

Logic—Sample Test A1 with Answers

NAME _____

1. Define 'counterexample'.

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

2. Define 'valid'.

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.

3. Irene is seeking to find a date for the homecoming dance.

Kevin is seeking to find a date for the homecoming dance.

Thus, Irene and Kevin could go to the homecoming dance together.

INVALID

4. No Frozberts are Gimpsits.

No Kragwizers are Frozberts.

Thus, no Kragwizers are Gimpsits.

INVALID

5. Paul took a sledgehammer, swung it hard, and hit an uncooked egg with the sledgehammer.

Thus, the egg cracked open and probably splattered.

INVALID

6. Ron lost his glasses in the river, the only pair of glasses he has ever had.

Someone had to help Ron in his effort to find his glasses from the river.

Thus, someone found what Ron lost.

INVALID

7. Tim ate pizza last night.

Ben ate pizza last night.

Michael ate pizza last night.

Thus, Either Tim, Ben, or Michael ate pizza last night.

VALID

Translate the following sentences into the language of sentential logic using the abbreviations given to you.

B = "We won the battle."

L = "We're likely to lose the war."

O = "The other team plays badly." *P* = "We play well." *W* = "We will win the game."

8. We won the battle, but we're likely to lose the war.

B & L

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9. We're not likely to lose the war unless we didn't win the battle.

$\sim\sim B \supset \sim L$ or you could have written $\sim L \vee \sim B$

10. We are unlikely to lose the war only if we won the battle.

$\sim L \supset B$

11. If the other team plays badly or if we play well, then we'll win the game.

$(O \vee P) \supset W$

12. If the other team doesn't play badly and we don't play well, then we aren't going to win the game.

$(\sim O \ \& \ \sim P) \supset \sim W$

13. We do play well, but if the other team doesn't play badly, we won't win the game.

$P \ \& \ (\sim O \supset \sim W)$

$A =$ "You apologize." $W =$ "We win the election."

$L =$ "You leave." $T =$ "There's going to be trouble."

$S =$ "Somebody will be happy."

14. If you don't apologize or leave, then there's going to be trouble.

$\sim(A \vee L) \supset T$

15. Unless you leave, nobody will be happy.

$\sim L \supset \sim S$

16. There's going to be trouble: if we don't win the election, then nobody will be happy.

$T \ \& \ (\sim W \supset \sim S)$

17. If you leave, somebody will be happy.

$L \supset S$

$M =$ "Melinda had an illness." $A =$ "Melinda was able to find the clinic."

$S =$ "Stephanie had an illness." $O =$ "The clinic was open."

18. Neither Melinda nor Stephanie were sick, but the clinic was open.

$\sim(M \vee S) \ \& \ O$

19. Melinda had an illness, and if the clinic was open, she couldn't find it.

$M \ \& \ (O \supset \sim A)$

20. Stephanie and Melinda were not both sick, but one of them had an illness.

$\sim(S \ \& \ M) \ \& \ (S \vee M)$

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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 circling one of them.*

$$\begin{array}{l} 21. \quad A \ \& \ \sim B \\ \quad \quad B \supset A \\ \hline \quad \quad \sim A \end{array}$$

A	B	A & ~B	B ⊃ A	~A
T	T	T F FT	T T T	F T
F	T	F F FT	T F F	T F
T	F	T T TF	F T T	F T
F	F	F F TF	F T F	T F

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

$$\begin{array}{l} 22. \quad A \supset (B \supset C) \\ \quad \quad A \ \& \ \sim B \\ \hline \quad \quad C \end{array}$$

A	B	C	A ⊃ (B ⊃ C)	A & ~B	C
T	T	T	T T T T T	T F FT	T
F	T	T	F T T T T	F F FT	T
T	F	T	T T FT T	T T TF	T
F	F	T	F T FT T	F F TF	T
T	T	F	T F T F F	T F FT	F
F	T	F	F T T F F	F F FT	F
T	F	F	T T FT F	T T TF	F
F	F	F	F T FT F	F F TF	F

