

Friday, Jan. 20

1. Show that $(p \rightarrow r) \vee (q \rightarrow r)$ is logically equivalent to $(p \wedge q) \rightarrow r$ by developing a series of logical equivalences.

2. Show that $\neg(p \rightarrow q) \rightarrow \neg q$ is a Tautology by developing a series of logical equivalences with it and T.

3. There is an island of knights and knaves. The knights always tell the truth. The knaves always lie. You encounter two people, A and B, and they both make a statement. Determine if you can tell what type of people each is or not.
A says "I am a knight"
B says "I am a knight"

4. Same problem setup as 1) but A and B do the following:
A says "At least one of us is a knave"
B says nothing

5. Same problem setup as 1) but now there is also a third type of person, a spy who can either lie or tell the truth.

You encounter three people A, B, and C. You know one is a knight, one is a knave and one is a spy. Each of the three people knows the type of person each of the other two people is. Determine if there is a unique solution of who the knight, knave or spy is. If not list at least two possibilities.

A says "C is the Knave"

B says "A is the Knight"

C says "I am the Spy."

6. Same problem setup as 3) but the three say:

A says "I am the Knight"

B says "A is telling the truth"

C says " I am the Spy"

7. The Zebra puzzle

Five men with different nationalities and with different jobs live in consecutive houses on a street. The houses are painted different colors. The men have different pets and have different favorite drinks. Determine who owns a zebra and whose favorite drink is mineral water (which is one of the favorite drinks) given these clues:

1. The Englishman lives in the red house.
2. The Spaniard owns a dog.
3. The Japanese man is a painter.
4. The Italian drinks tea.
5. The Norwegian lives in the first house on the left.
6. The green house is on the right of the white one.
7. The photographer breeds snails.
8. The diplomat lives in the yellow house.
9. Milk is drunk in the middle house.
10. The owner of the green house drinks coffee.
11. The Norwegians house is next to the blue one.
12. The violinist drinks orange juice.
13. The fox is in a house next to that of the physician.
14. The horse is in a house next to that of the diplomat.

Hint: Make a table where the rows represent the men and columns represent the colors of their houses, their jobs, their pets, and their favorite drinks and use logical reasoning to determine the correct entries in the table.