

# Introduction to Logical Reasoning

## Problem Set #6

Although I strongly suggest that you write out answers to all these problems, you do *not* have to turn in any written responses. You do, however, need to be prepared to do these types of problems, for questions on the weekly quizzes and exams will primarily be drawn from the problem sets. The solutions to these problems will be provided, so you can check your own work and seek help from me as necessary.

We will devote considerable time to these types of problems during the next in-class workshop. In order to make that workshop productive, please make a solid start on them. That way you can use the workshop to address the difficulties you are facing.

If you do the extra credit logic puzzle, you must turn in a computer-type-written solution at the beginning of class on Sunday, October 14<sup>th</sup>.

### Parts A and B Instructions

Each of the following problems presents a statement in English. Translate each of them into the language of symbolic logic, using the indicated capital letters to label each simple proposition involved. (Please note that I did not come up with these statements, but they were taken from a common textbook on logic with apparently some jingoistic presumptions.)

#### Part A Problems

- Iran raises the price of oil but Libya does not raise the price of oil. (I, L)
- Either Iran or Libya raises the price of oil. (I, L)
- Iran and Libya both raise the price of oil. (I, L)
- Iran and Libya do not both raise the price of oil. (I, L)
- Iran and Libya both do not raise the price of oil. (I, L)
- Iran or Libya raises the price of oil but they do not both do so. (I, L)
- Saudi Arabia buys five hundred more warplanes, and either Iran raises the price of oil or Jordan requests more U.S. aid. (S, I, J)
- Either Saudi Arabia buys five hundred more warplanes and Iran raises the price of oil, or Jordan requests more U.S. aid. (S, I, J)
- It is not the case that Egypt's food shortage worsens, and Jordan requests more U.S. aid. (E, J)
- It is not the case that either Egypt's food shortage worsens or Jordan requests more U.S. aid. (E, J)
- Either it is not the case that Egypt's food shortage worsens or Jordan requests more U.S. aid. (E, J)
- It is not the case that both Egypt's food shortage worsens and Jordan requests more U.S. aid. (E, J)
- Jordan requests more U.S. aid unless Saudi Arabia buys five hundred more warplanes. (J, S)
- Unless Egypt's food shortage worsens, Libya raises the price of oil. (E, L)
- Iran won't raise the price of oil unless Libya does so. (I, L)
- Unless both Iran and Libya raise the price of oil neither of them does. (I, L)
- Libya raises the price of oil and Egypt's food shortage worsens. (L, E)
- It is not the case that neither Iran nor Libya raises the price of oil. (I, L)
- Egypt's food shortage worsens and Jordan requests more U.S. aid, unless both Iran and Libya do not raise the price of oil. (E, J, I, L)
- Either Iran raises the price of oil and Egypt's food shortage worsens, or it is not the case both that Jordan requests more U.S. aid and that Saudi Arabia buys five hundred more warplanes. (I, E, J, S)

- Either Egypt's food shortage worsens and Saudi Arabia buys five hundred more warplanes, or either Jordan requests more U.S. aid or Libya raises the price of oil. (E, S, J, L)
- Saudi Arabia buys five hundred more warplanes, and either Jordan requests more U.S. aid or both Libya and Iran raise the price of oil. (S, J, L, I)
- Either Egypt's food shortage worsens or Jordan requests more U.S. aid, but neither Libya nor Iran raises the price of oil. (E, J, L, I)
- Egypt's food shortage worsens, but Saudi Arabia buys five hundred more warplanes and Libya raises the price of oil. (E, S, L)
- Libya raises the price of oil and Egypt's food shortage worsens; however, Saudi Arabia buys five hundred more warplanes and Jordan requests more U.S. aid. (L, E, S, J)

