

Logic—Sample Final Examination E1

NAME \_\_\_\_\_

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

A = “The animal is a bovine.”

B = “The animal is a bull.”

C = “The animal is a cow.”

1. “The animal is a bovine, and if it is not a cow, then it is a bull.”
2. “Unless the animal is not bovine, it is a cow.”
3. “The animal is not both a cow and a bull.”
4. “Only if the animal is a cow, is it bovine.”
5. “If the animal is a cow, then it is not a bull, and vice versa.”
6. “The animal is bovine if and only if it is a cow or a bull.”

T = “Harmon owns a truck.”

S = “Harmon owns a sports car.”

D = “Harmon drives.”

W = “Harmon wants to own a sports car.”

7. “Harmon owns both a truck and a sports car, but he doesn’t drive.”
8. “It’s untrue that if Harmon owns a truck, he doesn’t drive.”
9. “Unless Harmon doesn’t drive, he doesn’t own a sports car.”
10. “Harmon neither owns nor wants to own a sports car.”

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

$Ax = x$  is an apple

$Px = x$  is a pear

$Tx = x$  is a tree

$d =$  my desk

$Gx = x$  is green

$Rx = x$  is red

$Oxy = x$  is on  $y$

$S =$  It is September

11. “All apples are either red or green.”
12. “Not all pears are green.”
13. “There are pears on a tree that are neither red nor green.”
14. “If there is a red apple on my desk, then it is not on a tree.”
15. “No apples are red, unless it is September.”
16. “Even though it is September, none of the apples on the trees are red yet.”
17. “Every red apple is on some green tree or other.”
18. “There is no tree that has both pears and apples on it.”
19. “A green pear or apple is on my red desk.”
20. “Each pear on my desk is green, but none of the apples on my desk are.”

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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.

- 21.  $\sim(\sim F \vee (\sim\sim E \supset \sim R)) \& \sim J$
- 22.  $\sim\sim(T \& \sim\sim E) \vee E$
- 23.  $\forall x \sim \forall y (Q \supset (Kxy \vee Kyx))$
- 24.  $\exists xy (Rx \& Fxy)$
- 25.  $\forall x (U \& \sim \forall y Syy)$
- 26.  $\forall xy (Lxc = y \& Py)$
- 27.  $\exists z \forall y (Wzy \supset \sim(z = y)) \& Pa) \vee K$

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.*

- 28.  $\sim W \& L$   
 $\sim W \supset E$   


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 $L \& E$


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

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$$\begin{array}{r}
 29. \quad E \vee \sim D \\
 \quad D \vee J \\
 \hline
 \quad E \vee J
 \end{array}$$


Valid or invalid? \_\_\_\_\_

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

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

$$30. \{ \text{“Pedro is not going”}, \text{“Laurie is going,”} \text{“Pedro is going if and only if Laurie is going,”} \}$$


Consistent or Inconsistent? \_\_\_\_\_

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

$$31. \{ \text{“Rachel and Jennifer are camping,”} \text{“Rachel is camping unless Jennifer is,”} \}$$


Consistent or Inconsistent? \_\_\_\_\_

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

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For each of the following sentences indicate whether it is a tautology, a contradiction, or a contingent sentence. Show some kind of formal proof.

32. “Unless Audrey lives in a cave, she doesn’t live in a cave.”

33. “If Indiana is where she lives, she doesn’t live in Indiana.”

34. “Everest is taller than everything in existence.”

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Use the truth tree method to determine whether the set of sentences is consistent. Number all lines. Label all derived lines with the rule and the line from which they were derived. Answers should look just as in the book (except that you should cross out each complex sentence after you use it.)

35.  $\{ A \vee B, \sim(P \supset A), \sim(P \& B) \}$

36.  $\{ \sim R \vee T, J \supset R, \sim(T \vee \sim J) \}$

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37. {  $\exists xPx \ \& \ \exists z\sim Pz$ ,  $\forall xz((Px \ \& \ Pz) \supset Lxz)$ ,  $\forall yLyy$  }

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38.  $\{ \exists x((Px \ \& \ \sim(x = b)) \ \& \ \sim Fbx), \ \forall x \forall z(((Px \ \& \ Pz) \ \& \ \sim(x = z)) \supset Fxz), \ \forall y \sim Fyy \}$

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Use the truth tree method to determine whether the argument is valid. Number all lines. Label all derived lines with the rule and the line from which they were derived. Answers should look just as in the book (except that you should cross out each complex sentence after you use it.)

$$\begin{array}{l} 39. \quad K \supset L \\ \quad \quad L \supset M \\ \hline \quad \quad \sim M \supset \sim K \end{array}$$

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40.  $\exists x(Px \ \& \ Bx)$   
 $\forall y(Py \supset y = b)$ 

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 $Ba$

41. Why do we translate arguments like “All cats meow. Frisky is a cat. Thus, Frisky meows.” with quantifier logic, which is harder, instead of with propositional logic, which is easier?

42. Why could we not create a symbol in sentential logic to represent the English connective ‘because’?