ASHESI

Discrete Structures and Theory (Spring 2023)

Discussion 2

Date: 27/01/2023

Exercise 1:

Translate the following statement into propositional logic using the propositions provided:

"You cannot edit a protected Wikipedia entry unless you are an administrator."

Express your answer in terms of *e: "You can edit a protected Wikipedia entry"* and *a: "You are an administrator."*

Exercise 2:

Translate the following statement into propositional logic using the propositions provided:

"You can see the movie only if you are over 18 years old or you have the permission of a parent." Express your answer in terms of *m: "You can see the movie", e: "You are over 18 years old",* and *p: "You have the permission of a parent."*

Exercise 3:

State the converse, contrapositive, and inverse of each of these conditional statements.

a) If it snows today, I will ski tomorrow.

b) I come to class whenever there is going to be a quiz.

c) A positive integer is a prime only if it has no divisors other than 1 and itself.

Exercise 4:

Construct a truth table for each of these compound propositions.

a) $p \oplus \neg p$ b) $\neg p \leftrightarrow q$

c) $\neg p \rightarrow (q \rightarrow r)$ d) $(p \rightarrow q) \vee (\neg p \rightarrow r)$

Exercise 5:

The following exercises relate to inhabitants of the island of knights and knaves created by Smullyan, where knights always tell the truth and knaves always lie. You encounter two people, A and B. Determine, if possible, what A and B are if they address you in the ways described. If you cannot determine what these two people are, can you draw any conclusions?

a. A says "At least one of us is a knave" and B says nothing.
b. A says "The two of us are both knights" and B says "A is a knave."

Exercise 6:

Use truth tables to verify these equivalences:

a. $p \wedge \boldsymbol{T} \equiv p$
b. $p \wedge \boldsymbol{F} \equiv \boldsymbol{F}$

Exercise 7:

Use De Morgan's laws to find the negation of each of the following statements.

a. Kwame will take a job in industry or go to graduate school.
b. Yoshiko knows Java and calculus.
c. James is young and strong.
d. Rita will move to Oregon or Washington.

Exercise 8:

Show that the statement $[\mathrm{p} \wedge (\mathrm{p} \rightarrow \mathrm{q})] \rightarrow \mathrm{q}$ is a tautology using

a. A truth table.
b. Logical equivalences