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~~155~~ Math 155: Logical Reasoning In-class Exercises

1. Are the following pairs of statements negations of each other?

(a) Pat drinks coffee. Y  
Pat does not drink coffee.

(b) Pat drinks coffee. N  
Pat drinks tea.

(c) The number of students in this class is even. Y  
The number of students in this class is odd.

*note: zero is an even number (0/2 has no remainder)*

(d) The balance in my Visa account is a positive number. N  
The balance in my Visa account is a negative number.

*real numbers are either positive or negative or zero*

(e) There are fewer than twenty students in this class. Y  
There are at least twenty students in this class.

*↙*  
 $x < 20$  *↘*  $x \geq 20$

(f) Everyone at the bar right now wants a beer. N  
No-one at the bar wants a beer.

*see class notes*

2. Which “or”, inclusive or exclusive, is meant in the following sentences?

(a) Wanted: Dead or Alive! *exclusive\**

(b) Would you like milk or sugar in your tea? *inclusive*

(c) I want to get an A or a B for my final mark in Pat’s math class. *exclusive*

3. Let  $p$  = “Pat drank tea” and  $q$  = “Pat drank coffee”. Translate the following into logical symbols.

(a) Pat drank tea or coffee.  $p \vee q$

(b) Pat drank tea or she didn't.  $p \vee \sim p$  } either  
 $p \oplus \sim p$  }

(c) Pat drank tea and not coffee.

$p \wedge \sim q$

(d) Pat drank tea but not coffee.  $p \wedge \sim q$  brackets are necessary!

(e) It's not true that Pat drank both tea and coffee.  $\sim (p \wedge q)$

4. Answer the questions, based on the given information, with Y (yes), N (no), or M (maybe).

(a) True: I drank tea and coffee today.  $\leftarrow$  "and" means both are true  
 Question: Did I drink tea today?  $\leftarrow$  "or" is at least one true?  
 Y

(b) True: I drank tea today.  
 Question: Did I drink tea or coffee today? Y (at least one)

Question: Did I drink tea and coffee today? M (need both, don't know second)

(c) True: I drank tea or coffee today.  $\rightarrow$  tea or ~~coffee~~ or ~~both~~  
 True: I did not drink coffee today.  $\uparrow$   
 Question: Did I drink tea today? Y

(d) True: I drank tea or coffee today.  $\rightarrow$  ~~tea~~ or coffee or both  
 True: I drank coffee today.  $\uparrow$  no tea  $\uparrow$  tea  
 Question: Did I drink tea? M

(e) True: I drank tea or coffee today but not both.  $\rightarrow$  ~~tea~~ or coffee or ~~both~~  
 True: I drank coffee today.  $\uparrow$   
 Question: Did I drink tea today? N