

Logic—Sample Final Examination E2

6. The menu at the cafeteria says that the roast mutton dish comes with your choice of three vegetable side dishes. Jackie reads the menu, looks at the available vegetables, and says to her buddy Ingrid, I can have green beans or mashed potatoes. Ingrid, trying to remember from her logic class last semester how to formalize Jackie's statement, thinks to herself that Jackie is claiming $(G \ \& \ P)$, where $G =$ "Jackie can have green beans," and $P =$ "Jackie can have mashed potatoes." Which of the following is true?
- a) Ingrid has made an error. She should have used ' \vee ' in her translation, not ' $\&$ '.
 - b) Jackie said something logically invalid. She should have used 'and' instead of 'or'.
 - c) This situation shows that logic doesn't always work in the real world.
 - d) This example illustrates that sometimes 'or' should be translated as ' $\&$ '.
 - e) Ingrid never should have broken up Jackie's statement into a conjunction because Jackie's disjunction came within the scope of the word 'can' which denotes possibility.
7. Football playoffs are coming up soon, and that means inevitably that hypothetical playoff situations will be considered by sports pundits. On TV, Terry Bradshaw claims that the Saints will make it into the playoffs if the Bears win or the Giants don't win. Howie Long says the only way the Saints will be kept out of the playoffs is if the Giants win and the Bears don't win. Which of the following is true?
- a) Terry and Howie are saying essentially the same thing.
 - b) Terry and Howie are stating conflicting claims.
 - c) Terry and Howie's claims are not the same but they don't conflict with each other.
8. What was the lesson of the Wason Selection Task (Hint: remember the puzzle with the 4 cards, flipping some cards over to check whether a rule has been violated)?
- a) Sentential logic can lead us to the wrong answers sometimes because it doesn't capture certain aspects of the way we ought to reason with conditionals.
 - b) In certain cases, we instinctively do not reason using sentential logic, but instead use context-dependent reasoning and that leads us astray.
 - c) People usually use a crude form of probabilistic reasoning to figure out puzzles like the Wason selection task, and this rarely leads to errors in reasoning.
 - d) Activities like selection require a more powerful logic than sentential logic. Thus, we need the resources of quantificational logic.
 - e) Conversational implicature often leads us to think that disjunctions are exclusive, even though formal logic teaches us that disjunctions are always inclusive.

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9. This semester, we learned how to translate arguments like

Socrates is a human.
All humans are mortal.
Thus, Socrates is mortal.

by using quantificational logic as follows:

Hs
 $\forall x(Hx \supset Mx)$
Thus, Ms

But we already knew how to translate the argument given in English into sentential logic without introducing any symbols like \forall or \exists . So why don't we translate the argument into sentential logic instead of bothering with the more complicated quantificational translation?

10. Why can't we in general use truth tables to determine the validity of sentences of quantificational logic?
11. Why is the following not a sentence of quantificational logic?
 $\exists x(\forall z(Pz \supset \sim Gkxz)) \& Py$

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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 points each.)

A = “The animal is a bovine.”

B = “The animal is a bull.”

C = “The animal is a cow.”

12. “The animal is a bovine, and if it is not a cow, then it is a bull.”

13. “Unless the animal is not bovine, it is a cow.”

14. “The animal is not both a cow and a bull.”

15. “Only if the animal is a cow, is it bovine.”

16. “If the animal is a cow, then it is not a bull, and vice versa.”

17. “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 owns a sports car.”

18. “Harmon owns both a truck and a sports car, but he doesn’t drive.”

19. “It’s untrue that if Harmon owns a truck, he doesn’t drive.”

20. “Unless Harmon doesn’t drive, he doesn’t own a sports car.”

21. “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. (These problems are worth 1 points each.)

$Ax = x$ 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

22. “All apples are either red or green.”

23. “Not all pears are green.”

24. “There are pears on a tree that are neither red nor green.”

25. “If there is a red apple on my desk, then it is not on a tree.”

