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- (1) An inhabitant, Carl, of the island Knights and Knaves tells you “If Sue is a knave, then this road leads to the capital.” However, later you learn that Carl is a knave. What does it tell you?
- (2) Many trucks carry the message: “If you do not see my mirrors, then I do not see you”. Can you rewrite it in an equivalent form without using the word “not”?
- (3) On the island of Knights and Knaves, a traveler meets two inhabitants: Carl and Bill. Bill says: “Carl is a Knave”. Carl says: “If Bill is a Knight, then I am a Knight, too.”
Can you determine whether each of them is a Knight or a Knave?
- (4) Alice says “I say what I mean”. Is it the same as her saying “I mean what I say”?
- (5) On the island next to the island of knights and knaves there are 3 kinds of people:
knights, who always tell the truth
knaves, who always lie
normal people, who sometimes lie and sometimes tell the truth
On that island, you meet 3 people, A, B, and C, one of whom is a knight, one a knave, and one normal (but not necessarily in that order). They make the following statements:
A: I am normal
B: That is true
C: I am not normal
What are A, B, and C?
- (6) Check whether $A \implies B$ and $B \implies A$ are equivalent, by writing the truth table for each of them.

- (7) Check that $A \implies B$ is equivalent to $(\text{NOT } A) \text{ OR } B$ (thus, “if you do not clean up your room, you will be punished” and “clean up your room, or you will be punished” are the same).
- (8) A teacher tell the student “If you do not take the final exam, you get an F”. Does it mean that
- If the student does take the final exam, he will not get an F
 - If the student does not get an F, it means he must have taken the final exam.
- (9) Write the truth table for the following. Are they equivalent (i.e., do they always give the same value)?
- $(A \text{ OR } B) \text{ AND } (A \text{ OR } C)$
 - $A \text{ OR } (B \text{ AND } C)$.
- (10) Define a new logical operation, XOR (exclusive or) as follows: $A \text{ XOR } B$ is true if exactly one of A, B is true, and false otherwise.
- Write the truth table for $A \text{ XOR } B$.
 - Can you express XOR using only AND, OR, and NOT (that is, write a formula equivalent to $A \text{ XOR } B$ using only AND, OR, and NOT)?
- (11) (a) Write truth tables for formulas $A \text{ AND } (B \text{ OR } C)$ and $(A \text{ AND } B) \text{ OR } C$ (hint: there will be 8 rows in the table). Are these formulas equivalent (i.e., do they always give the same answer)?
- (b) The waiter in a restaurant tells you: “our fixed price dinner includes soup and appetizer or salad.”
Denoting
 A = your dinner will include soup
 B = your dinner will include appetizer
 C = your dinner will include salad
 what would be the correct way to write his statement using letters A, B, C and operations AND, OR?
- (12) 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.
- All babies are illogical.
 - Nobody is despised who can manage a crocodile.
 - Illogical persons are despised.
- Can you guess what would be the natural conclusion from these 3 statements?