

Homework 1 :Basic Logic, Sets

➤ Basics of logic. Knights and knaves. NOT, AND, OR, IF.

1. **(new)** On the island of knights and knaves, you meet two inhabitants: Sally and Zippy. Sally claims “I and Zippy are both knights or both knaves”. Zippy says, “Sally and I are the same.” So, who is a knight and who is a knave?
2. **(same as in class notes)** On the island of Knights and Knaves, you meet three inhabitants: Bozo, Carl, and Joe. Bozo says that Carl is a knave. Carl tells you, ‘Of Joe and I, exactly one is a knight.’ Joe claims, ‘Bozo and I are different.’
3. **(none)**
4. **(new)** Evaluate:
(NOT P) AND (P OR Q)
Clarification: if the letters P and Q are confusing you, change the variable names to A and B .
5. **(same as in class notes)** Write the truth table for each of the following formulas. Are they equivalent (i.e., do they always give the same value)?
 - a. $(A \text{ OR } B) \text{ AND } (A \text{ OR } C)$
 - b. $A \text{ OR } (B \text{ AND } C)$.

6. (none)

➤ Sets. Notation. Union, intersection, complement. Cardinality.

7. **(same as in class notes, started in class)** Let us take the usual deck of cards. As you know, there are 4 suits, hearts, diamonds, spades, and clubs, 13 cards in each suit.
 - If we Denote:
 H =set of all hearts cards
 Q =set of all queens
 R =set of all red cards
 - Then, describe by formulas (such as $H \cap Q$) the following sets:
 - a) all red queens
 - b) all black cards
 - c) all cards that are either hearts or a queen
 - d) all cards other than red queens
 - How many cards are there in each set?
8. **(same as in class notes)** Let: A =set of all people who know French
 B =set of all people who know German
 C =set of all people who know Russian
 - Describe in words the following sets:
 (a) $A \cap B$ (b) $A \cup (B \cap C)$ (c) $(A \cap B) \cup (A \cap C)$ (d) $C \cap \bar{A}$.
9. **(same as in class notes)** In a class of 25 students, 10 students know French, 5 students know Russian, and 12 know neither. How many students know both Russian and French?
Hint: use a Venn diagram.

➤ **Coordinates. Equation of the line. (Try your best and do not worry if you really do not know what to do. We will discuss these problems next week)**

19 Draw the graphs of the following functions (on a quadrille paper):

a. $2x + 3y = 1$

b. $2x - 1 = y$

c. $y = |x| - 2$

Hints: first, solve for y so that you have $y = \text{function}(x)$. Then, if you do not know any shortcuts, make a table with x and y column, pick five values for x , use them to calculate the corresponding value for y by plugging in the equation. The x - values are your choice; for example, -3,-1, 0,1,3. Draw the (x,y) pairs on a x - y coordinate system, then draw the line(s)/curve(s) through the points