26. “No apples are red, unless it is September.”

27. “Even though it is September, none of the apples on the trees are red yet.”

28. “Every red apple is on some green tree or other.”

29. “There is no tree that has both pears and apples on it.”

30. “A green pear or apple is on my red desk.”

31. “Each pear on my desk is green, but none of the apples on my desk are.”

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

$Bxy = x$ is a brother to y

$Sxy = x$ is a sister to y

$Ixy = x$ is in y

$Cx = x$ is a car

$Oxy = x$ owns y

$Dx = x$ is a dress

$Wx = x$ is white

$c =$ Christine

$a =$ Amber

$s =$ Steve

32. “Amber doesn’t own a white dress.”

33. “Steve is not in Amber’s car.”

34. “Christine is an only child.”

35. “Amber is Steve’s sister, but Christine isn’t.”

36. “One of Amber’s sisters is in Christine’s car.”

37. “Christine has Amber’s dress in her car.”

38. “None of Steve’s brothers owns a white car.”

39. “Some of Amber’s sister’s dresses are in her car.”

40. “Christine and Steve are currently located in a car together.”

41. “Christine’s dress is in one of Steve’s cars.”

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Use the **truth table** method to determine whether the sentence is a tautology, a contradiction or is a contingent sentence. (4 points)

42. $(\sim C \ \& \ \sim D) \vee \sim(C \supset \sim D)$

Use the **truth table** method to determine whether the argument is valid. (4 points)

43.
$$\begin{array}{l} \sim A \ \& \ \sim F \\ \underline{R \vee \sim(A \supset \sim A)} \\ \sim(F \vee \sim R) \end{array}$$

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44. Use the **truth table** method to prove that $(\sim G \vee \sim S)$ is inconsistent with $\sim(G \supset \sim S)$. (4 points)

Use either the **truth table** method **or** the **truth tree** method to determine whether the set of sentences is consistent. (4 points)

45. $\{ \sim R \vee \sim T, T \vee Q, \sim Q \vee R \}$

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46. Prove that “All cats are black,” and “No cats are black,” are consistent with one another. Use the **truth tree** method. (4 points)
47. Prove that from a contradiction ($A \ \& \ \sim A$), one can validly infer any conclusion whatsoever, namely B. Use either the **truth table** method **or** the **truth tree** method. (4 points)

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Use either the **truth table** method or the **truth tree** method to determine whether the argument is valid. (4 points)

48. $\sim((A \ \& \ \sim B) \ \& \ \sim(C \supset \sim D)) \ \& \ ((A \ \& \ \sim B) \ \& \ \sim(C \supset \sim D))$
 $\underline{B \ \vee \ (\sim(A \supset \sim E) \ \vee \ D)}$
 $\sim(\sim C \ \vee \ (E \ \& \ \sim(A \ \vee \ C)))$

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Use either the **truth table** method or the **truth tree** method to determine whether the two given statements are logically equivalent. (4 points)

49. $\{ (\sim(X \supset \sim X) \vee (X \vee \sim X)) \ \& \ \sim X, X \supset \sim(\sim X \vee (\sim X \supset X)) \}$

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Use the **truth tree** method to determine whether the argument is valid. (4 points)

50. $\exists x\exists yTxy$
 $\forall x\forall y(Txy \supset Rxy)$

 Rab

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Use the **truth tree** method to determine whether the argument is valid. (4 points)

51. $\forall x(Dx \supset \forall y(\sim Gyx))$
Df

Gaf

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Use the **truth tree** method to determine whether the argument is valid. (4 points)

52.
$$\frac{\forall x(Jx \supset Tx)}{\forall x(\exists y(Jy \ \& \ Fxy) \supset \exists z(Tz \ \& \ Fxz))}$$

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Use the **truth tree** method to determine whether the set of sentences is consistent.
(4 points)

53. $\{ \forall x \exists y Kxy \vee L, \sim \exists y Kby, L \supset \forall x \exists z Kbz \}$