CS 3653 – Discrete Mathematics for Computer Science

Assignment # 1	Due – Jan 17, 2022, 11:59pm (CST)
Chapter # 1.1 - 1.3	Max. Points # 25

SN	QUESTION	Pts
1	What is the negation of each of these propositions? a) Jennifer and Teja are friends. b) There are 13 items in a baker's dozen. c) Abby sent more than 100 text messages yesterday. d) 121 is a perfect square.	4 X 0.5
2	Let p and q be the propositions "The election is decided" and "The votes have been counted," respectively. Express each of these compound propositions as an English sentence. a) ¬p　　　　　　　　b) p ∨ q c) ¬p ∧ q　　　　　　d) q → p e) ¬q → ¬p　　　　　f) ¬p → ¬q g) p ↔ q　　　　　　h) ¬q ∨ (¬p ∧ q)	8 X 0.5
3	Let p, q, and r be the propositions p: You get an A on the final exam. q: You do every exercise in this book. r: You get an A in this class. Write these propositions using p, q, and r and logical connectives (including negations). a) You get an A in this class, but you do not do every exercise in this book. b) You get an A on the final, you do every exercise in this book, and you get an A in this class. c) To get an A in this class, it is necessary for you to get an A on the final. d) You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class. e) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class. f) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.	6 X 0.5

4	State the converse, contrapositive, and inverse of each of these conditional statements. a) If it snows tonight, then I will stay at home. b) I go to the beach whenever it is a sunny summer day. c) When I stay up late, it is necessary that I sleep until noon.	3 X 1

5	Construct a truth table for each of these compound propositions. a) $p \rightarrow \neg p$ b) $p \leftrightarrow \neg p$ c) $p \oplus (p \vee q)$ d) $(p \wedge q) \rightarrow (p \vee q)$ e) $(q \rightarrow \neg p) \leftrightarrow (p \leftrightarrow q)$ f) $(p \leftrightarrow q) \oplus (p \leftrightarrow \neg q)$	6 X 0.5

6	Evaluate each of these expressions. a) 1 1000 $\wedge$ (0 1011 $\vee$ 1 1011) b) (0 1111 $\wedge$ 1 0101) $\vee$ 0 1000 c) (0 1010 $\oplus$ 1 1011) $\oplus$ 0 1000 d) (1 1011 $\vee$ 0 1010) $\wedge$ (1 0001 $\vee$ 1 1011)	4 X 0.5

7	Following exercise relates 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 way described below: A says "The two of us are both knights" and B says "A is a knave." If you cannot determine what these two people are, can you draw any conclusions?	2

8	Find the output of each of these combinatorial circuits. 	2 X 1

9	Construct a combinatorial circuit using inverters, OR gates, and AND gates that produces the output $((\neg p \vee \neg r) \wedge \neg q) \vee (\neg p \wedge (q \vee r))$ from input bits p, q, and r.	1

10	Show that each of these conditional statements is a tautology by using truth tables. a) $(p \land q) \to p$ b) $p \to (p \lor q)$ c) $\neg p \to (p \to q)$ d) $(p \land q) \to (p \to q)$ e) $\neg (p \to q) \to p$ f) $\neg (p \to q) \to \neg q$	6 X 0.5