Homework #4, Due: 2/7
Math 181 (Discrete Structures), Spring 2024

Problem 1 is worth 5 points, and Problem 2 is worth 5 points, 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 (based on your common sense understanding of the world) if it is 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 Maryland" 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 logical symbols, and determine (based on your common sense understanding of the world) if it is true or false.

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

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

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

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