether each of these sentences is a tautology, a contradiction, or a contingent sentence by constructing their truth tables. (These problems are worth 3 points each.)

$$23. \sim(A \vee (A \& \sim(\sim A \supset A)))$$

A	$\sim(A \vee (A \& \sim(\sim A \supset A)))$
T	F T T T F F FT T T
F	T F F F F T TF F F

Which is it: a tautology, a contradiction, or a contingent? CONTINGENT

$$24. \sim(((T \supset S) \supset \sim S) \supset \sim T)$$

T	S	$\sim(((T \supset S) \supset \sim S) \supset \sim T)$
T	T	F T T T F FT T FT
F	T	F F T T F FT T TF
T	F	T T F F T TF F FT
F	F	F F T F T TF T TF

Which is it: a tautology, a contradiction, or a contingent? CONTINGENT

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Test each of the following pairs of sentences for logical equivalence by constructing their truth tables. Label for each whether they are equivalent or inequivalent. (These problems are worth 3 points each.)

25. $\sim G \supset \sim(P \vee G)$ $(G \supset P) \& \sim P$

G	P	$\sim G \supset \sim(P \vee G)$	$(G \supset P) \& \sim P$
T	T	FT T FT TT	T TT F FT
F	T	TF F FT TF	F TT F FT
T	F	FT T FT TT	T FF F TF
F	F	TF T TFFF	F TF T TF

Which is it: equivalent or inequivalent? INEQUIVALENT

(If they are inequivalent, circle any row that proves that they are inequivalent.)

26. $\sim(B \supset \sim G)$ $\sim G \& B$

G	B	$\sim(B \supset \sim G)$	$\sim G \& B$
T	T	T T FFT	FT F T
F	T	F T T TF	TF T T
T	F	F F T FT	FT F F
F	F	F F T TF	TF F F

Which is it: equivalent or inequivalent? INEQUIVALENT

(If they are inequivalent, circle any row that proves that they are inequivalent.)

27. $K \vee \sim R$ $R \supset K$

K	R	$K \vee \sim R$	$R \supset K$
T	T	T T FT	T T T
F	T	F F FT	T F T
T	F	T T TF	F T T
F	F	F T TF	F T F

Which is it: equivalent or inequivalent? EQUIVALENT

(If they are inequivalent, circle any row that proves that they are inequivalent.)

28. Is the following sentence a contradiction? Justify your answer. (5 points.)

“If Jennifer is Swedish, then she isn’t Swedish.”

J	$J \supset \sim J$
T	TF F T
F	FT T F

It is not a contradiction.

29. Are the two following sentences logically equivalent? Justify your answer. (6 points.)

“Unless we don’t vote, we won’t win.” $\sim \sim V \supset \sim W$

“If we win, we will not have voted.” $W \supset \sim V$

V	W	$\sim \sim V \supset \sim W$	$W \supset \sim V$
T	T	TFT F FT	T F FT
F	T	FTF T FT	T T TF
T	F	TFT T TF	F T FT
F	F	FTF T TF	F T TF

They are equivalent.