

1. Negate the following statements. Write the negation in two equivalent, but different ways.
 - a) I am a grey rational. (You may assume he is a dragon!)
 - I am not a grey rational.
 - I am not grey or I am not rational
 - I am red or I am a predator.
 - b) You can pay your tuition with either a check or a credit card.
 - You can not pay your tuition with either a check or a credit card.
 - You can not pay you tuition with a check and you can not pay with credit card.
 - c) I like chocolate chips and ice cream.
 - I do not like chocolate chips and ice cream.
 - I do not like chocolate chips or I do not like ice cream.
 - d) If you do your homework, then you will receive a better grade in class.
 - You do your homework and you do not receive a better grade in class.
 - You do your homework and you receive a lesser grade in class.
 - e) The faculty resolution passed unanimously.
 - The faculty resolution did not pass unanimously.
 - At least one member of the faculty did not vote for the resolution.
2. Answer the following dragon problem, similar to those on the in-class activity. Remember that rational dragons tell the truth and predator dragons lie. Recall there are only two colors of dragons red and grey.
 - a) A knight comes across a dragon and draws his sword. He quickly inquires, "What color and type of dragon are you?"
 - Dragon: 1) If I were a predator, then I would be lying.
 - 2) I am not red.State what color and type of Dragon the knight encountered.

Grey Rational
 - b) Write a proof of the answer you found in part a). Be sure to draw out all of the logical reasoning you used. Make sure your proof shows not only that your answer works, but that it is the **only** possible correct answer.
3. Recall the Prison Activity from class. Remember the third prisoner was able to determine his hat color and thus was set free, even though he was blind.

One possible solution and the method used to arrive at the solution for this problem.

I found the third inmate's hat to be red. First I drew a diagram with the possible hat combinations of the three inmates. Then I eliminated the possibilities from the information that I know from the problem.

Options	Inmate 1	Inmate 2	Inmate 3
1	Red	Red	Red
2	Red	White	White
3	White	Red	White
4	White	White	Red
5	Red	Red	White
6	Red	White	Red
7	White	Red	Red

Since the first inmate does not know what color his hat is that must mean that he either sees a red hat and a white hat or two red hats. Thus option 2 can't be the case because inmate 1 would have known his hat color. Since inmate 2

did not know his hat color then he must have also seen either one white hat or two reds. Thus option 3 could not be the case because inmate 2 would have known his hat color. Finally, inmate 2 knew that inmate 1 did not know his hat color so option 5 could not be the case. Since if inmate 1 did not know and inmate 2 could see that inmate 3's hat was white then he would have known that inmate 1 saw a white and a red hat and that his own hat was red. But inmate 2 also did not know his hat color, thus option 5 is not the case. The only remaining cases are when inmate 3's hat is red. Therefore inmate 3's hat is red.

- a) Prove the following statement:
The third inmate's hat is red.

(One possible proof—by contradiction)

Proof: Suppose the third inmate's hat is white. Then since the first inmate does not know his own hat color and he sees a white hat on the third inmate we know the second inmate had a red hat. Otherwise the first inmate would have seen two white hats and known his hat was red since there were only two white hats in the box.

But the second inmate can also see the white hat on the third inmate's head, and knowing that the first inmate can't tell what color his hat is. The second inmate would know that the first inmate saw a red hat and a white hat and thus he would be able to correctly guess the color of his own hat. This is a CONTRADICTION since the second inmate can not tell what color his hat is.

Thus the third inmate's hat must not be white. Therefore the third inmate's hat is red.