

CS1800

Fall 2025

Recitation 2 - Practice Questions for Homework 1

September 17 & 18, 2025

Recitations

CS1802 Recitations are dedicated time set aside to work on practice problems that specifically prepare you for the current homework or upcoming quiz.

Recitations are in-person and attendance is expected.

The solutions are published at the same time as the problems, so you can check your work. There is no need to submit anything.

Approaching the Problems

These practice problems are labelled according to which Homework or Quiz topic they will help you prepare for. You do not need to complete every practice question; we encourage you to do at least one per topic, and to prioritize the topics you would like to practice.

Instructors & Teaching Assistants

Your recitation is led by a Khoury College professor, assisted by a knowledgeable and wonderful Teaching Assistant. Professors and TAs are fantastic resources, and you have the opportunity in recitation to work with them in a smaller group -- I strongly recommend you take advantage of the time to review your solutions to these practice problems, ask for help on the homework, or review material from lecture.

Practice Problems for Logical Equivalence (HW1, Question 1)

For each pair of logical expressions below, determine whether they are logically equivalent.

- If yes... Apply the laws of logical equivalence to prove that they are the same. Take one step at a time and label each step with one law.
- If no... give values for p and q that would yield a counterexample. Simplify both expressions to demonstrate that they are not the same.

For full credit, both *yes* and *no* answers should be clear, precise, and walk through your solution one small step at a time.

Part A $\neg(p \wedge (q \vee \neg p))$
 $\neg p \vee \neg q$

Are the two expressions logically equivalent? _____

Demonstrate equivalence with a proof, or inequivalence with a thorough counterexample.

Part B $p \vee \neg(p \vee q)$
 $p \vee \neg q$

Are the two expressions logically equivalent? _____

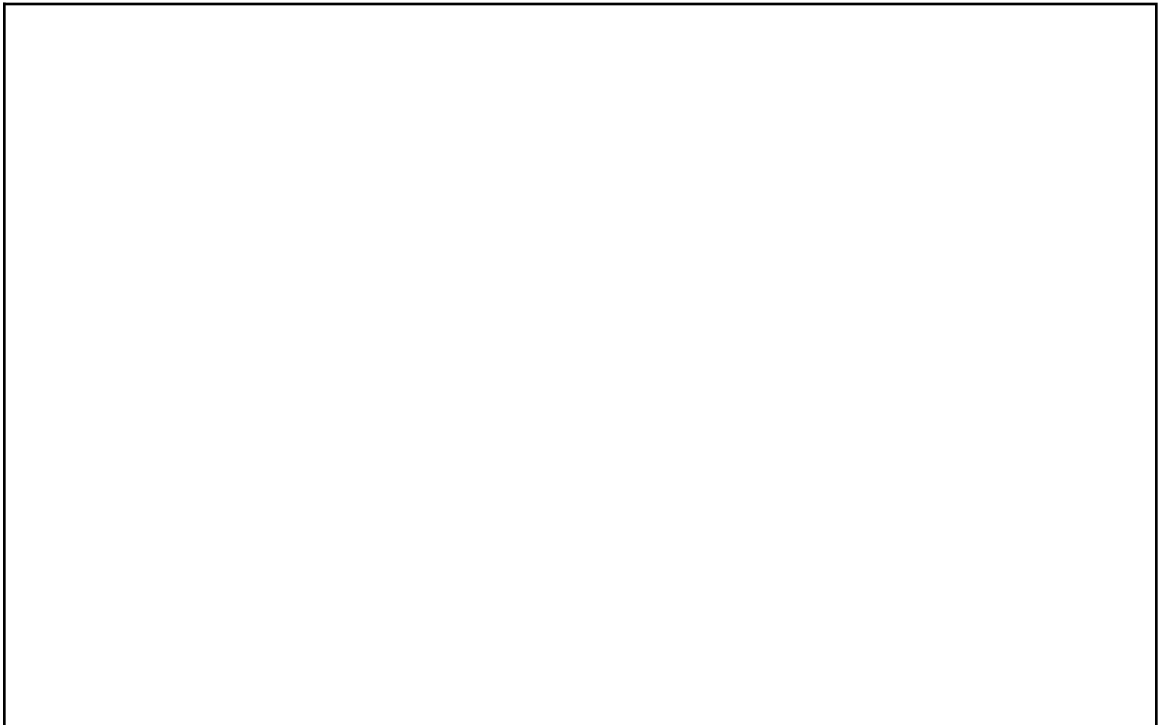
Demonstrate equivalence with a proof, or inequivalence with a thorough counterexample.

