

Logic—Final Examination E4

NAME _____

Evaluate whether the following arguments are valid. Write a V or an I next to each argument. (1 point each)

1. Only a few people take progesterone supplements.
All the people who do take progesterone supplements are women.
Thus, there are women who don't take progesterone supplements.

2. All frogs croak.
There is a frog swimming in the pond in my back yard.
Thus, some frogs croak.

3. There is smoke rising from the smokestack.
Fires always result in smoke being produced.
Thus, there is a fire producing the smoke coming out of the smokestack.

4. It is incorrect that Lorraine never smokes.
Thus, it is incorrect that Lorraine always smokes.

5. Without good weather on the date of the spraying, the pesticide will not eradicate the mosquitoes.
The pesticide will not eradicate the mosquitoes.
Thus, the weather will not be good on the date of the spraying.

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Translate the following sentences into the language of sentential logic using the abbreviations given to you. (These problems are worth 1 point each.)

B = “The forest contains beech trees.”

C = “The forest will be cleared.”

E = “The forest contains elm trees.”

O = “The forest is replanted with oaks.”

6. “The forest has beeches and elms.”

7. “The forest will be cleared if it doesn’t contain any elms or beeches.”

8. “Either elm trees and beech trees are in the forest, or the forest will be cleared.”

9. “The forest doesn’t contain both elm trees and beech trees.”

10. Unless there are elms in the forest, it will be cleared and replanted with oaks.”

11. “If the forest isn’t cleared, it won’t be replanted with oaks.”

L = “Our leader is at the meeting.”

A = “We will be able to accomplish something.”

P = “The protesters are allowed near the premises.”

E = “The press is allowed near the premises.”

12. “Without our leader being at the meeting, we won’t be able to get anything accomplished.”

13. “We’ll be able to accomplish something only if the protesters are not allowed near the premises.”

14. “The protestors won’t be allowed near the premises if our leader is at the meeting.”

15. “If neither the protestors nor press are allowed near the premises, we will be able to accomplish something.”

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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 1 point each.)

$Ax = x$ is alabaster.

$Sx = x$ is smooth.

$Mx = x$ is malachite.

$Tx = x$ is a temple.

$Dx = x$ is damaged.

$Cx = x$ is cared for.

$s =$ the statue

$f =$ the floor

16. “The alabaster floor will be damaged if it is not cared for.”

17. “No temples are made of malachite.”

18. “The only temple that is damaged is the alabaster one.”

19. “Unless the statue is a malachite statue, it isn’t cared for.”

20. “The floor is undamaged, but everything else is damaged.”

21. “The statue is made of neither alabaster nor malachite.”

22. “Every alabaster thing is cared for, except possibly the statue, which is damaged.”

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$Px = x$ is a person.

$Cx = x$ is a coat.

$Bxy = x$ belongs to y . (y owns x , y possesses x , y has x , etc.)

$Wxy = x$ is wearing y .

$Sxyz = x$ sold y to z .

$Fx = x$ is made of fur.

$s =$ Shawn

$l =$ Laurie

23. "Shawn sold his only coat to Laurie."

24. "No one sold anything to Shawn."

25. "All Shawn's coats are fur coats."

26. "Laurie has a fur coat."

27. "Someone is wearing one of Laurie's coats."

28. "Anyone wearing fur possesses a coat."

29. "Any coat that is fur belongs to either Shawn or Laurie."

30. "Laurie only wears non-fur coats."

31. "No one besides Laurie is wearing a fur coat."

32. "Everyone is wearing what he or she owns."

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Label each of the following sequences of symbols with a check mark if and only if it is a legitimate statement of logic. Mark the expression with an 'X' if and only if it is not a legitimate statement. (1 point each)

33. $W \vee (\sim T \supset \sim(W \& \sim T)) \& \sim T$

34. $\exists x \forall x (Cx \supset \sim Exx)$

35. $\exists x (Gh = x)$

36. $\sim X(z = y) \& Pa$

37. $\forall x \sim \forall y \sim \sim (Q \supset Kxy)$

38. $\forall f (c \neq f \supset \sim If)$

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 at least one of them.* (4 points.)