#### Part B Problems

- If Argentina mobilizes then if Brazil protests to the UN then Chile will call for a meeting of all the Latin American states. (A, B, C)
- If Argentina mobilizes then either Brazil will protest to the UN or Chile will call for a meeting of all the Latin American states. (A, B, C)
- If Argentina mobilizes then Brazil will protest to the UN and Chile will call for a meeting of all the Latin American states. (A, B, C)
- If Argentina mobilizes then Brazil will protest to the UN, and Chile will call for a meeting of all the Latin American states. (A, B, C)
- If Argentina mobilizes and Brazil protests to the UN then Chile will call for a meeting of all the Latin American states. (A, B, C)
- If either Argentina mobilizes or Brazil protests to the UN then Chile will call for a meeting of all the Latin American states. (A, B, C)
- Either Argentina will mobilize or if Brazil protests to the UN then Chile will call for a meeting of all the Latin American states. (A, B, C)
- If Argentina does not mobilize then either Brazil will not protest to the UN or Chile will not call for a meeting of all the Latin American states. (A, B, C)
- If Argentina does not mobilize then neither will Brazil protest to the UN nor will Chile call for a meeting of all the Latin American states. (A, B, C)
- It is not the case that if Argentina mobilizes then both Brazil will protest to the UN and Chile will call for a meeting of all the Latin American states. (A, B, C)
- If it is not the case that Argentina mobilizes then Brazil will not protest to the UN, and Chile will call for a meeting of all the Latin American states. (A, B, C)
- Brazil will protest to the UN if Argentina mobilizes. (B, A)
- Brazil will protest to the UN only if Argentina mobilizes. (B, A)
- Chile will call for a meeting of all the Latin American states only if both Argentina mobilizes and Brazil protests to the UN. (C, A, B)
- Brazil will protest to the UN only if either Argentina mobilizes or Chile calls for a meeting of all the Latin American states. (B, A, C)
- Argentina will mobilize if either Brazil protests to the UN or Chile calls for a meeting of all the Latin American states. (A, B, C)
- Brazil will protest to the UN unless Chile calls for a meeting of all the Latin American states. (B, C)
- If Argentina mobilizes, then Brazil will protest to the UN unless Chile calls for a meeting of all the Latin American states. (A, B, C)
- Brazil will not protest to the UN unless Argentina mobilizes. (B, A)

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## Problem Set #6

20. Unless Chile calls for a meeting of all the Latin American states, Brazil will protest to the UN. (C, B)
21. Argentina's mobilizing is a sufficient condition for Brazil to protest to the UN. (A, B)
22. Argentina's mobilizing is a necessary condition for Chile to call for a meeting of all the Latin American states. (A, C)
23. If Argentina mobilizes and Brazil protests to the UN, then both Chile and the Dominican Republic will call for a meeting of all the Latin American states. (A, B, C, D)
24. If Argentina mobilizes and Brazil protests to the UN, then either Chile or the Dominican Republic will call for a meeting of all the Latin American states. (A, B, C, D)
25. If neither Chile nor the Dominican Republic calls for a meeting of all the Latin American states, then Brazil will not protest to the UN unless Argentina mobilizes. (C, D, B, A)

### Parts C Instructions

Each of the following problems presents a statement in logical form. Construct a truth table for each, and use that table to briefly explain whether it is a tautology, a contradiction, or a contingent statement.

### Part C Problems

1.  $[p \rightarrow (p \rightarrow q)] \rightarrow q$ .
2.  $p \rightarrow [(p \rightarrow q) \rightarrow q]$ .
3.  $(p \& q) \& (p \rightarrow \sim q)$ .
4.  $p \rightarrow [\sim p \rightarrow (q \vee \sim q)]$ .
5.  $p \rightarrow [p \rightarrow (q \& \sim q)]$ .
6.  $(p \rightarrow p) \rightarrow (q \& \sim q)$ .
7.  $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ .
8.  $[p \rightarrow (q \rightarrow p)] \rightarrow [(q \rightarrow q) \rightarrow \sim(r \rightarrow r)]$ .
9.  $\{[(p \rightarrow q) \& (r \rightarrow s)] \& (p \vee r)\} \rightarrow (q \vee s)$ .
10.  $\{[(p \rightarrow q) \& (r \rightarrow s)] \& (q \vee s)\} \rightarrow (p \vee r)$ .

**Note:** There may a lot of exercises here. Do not feel obligated to do all of them. I often assign many exercises so that you have plenty of opportunities to practice the skills these exercises are trying to impart. I suggest doing just enough of them so that you are confident that you could use these skills on a quiz or an exam.

### Extra Credit Logic Puzzle

A father said to his daughter, "I have here a one-riyal bill and a five-hundred-riyal bill. You make a statement to me. If this statement is true, I'll give you one and only one of these bills, but if your statement is false, I'll give you nothing".

**Question:** What statement could the daughter say to her father to ensure that she gets the five-hundred-riyal bill?

To receive full credit you must justify your answer with a logical argument showing why you are 100% right. That is to say, this question has a definitive answer that can be justified without *any* guessing on your part.