CENG 115 – Discrete Structures
Homework 1

October 13, 2022

Due Date: October 25, 2022

Exercise 1 Propositional Logic

Let the statement $p(N)$ be "My exam grade average is greater than or equal to N" and $q(G)$ be "My course grade is G", where N is a number between 0 and 100, G is a letter grade in the set $\{\texttt{AA}, \texttt{BA}, \texttt{BB}, \texttt{CB}, \texttt{CC}, \texttt{DC}, \texttt{DD}, \texttt{FD}, \texttt{FF}\}$.

The rules of grade assignment is given in the following table:

Grade	Condition
AA	$90 \leq N \leq 100$
BA	$85 \leq N < 90$
BB	$80 \leq N < 85$
CB	$75 \leq N < 80$
CC	$70 \leq N < 75$
DC	$65 \leq N < 70$
DD	$60 \leq N < 65$
FD	$55 \leq N < 60$
FF	$0 \leq N < 55$

a. Write the logical equivalent of the statement "My exam grade average is less than 95.".

b. Write the logical equivalent of the statement "My exam grade average is larger than or equal to 78, but smaller than 96".

c. Write the logical equivalent of the statement "If my exam grade is in the range $[70, 75)$ then my course grade will be CC."

d. Write a single compound logical statement that summarises all of the rules of grade assignment.

Exercise 2 Truth Tables

Construct the truth tables for the following propositions:

a. $(\neg p \vee q) \wedge (p \vee \neg q)$

b. $(\neg p \oplus q) \vee (p \oplus \neg q)$

c. $\neg(\neg p \rightarrow q) \oplus (p \rightarrow \neg q)$

Exercise 3 Propositional Equivalences

a. (Ex. 1.2-22) Show that $(p \rightarrow q) \wedge (p \rightarrow r)$ and $p \rightarrow (q \wedge r)$ are logically equivalent.

b. (Ex. 1.2-25) Show that $(p \rightarrow r) \vee (q \rightarrow r)$ and $(p \wedge q) \rightarrow r$ are logically equivalent.

c. (Ex. 1.2-30) Show that $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ is a tautology.