CS1382 Discrete Computational Structures
Spring 2019 Homework II
10 points

(Due Date: Fri March 22, 2019 at 11:59pm)

1. Describe (write) an algorithm that takes a list of n integers $a_1, a_2, \ldots, a_n$ and finds the number of integers each greater than five in the list. Find the "best" big-O notation to describe the complexity of the algorithm.

2. Describe (write) an algorithm that takes a list of n integers (n >= 1) and finds the average of the largest and smallest integers in the list. Find the "best" big-O notation to describe the complexity of the algorithm.

3. Prove or disprove that the greedy algorithm for making change always uses the fewest coins possible when the denominations available are 1-cent coins, 8-cent coins, and 20-cent coins.

4. Write the truth table for the proposition $\neg (r \rightarrow \neg q) \vee (p \wedge \neg r)$.

5. Determine whether $p \rightarrow (q \rightarrow r)$ and $p \rightarrow (q \wedge r)$ are equivalent .

6. Determine whether this proposition is a tautology: $((p \rightarrow q) \wedge \neg p) \rightarrow \neg q$.

7. Write the contrapositive, converse and the inverse of the following:
    If you try hard, then you will win.

8. On the island of knights and knaves you encounter two people A and B. Knights always tell the truth and their opposites, knaves always lie. Person A says "B is a knave" and Person B says "We are both knights". Determine whether each person is a knight or a knave.

9. Determine whether the following compound proposition is satisfiable:
    $(\neg p \vee \neg q) \wedge (p \rightarrow q)$

10. Suppose the variable x represents students and y represents courses and:
    F(x): x is a freshman   *A(x): x is a part-time student*   *T(x,y): x is taking y*
    Write the statement in good English without using variables in your answers.
    a. F(Mikko)
    b. $\neg \exists y\, T (Joe, y)$
    c. $\exists x (A(x) \wedge \neg F(x))$

11. Show that the premises "Everyone who read the textbook passed the exam", and "Ed read the textbook" imply the conclusion "Ed passed the exam".

12. Determine whether the following argument is valid:

$p \rightarrow r$

$q \rightarrow r$

$\underline{q \vee \neg r}$

$\therefore \neg p$