Due: Thursday 12/4/14 at start of lecture

1. You are about to leave for school in the morning and discover that you don't have your glasses. You know the following statements are true:

a. If I was reading the newspaper in the kitchen, then my glasses are on the kitchen table.
b. If my glasses are on the kitchen table, then I saw them at breakfast.
c. I did not see my glasses at breakfast.
d. I was reading the newspaper in the living room or I was reading the newspaper in the kitchen.
e. If I was reading the newspaper in the living room then my glasses are on the coffee table.

Where are the glasses? (10pts)

2 - 5. The logician Raymond Smullyan describes an island containing two types of people: knights who always tell the truth and knaves who always lie. You visit the island and have the following encounters.

2. Two natives who speak to you as follows:
A says: B is a knight.
B says: A and I are of opposite type.
What are A and B? (10pts)

3. Two more natives C and D address you as follows:
C says: Both of us are knights.
D says: A is a knave.
What are C and D? (10 pts)

4. Another two natives E and F approach you but only E speaks.
E says: Both of us are knaves.
What are E and F? (10pts)

5. Finally, you meet a group of six natives, U, V,W, X,Y, and Z, who speak to you as follows:
U says: None of us is a knight.
V says: At least three of us are knights.
W says: At most three of us are knights.
X says: Exactly five of us are knights.
Y says: Exactly two of us are knights.
Z says: Exactly one of us is a knight.
Which are knights and which are knaves? (10pts)

6. In the back of an old cupboard you discover a note signed by a pirate famous for his bizarre sense of humor and love of logical puzzles. In the note he wrote that he had hidden treasure somewhere on the property. He listed five true statements (a–e below) and challenged the reader to use them to figure out the location of the treasure.

a. If this house is next to a lake, then the treasure is not in the kitchen.
b. If the tree in the front yard is an elm, then the treasure is in the kitchen.
c. This house is next to a lake.
d. The tree in the front yard is an elm or the treasure is buried under the flagpole.
e. If the tree in the back yard is an oak, then the treasure is in the garage.

Where is the treasure hidden? (10pts)

7. The famous detective Percule Hoirot was called in to solve a baffling murder mystery. He determined the following facts:

a. Lord Hazelton, the murdered man, was killed by a blow on the head with a brass candlestick.
b. Either Lady Hazelton or a maid, Sara, was in the dining room at the time of the murder.
c. If the cook was in the kitchen at the time of the murder, then the butler killed Lord Hazelton with a fatal dose of strychnine.
d. If Lady Hazelton was in the dining room at the time of the murder, then the chauffeur killed Lord Hazelton.
e. If the cook was not in the kitchen at the time of the murder, then Sara was not in the dining room when the murder was committed.
f. If Sara was in the dining room at the time the murder was committed, then the wine steward killed Lord Hazelton.

Is it possible for the detective to deduce the identity of the murderer from these facts? If so, who did murder Lord Hazelton? (Assume there was only one cause of death.) (10pts)

Some of the arguments in 8–13 are valid by universal modus ponens or universal modus tollens; others are invalid and exhibit the converse or the inverse error. State each line in the argument symbolically and state which arguments are valid and which are invalid. Justify your answers. (5pts each)

8. All healthy people eat an apple a day.
Keisha eats an apple a day.
∴ Keisha is a healthy person.

9. All freshmen must take writing.
Caroline is a freshman.
∴ Caroline must take writing.

10. All cheaters sit in the back row.
Monty sits in the back row.
∴ Monty is a cheater.

11. If compilation of a computer program produces error messages, then the program is not correct.
Compilation of this program does not produce error messages.
∴ This program is correct.

12. All honest people pay their taxes.
Darth is not honest.
∴ Darth does not pay his taxes.

13. If a number is even, then twice that number is even.
The number 2n is even, for a particular number n.
∴ The particular number n is even.