39.
$$\begin{array}{l} S \& \sim O \\ R \vee O \\ \hline \sim R \supset \sim S \end{array}$$

S	R	O	$S \& \sim O$	$R \vee O$	$\sim R \supset \sim S$

Valid or invalid? If it is invalid, circle any one row that proves that it is invalid.

40.
$$\begin{array}{l} \sim E \vee (\sim H \& E) \\ E \& \sim (H \supset \sim E) \\ \hline \sim (E \supset \sim (H \& E)) \end{array}$$
 (3 points)

E	H	$\sim E \vee (\sim H \& E)$	$E \& \sim (H \supset \sim E)$	$\sim (E \supset \sim (H \& E))$

Valid or invalid? If it is invalid, circle any one row that proves that it is invalid.

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Use the truth table method to determine whether the set of sentences is equivalent. (4 points)

41. { “Roger is not visiting if Doris is”, “Doris is visiting if Roger isn’t” }

R	D		

Equivalent or inequivalent?

If it is inequivalent, circle any one row that proves that it is inequivalent.

42. Use the truth table method to determine whether the set of sentences is consistent. (4 points)
 { “Frank isn’t meeting the CFO unless Frank is golfing.”, “Frank is neither golfing nor meeting the CFO.” }

M	G		

Consistent or inconsistent?

If it is consistent, circle any one row that proves that it is consistent.

For each of the following three sentences indicate whether it is a tautology, a contradiction, or a contingent sentence. Show some kind of formal proof. Use auxiliary premises if needed.

43. “Either cobras and vipers live here, or neither boas nor vipers live here.” (4 points)

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44. “Wendy is present only if she isn’t present.” (3 points)

45. You need to add in several implicit premises to evaluate this sentence properly:
“Joe is a brother to his sister Angela, and Joe is a brother to all of Angela’s brothers.” (5 points)

46. Are the following sentences logically consistent? Show some kind of formal proof. (4 points)
 $\{ \sim(Z \supset D) \vee \sim I, I \ \& \ (\sim D \supset \sim Z), \}$

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Use the truth tree method to determine whether the set of sentences is consistent.

47. $\{ \sim R \vee T, J \supset R, \sim(T \vee \sim J) \}$ (4 points)

48. $\{ \exists x(Px \ \& \ a=x), \forall xy((Py \ \& \ x=a) \supset Qxy), \forall x \sim Qxx \}$ (6 points)

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Use the truth tree method to determine whether the argument is valid.

49. (4 points)

$$\begin{array}{l} (Y \vee \sim Y) \supset \sim N \\ O \supset (U \& \sim U) \\ \hline \sim(N \vee O) \end{array}$$

50. (6 points)

$$\begin{array}{l} \sim \forall x (Px \supset \exists w \sim Dwx) \\ \hline \exists z (Pz \& \forall y Dzy) \end{array}$$

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51. What is the definition of an equivalence relation? (1 point)

The following questions are worth 3 points each.

52. The relation L , where Lxy means “ x is at least as large as y .”

Reflexive? (Reflexive / Irreflexive / Neither)

Symmetric? (Symmetric / Anti-symmetric / Neither)

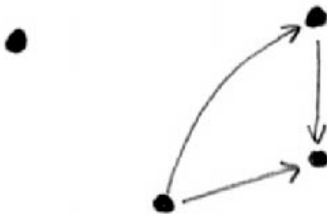
Transitive? (Transitive / Not-transitive)

53. The relation R , where R is defined over the universe pictured below.

Reflexive? (Reflexive / Irreflexive / Neither)

Symmetric? (Symmetric / Anti-symmetric / Neither)

Transitive? (Transitive / Not-transitive)



54. The relation Q , where Q is defined over the universe pictured below.

Reflexive? (Reflexive / Irreflexive / Neither)

Symmetric? (Symmetric / Anti-symmetric / Neither)

Transitive? (Transitive / Not-transitive)

