Homework #4, Due: 2/8
Math 181 (Discrete Structures), Spring 2023

Problem 1 is worth 5 points (1.25 pts each part), and Problem 2 is worth 5 points (1.25 pts each part), for a total of 10 points. Remember to *show your work* and *explain your answers* on all problems!

1. Let $P(x)$ denote the statement "x is a professional athlete" and $Q(x)$ the statement "x plays soccer." The domain of discourse is the set of all people.

   For each of the following: write the proposition in English, and determine if it's true or false.

   (a) $\forall x\, Q(x) \to P(x)$

   (b) $\forall x\, P(x) \vee Q(x)$

   (c) $\exists x\, \neg P(x) \wedge Q(x)$

   (d) $\exists x\, P(x) \wedge \neg Q(x)$

2. Let $P(x)$ denote the statement "x lives in Virginia" and $Q(x)$ the statement "x lives in the United States." The domain of discourse is the set of all people.

   For each of the following: write the proposition in symbols, and determine if it's true or false.

   (a) Everyone who lives in Virginia lives in the United States.

   (b) Everyone who lives in the United States lives in Virginia.

   (c) There is someone who lives in Virginia but does not live in the United States.

   (d) There is someone who does not live in Virginia but does live in the United States.