

CS 182 Topics - Homework 6

CS 193

Refer to the **README.md** file and lecture slides for guidance on **182 topics** and **LaTeX syntax**.

1 Propositions

2 points

Indicate which of the following statements are propositions. In your answer, list the letters of the options that are propositions.

- a) Purdue has the oldest computer science department in the United States.
- b) 10 percent of the population is left handed.
- c) What's for lunch?
- d) $(x + y) < (z + r)$

Answer: a, b, d

2 Logical Equivalences

6 points

Show that $\neg(p \rightarrow q) \equiv p \wedge \neg q$ using a truth table. Replace the dashes inside the following table with “T” or “F” to denote True and False.

(Hint: The values for the $\neg(p \rightarrow q)$ and $p \wedge \neg q$ columns should be equal.)

p	q	$\neg q$	$p \rightarrow q$	$\neg(p \rightarrow q)$	$p \wedge \neg q$
T	T	F	T	F	F
T	F	T	F	T	T
F	T	F	T	F	F
F	F	T	T	F	F

3 Conditionals

6 points

Which of the following statements will always evaluate to **False**, regardless of if p, q, and r are set to True or False? **Select all that apply.**

- a) $P \wedge \neg P$
- b) $(P \vee Q) \wedge (\neg P \wedge \neg Q)$
- c) $(P \rightarrow Q) \wedge (Q \rightarrow R)$
- d) $P \vee \neg P$
- e) $(P \wedge Q) \vee (P \wedge \neg Q)$
- f) $(P \rightarrow Q) \vee (P \wedge \neg Q)$

Answer: a, b

4 Predicates and Quantifiers

6 points

You must use the correct math symbols to receive full points. For example, if you are referring to the logical connective AND, you must type \wedge .

1. Let x be any animal. Let $P(x)$ denote the statement “ x is a dog.” Let $Q(x)$ denote the statement “ x is a mammal.” Express the following statement in terms of quantifiers and predicates: **“All dogs are mammals”**.
2. Let x be a student at Purdue University. Let $C(x)$ denote the statement that “ x is a computer science major.” Let $D(x)$ denote the statement that “ x is a data science major.” Let $A(x)$ denote the statement that “ x is an artificial intelligence major.” Express the following statement in terms of quantifiers and predicates: **“There exist students that study all three majors: computer science, data science, and artificial intelligence. (Triple Major!)”**

Answer for number 1: $\forall x(P(x) \rightarrow Q(x))$

Answer for number 2: $\exists x(C(x) \wedge D(x) \wedge A(x))$