Homework 1
CS 311: Discrete Math for CS (Bulko)
Due 02/02/18 - Friday @ 11:59 pm

Problem 1

(4 points each). Identify whether the following statements are propositions or not. Determine the truth value of the propositions.

a. Addis Ababa is the capital of Ethiopia.
b. What day is it today?
c. Read between the lines and answer the following questions.
d. 2 + 2 = 5
e. x + 1 = 2

Problem 2

(3 points each). Construct a truth table for the following logical statements:

a. ¬(p ⊕ q) → (q ∨ p) ∧ q
b. ((p ∧ ¬q) → (r ∨ p))

Problem 3

(6 points each). What is the contrapositive, converse and the inverse of the following statements?

a. If a quadrilateral is a rectangle, then it has two pairs of parallel sides.
b. A positive integer is prime only if it has no divisors other than 1 and itself.
c. If a student is in CS 311, then the student is learning discrete math.
Problem 4

(5 points each). Let a be the proposition "I will go skiing", b be the proposition "It is snowing", and c be the proposition "I have work."

Write the following sentences in propositional logic using the propositions above:

a) I will go skiing provided it is snowing and I dont have work.
b) I will go skiing unless I have work.
c) I will go skiing if and only if I have work.

Problem 5

(8 points each). Show that the following statements are logically equivalent.

a. \((p \rightarrow q) \lor (p \rightarrow r)\) and \(p \rightarrow (q \lor r)\)
b. \(\neg((p \lor q) \rightarrow \neg q)\) and \(q\)

Problem 6

(5 points each). Evaluate the following bit string expressions.

a) \(0011 \lor (1111 \land 0101)\)
b) \(110010 \land (111000 \oplus 010110)\)

Problem 7

(5 points each). Determine whether each of the following formulas is a tautology, contingency, or contradiction. Show how you arrived at each answer.

a) \((p \rightarrow q) \lor (q \rightarrow p)\)
b) \(\neg((\neg(p \land q) \rightarrow (p \rightarrow \neg q)))\)
c) \((\neg p \lor q) \rightarrow q\)