SAMPLE Exam 1
EECS 203, Fall 2023

Name (ALL CAPS): _____

Uniqname (ALL CAPS): _____

8-Digit UMID: _____

Instructions

- When you receive this packet, fill in your name, Uniqname, and UMID above.
- Once the exam begins, make sure you have problems 1-7 in this booklet.
- Write your UMID in the blank at the top of every other page.
- No one may leave within the last 10 minutes of the exam.
- After you complete the exam, sign the Honor Code below. If you finish when time is called, your proctor will give you time to sign the Honor Code.
- Do not detach the scratch paper at the end of the packet.
- Do not discuss the exam until solutions have been released!

Materials

- No electronics allowed, including calculators.
- You may use one 8.5″ by 11″ note sheet, front and back, created by you.
- You may not use any other sources of information.

Honor Code

This exam is administered under the College of Engineering Honor Code. Your signature endorses the pledge below. We will not grade your exam without your signature.

I have neither given nor received unauthorized aid on this examination, nor have I concealed any violations of the Honor Code. I further agree not to discuss any aspect of this examination in any way, shape, or form until the solutions have been published.

Signature: _____

Part A: Single Answer Multiple Choice

Instructions

- There are 2 questions in this section.
- Shade the bubble you believe to be correct.
- There is only one correct answer option for each question in this section. If you shade more than one bubble, your answer will be marked as incorrect.

Problem 1. (4 points)

ⓐ ⓑ ⓒ ⓓ ⓔ

How many rows does the truth table for $(p \vee q) \wedge (r \rightarrow (\neg r \wedge q))$ have?

(a) 4

(b) 5

(c) 8

(d) 16

(e) 32

Problem 2. (4 points)

ⓐ ⓑ ⓒ ⓓ ⓔ

Which of the following is the correct assumption to start a proof by **contradiction** for the statement:

"If n^2 is even, n is also even."

"Seeking a contradiction, assume ..."

(a) n^2 is odd and n is even.

(b) n^2 is even and n is odd.

(c) if n is odd, then n^2 is odd.

(d) if n^2 is even, then n is odd.

(e) if n^2 is even, then n is even.

UMID: _____

Part B: Multiple Answer Multiple Choice

Instructions

- There are 2 questions in this section.
- Shade whichever boxes you believe are correct. **This could be all answers, no answers, or anything in between.**
- If there are no correct answers, leave all the boxes blank.

Problem 3. (4 points)

a b c d e

Let the domain of x and y be the **non-zero integers**. Which of the following are true?

(a) $\exists x \exists y \left[x^2 + y^2 = 3\right]$

(b) $\forall x \exists y \left[(y < 0) \rightarrow (y < x^2)\right]$

(c) $\forall x \forall y \left[(y < 0) \rightarrow (y < x^2)\right]$

(d) $\forall y \exists x \left[\frac{x}{y} = 1\right]$

(e) $\exists x \forall y \left[\frac{x}{y} = 1\right]$

Problem 4. (4 points)

a b c d e

Which of the following statements are equivalent to the **negation** of the proposition below?

$$\exists x \forall y \left[P(x, y) \rightarrow (x \neq y)\right]$$

(a) $\forall x \exists y \left[P(x, y) \wedge (x = y)\right]$

(b) $\forall x \exists y \left[\neg P(x, y) \rightarrow (x = y)\right]$

(c) $\forall x \neg \forall y \left[P(x, y) \rightarrow (x \neq y)\right]$

(d) $\exists x \forall y \left[P(x, y) \wedge (x = y)\right]$

(e) $\exists x \forall y \left[\neg P(x, y) \wedge (x \neq y)\right]$

Part C: Short Answer

Instructions

- There are 1 questions in this section
- Write your solution in the space provided below the question
- Don't simplify your answers
- Show your work and include justification

Problem 5: Quantifier Prove or Disprove (6 points)

Prove or disprove the following statement:

$$\forall x \exists y \, [y > x]$$

Note: The domain for x and y is **integers.**

Final Answer:
Bubble prove or disprove, then continue your work below. **Show your work**.

◯ Prove ◯ Disprove

Part D: Free Response

Instructions

- There are 2 questions in this section
- Write your solution in the space provided
- Write down your answer with care: **answers that are unreadable (such as too faint or too messy) will not be graded**
- If you have multiple answers, you must indicate which one you want graded. Otherwise, we will grade your least favorable answer.
- Show your work and include justification

Problem 6: Rational and Irrational Proof (9 points)

Prove or disprove each of the following statements.
Note: If you use a specific irrational number in your proof/disproof, you do **not** need to prove that it is irrational. You can simply state that it is.

(a) Prove or disprove: For all rational numbers x and irrational numbers y, their sum $x+y$ is irrational.

(b) Prove or disprove: For all irrational numbers x and y, their difference $x-y$ is irrational.

Problem 7: Truth Table (8 points)

p	q	r	s	t	w
T	T	T	T	T	F
T	T	F	T	F	F
T	F	T	T	T	F
T	F	F	T	F	F
F	T	T	T	T	F
F	T	F	F	T	T
F	F	T	T	T	T
F	F	F	T	T	T

Use the truth table for the compound propositions s, t, and w given above to answer the following questions.

(a) Is $(s \wedge w) \vee t$ a tautology? Briefly explain your answer.

(b) For each unknown proposition, s, t, and w:

- Find an expression for the proposition as a compound proposition using p, q, and/or r.
- You may use **only** $\wedge$, $\vee$, $\neg$, and parentheses in each expression.
- You may use p, q, and r **at most once** in each expression.

This is a space for scratch work. DO NOT DETACH THIS PAPER FROM YOUR EXAM.