

MATH 6
HOMEWORK 7: LOGIC AND SETS REVIEW

1. You meet two inhabitants: Alice and Zed. Alice tells you, 'At least one of the following is true: that Zed is a knave or that I am a knight.' Zed says, 'It's not the case that Alice is a knave.' Can you determine who is a knight and who is a knave? Try to use truth table to solve it.
2. Write truth table for this formula:
 $\text{not}P \cap (Q \cup \text{not}R)$
3. Using Venn diagrams, explain why $\overline{A \cap B} = \overline{A} \cup \overline{B}$.
(b) Do the same for formula $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
4. If $A = \{1, 3, 5\}$, $B = \{3, 5, 6\}$ and $C = \{1, 3, 7\}$
 - (a) Verify that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
 - (b) Verify $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
5. In a survey of university students, 64 had taken mathematics course, 94 had taken chemistry course, 58 had taken physics course, 28 had taken mathematics and physics, 26 had taken mathematics and chemistry, 22 had taken chemistry and physics course, and 14 had taken all the three courses. Find how many had taken one course only?
6. You probably know Lewis Carroll as the author of Alice in Wonderland and other books. What you might not know is that he was also a mathematician very much interested in logic, and had invented a number of logic puzzles. Here is one of them: You are given 3 statements.
 - (a) All babies are illogical.
 - (b) Nobody is despised who can manage a crocodile.
 - (c) Illogical persons are despised.Can you guess what would be the natural conclusion from these 3 statements?
7. A barber in a small town decides that he will shave all men who do not shave themselves (and only them). Should he shave himself?