# Quiz 1
# EECS 203
# Spring 2015

**Name (Print):** _____

**uniqname (Print):** _____

**Instructions.** You have 20 minutes to complete this quiz. You may not use any sources of information, including electronic devices, textbooks, or notes. Leave at least one seat between yourself and other students. Please write clearly. If we cannot read your writing, it will not be graded.

**Honor Code.** This course operates under the rules of the College of Engineering Honor Code. Your signature endorses the pledge below. After you finish your exam, please sign on the line below:

*I have neither given nor received aid on this examination, nor have I concealed any violations of the Honor Code.*

_____

YOUR SCORE

| Page | Points | Score |
|---|---|---|
| 1 | 18 | |
| 2 | 12 | |
| **Total** | **30** | |

**Problem I.** **(6, -2 per incorrect circle/non-circle, min 0 points)** We define the following predicates:

- $C(x)$: $x$ is a car
- $F(x)$: $x$ goes fast
- $S(x)$: $x$ is a sports car
- $R(x)$: $x$ is a race car

Consider the statement "Every car that goes fast is either a sports car or a race car." Zero or more of the expressions below are accurate translations of this statement. Circle each of the following that are correct.

(A) $\forall x C(x) \wedge F(x) \wedge (R(x) \vee S(x))$

(B) $\forall x((C(x) \wedge F(x)) \rightarrow R(x)) \vee ((C(x) \wedge F(x)) \rightarrow S(x))$

(C) $\forall x C(x) \rightarrow F(x) \wedge (R(x) \vee S(x))$

(D) $\forall x(C(x) \wedge F(x)) \rightarrow (S(x) \vee R(x))$

**Problem II.** **(6, -2 per incorrect circle/non-circle, min 0 points)** Zero or more of the following compound propositions are satisfiable, but which?

(A) $p \oplus q$

(B) $p \wedge (p \rightarrow \neg q) \wedge q$

(C) $(p \rightarrow q) \wedge (q \rightarrow \neg p)$

(D) $(\neg q \rightarrow p) \leftrightarrow (q \wedge (p \leftrightarrow q))$

**Problem III.** **(6, -2 per incorrect circle/non-circle, min 0 points)** We define the following propositions.

- $d$ : I will drive to work
- $g$ : Gas is cheap

Consider the sentence "I will not drive to work unless gas is cheap." Zero or more of the following statements correctly describe the sentence. Circle each statement that correctly describes the sentence.

(A) $\neg d \rightarrow \neg g$

(B) $g \rightarrow d$

(C) $d \rightarrow g$

(D) $d \vee \neg g$

## Problem IV. (4 points)

Let $P(x, y)$ be an arbitrary predicate with the domain of discourse being the integers. Consider the following two claims:

**Claim 1**: From $\forall x \exists y P(x, y)$ we can conclude that $\exists y \forall x P(x, y)$.

**Claim 2**: From $\exists y \forall x P(x, y)$ we can conclude that $\forall x \exists y P(x, y)$.

Exactly one of the following is correct. Circle the correct answer.

(A) only **Claim 1** is true

(B) only **Claim 2** is true

(C) both **Claim 1** and **Claim 2** are true

(D) neither is true

## Problem V. (8 points)

Prove or disprove the following using any method: $((\neg p \wedge a) \rightarrow q) \equiv (\neg q \rightarrow p \vee \neg a)$.

| | |
|---|---|
| $((\neg p \wedge a) \rightarrow q)$ | Premise |
| $(\neg q \rightarrow \neg(\neg p \wedge a))$ | Contrapositive |
| $(\neg q \rightarrow (p \vee \neg a))$ | DeMorgan's Law |

A truth table was also an acceptable answer, as were answers that simply eliminated the implication arrows. This was the shortest proof.