Part C $(p \wedge q) \vee (p \wedge \neg q)$
 q

Are the two expressions logically equivalent? _____

If yes, prove using the laws of logical equivalence.

If no, give values for p and q that would yield a counterexample and simplify both expressions.



Practice Problems for English & Logic (HW1, Question 2)

Consider the statements S , R , and U , below, about Laney's dogs, Grizz and Carol.

S = Carol takes Grizz's ball

R = Carol barks at Grizz

U = Grizz is annoyed.

- A** Translate into logical statements, using only the symbols \neg , \wedge , \vee , and/or \Rightarrow :
Carol takes Grizz's ball, or she barks at him, but never both.

- B** Translate into logical statements, using only the symbols \neg , \wedge , \vee , and/or \Rightarrow :
Grizz is annoyed but Carol isn't barking at him.

Evaluate each of the statements below as either True or False.

- C** $(26 \geq 26) \wedge (26 > 27)$

- D** $(26 \geq 26) \vee (26 > 27)$

- E** $\neg(19 = 3 + 3 + 13) \wedge (5 \times 2 = 15)$

Practice Problems for Truth Tables (HW1, Question 3)

The number of rows in a truth table must be 2^n , where n is the number of simple statements involved. Each column should add one simple step to a previous column(s). That's how we make the logical equivalence convincing -- by making it easy to show the reader how we get from one compound statement to the next.

- A** Let P = Biff sleeps in, and Q = it is Saturday. Write out a truth table for $Q \Rightarrow P$. How would express $Q \Rightarrow P$ in English?

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- B** Use a truth table to show that an implication and its contrapositive are equivalent, i.e.:
- $$p \Rightarrow q \equiv \neg q \Rightarrow \neg p$$

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- C** Let P = the crowd at Barclay’s does the wave, and Q = Ellie the Elephant dances. Write out a truth table for “The crowd at Barclays does the wave **if and only if** Ellie the Elephant dances”

Don’t worry about the logic symbols here, we just want to identify truth values that respect the original statement. For each row, briefly explain your answer.

P	Q	P if and only if Q	Explanation
T	T		
T	F		
F	T		
F	F		

- D** Let P = the Red Sox will win the world series this year, and Q = the Red Sox make another stupid trade. Write out a truth table for “The Red Sox will win the world series this year **unless** they make another stupid trade.”

Don’t worry about the logic symbols here, we just want to identify truth values that respect the original statement. For each row, briefly explain your answer.

P	Q	P unless Q	Explanation
T	T		
T	F		
F	T		
F	F		

Practice Problems for Predicates (HW1, Question 4)

- A** Negate the predicate $\exists x(x^2 = 2)$, fully distributing the negation such that there is no \neg at all in your final expression.

- B** Name a domain for which your negated statement in Part A is True, and one domain for which it is False.

- C** Let our domain be the real numbers. Express the statement “Every real number except zero has a multiplicative inverse” in predicate logic.

- D** Let our domain be all students in CS1800 this semester. Let $F(x, y)$ be the statement “ x and y are friends.” Translate this predicate into natural English:

$$\exists x \forall y \forall z (F(x, y) \wedge F(x, z) \wedge y \neq z) \Rightarrow \neg F(y, z)$$

- E** Let our domain be the integers. Translate this predicate into natural English:

$$\exists x \forall y (x \cdot y = 0)$$

F Negate the logic statement from part E, fully distributing the negation. Express the final result in logic and English.

G Let our domain be the real numbers. Translate this predicate into natural English:

$$\forall x \forall y ((x \geq 0 \wedge y < 0) \Rightarrow (x - y > 0))$$

H Negate the logic statement from part G, fully distributing the negation. Express the final result in logic and English.

Practice Problems for Implications and Proofs (HW1, Question 5)

A Suppose you know for sure that *If I study, then I will ace the first CS1800 quiz*. Which of the following must also be true?

- (A) - If I don't study, I will not ace the first CS1800 quiz.
- (B) - If I ace the first cs1800 quiz, then I studied.
- (C) - I don't ace the cs1800 quiz, then I didn't study.

B Let our domain be the positive integers. Prove the following statement by contrapositive: If $3n + 2$ is odd, then n is odd.

Begin by clearly stating what the contrapositive is. You can also use the definition that an odd number $n = 2k + 1$ for some integer k , and/or an even number $n = 2k$ for some integer k .

C Let our domain be the positive integers. Prove the following statement by contrapositive: If n^2 is odd, then n is odd.

Begin by clearly stating what the contrapositive is. You can also use the definition that an odd number $n = 2k + 1$ for some integer k , and/or an even number $n = 2k$ for some integer k .