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

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23. $M \supset N$

$K \supset P$

$N \supset K$

$M \supset P$

M	N	K	P	$M \supset N$	$K \supset P$	$N \supset K$	$M \supset P$
T	T	T	T	T	T	T	T
F	T	T	T	F	T	T	F
T	F	T	T	T	T	F	T
F	F	T	T	F	T	F	F
T	T	F	T	T	F	T	T
F	T	F	T	F	F	T	F
T	F	F	T	T	F	F	T
F	F	F	T	F	F	F	F
T	T	T	F	T	T	T	T
F	T	T	F	F	T	T	F
T	F	T	F	T	T	F	T
F	F	T	F	F	T	F	F
T	T	F	F	T	F	T	T
F	T	F	F	F	F	T	F
T	F	F	F	T	F	F	T
F	F	F	F	F	F	F	F

Which is it: valid or invalid? VALID

(If it is invalid, circle the 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.

24. $(J \supset \sim J) \& (\sim J \supset J)$

J	$(J \supset \sim J) \& (\sim J \supset J)$
T	F
F	F

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

25. $(A \& B) \supset (\sim A \supset \sim B)$

A	B	$(A \& B) \supset (\sim A \supset \sim B)$
T	T	T
F	T	T
T	F	T
F	F	T

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

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26. $[(\sim A \supset B) \supset C] \supset (A \& \sim C)$

A	B	C	$[(\sim A \supset B) \supset C] \supset (A \& \sim C)$
T	T	T	FT T T T T F T FFT
F	T	T	TF T T T T F F FFT
T	F	T	FT T F T T F T FFT
F	F	T	TF F F T T F F FFT
T	T	F	FT T T F F T T TTF
F	T	F	TF T T F F T F FTF
T	F	F	FT T F F F T T TTF
F	F	F	TF F F T F F F FTF

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

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.

27. $(C \supset \sim E) \& (E \supset C)$ $\sim C$

C	E	$(C \supset \sim E) \& (E \supset C)$	$\sim C$
T	T	T FFT F TTT	FT
F	T	F T FT F TFF	TF
T	F	T TTF T FTT	FT
F	F	F TTF T FTF	TF

Which is it: equivalent or inequivalent? INEQUIVALENT

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

28. $(B \vee \sim A)$ $\sim A \supset B$

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

29. $(X \& \sim Y) \supset \sim X$ $((X \supset Y) \vee \sim X)$

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

Which is it: equivalent or inequivalent? EQUIVALENT

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

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30. Translate the following argument and check to see whether it is valid. Use some or all of the sentence letters provided.

If the lawnmower isn't broken, then Bart can mow the lawn tomorrow.

Unless either Dave or Sheryl fixed the lawnmower, then it's broken.

If Dave fixed the lawnmower, Sheryl didn't, and if Sheryl fixed it, Dave didn't.

Thus, if Sheryl fixed the lawnmower, then Bart can mow the lawn tomorrow.

L = "The lawnmower is broken."

B = "Bart can mow the lawn tomorrow."

D = "Dave fixed the lawnmower."

S = "Sheryl fixed the lawnmower."

Translate the argument into symbols here:

$\sim L \supset B$
 $\sim(D \vee S) \supset L$
 $(D \supset \sim S) \ \& \ (S \supset \sim D)$
 Thus, $S \supset B$

Fill out the truth table here.

L	B	D	S	$\sim L \supset B$	$\sim(D \vee S) \supset L$	$(D \supset \sim S) \ \& \ (S \supset \sim D)$	$S \supset B$
T	T	T	T	FT	TT	TF	FT
F	T	T	T	TF	TT	TF	TT
T	F	T	T	FT	TF	TF	TF
F	F	T	T	TF	FF	TF	TF
T	T	F	T	FT	TT	FT	TT
F	T	F	T	TF	TT	FT	TT
T	F	F	T	FT	TF	FT	TF
F	F	F	T	TF	FF	FT	TF
T	T	T	F	FT	TF	TT	FT
F	T	T	F	TF	TF	TT	FT
T	F	T	F	FT	TF	TT	FT
F	F	T	F	TF	FF	TT	FT
T	T	F	F	FT	TF	FT	FT
F	T	F	F	TF	FF	FT	FT
T	F	F	F	FT	TF	FT	FT
F	F	F	F	TF	FF	FT	FT

Which is it: valid or invalid? INVALID

(If it is invalid, circle the row that proves that it is invalid.)