CMSC 2123 Discrete Structures
Assignment 1

Due: See the due date on D2L.

Problems

1. Construct the truth table for compound proposition $(q \rightarrow \neg p) \vee (\neg p \leftrightarrow \neg q)$.

2. Express these system specifications using the propositions p "The user enters a valid password," q "Access is granted," and r "The user has paid the subscription fee" and logical connectives (including negations). Please note some propositions below may be false.

(1) The user has paid the subscription fee but does not enter a valid password.

(2) Access is granted whenever the user has paid the subscription fee and enters a valid password.

(3) Access won't be denied unless the user has not paid the subscription fee.

(4) It's necessary to enter a valid password to have the access grated.

3. Determine whether $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ is a contingency, a tautology, or a contradiction?

4. $P(x, y)$ means "$x + 2y = xy$", where x and y are integers. Determine the truth value of:

(1) $\exists y P(3, y)$ (2) $\exists x \forall y P(x, y)$ (3) $\forall y \exists x P(x, y)$ (4) $\neg \forall x \exists y \neg P(x, y)$

5. Prove that if n is an integer, then n is even if and only if $7n + 4$ is even.

6. Identify the error(s) in the argument that if $\forall x(P(x) \vee Q(x))$ is true then $\forall x(P(x) \vee Q(x))$ is true.

Steps	Argument	Explanation
1	$\forall x(P(x) \vee Q(x))$	Premise
2	$P(c) \vee Q(c)$	Universal instantiation from (1)
3	$P(c)$	Simplification from (2)
4	$\forall x P(x)$	Universal generalization from (3)
5	$Q(c)$	Simplification from (2
6	$\forall x Q(x)$	Universal generalization from (5)
7	$\forall x(P(x) \vee \forall x Q(x))$	Conjunction from (4) and (6)

Submission

1. Please put your name and email address in the header of the document.

2. Submit your assignment on D2L by the due date, in pdf or doc(x) format or as web content directly on D2L.

Grading

For each question, the total points are 5: 5 for complete answer, 4 for almost correct, 3 for partially wrong, 2 for almost wrong, 0 for no submission. No 1 point. If you give a perfect solution, you can get 6 points -- 1 extra point as the bonus.