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<u>Homework H01</u>
MATH 3110/5110 (Barsamian)
Due at start of class Fri Jan 14, 2022

Problem:	1	2	3	4	5	Total	Rescaled
Your Score:							
Possible:	20	20	20	20	20	100	10

There is a large collection of ***Suggested Exercises***. (The whole list of suggested exercises for the course can be found on the web page.These exercises are not to be turned in and are not graded, but you should write down solutions for as many of them as possible and keep your solutions in a notebook for study.)

1.2 # 1, 3, 6, 8, 9, 13, 14, 15, 19

The five problems presented below are your ***Homework Assignment*** to be turned in.

Format for Homework:

- Write your solutions your own paper (not on this cover sheet)
- Assemble your solutions **in order**. (Don't combine more than one problem on a sheet of paper if it means that your solutions will be out of order.)
- Staple this cover sheet to the front of your solutions and turn in on Fri Jan 14

[1] (Study Video 1.2a and its notes.) Prove: For all Sets A and B, if $A \subset B$ then $A \cap C \subset B \cap C$.

[2] (Study Video 1.2a) Prove DeMorgan's Law for Sets: For all Sets A and B, $(A \cup B)^c = A^c \cap B^c$.
Hint: You need a two-part proof. In Part 1, prove: $(A \cup B)^c \subset A^c \cap B^c$. In Part 2, prove: $A^c \cap B^c \subset (A \cup B)^c$.

[3] (Study Video 1.2b) Define a relation on $\mathbb{Z}$ by saying that $m \sim n$ means that $m - n$ is a multiple of 3:

(a) Show that $\sim$ is an equivalence relation on the set $\mathbb{Z}$.

(b) What is [3]? [6]? [9]? [1]? [5]?

[4] (Study Video 1.2b) Recall that $\mathbb{R}^2 = \{P = (x, y) | x, y \in \mathbb{R}\}$
Define a relation on the set $\mathbb{R}^2$ by saying that for $P_1 = (x_1, y_1) \in \mathbb{R}^2$ and $P_2 = (x_2, y_2) \in \mathbb{R}^2$,
the symbol $P_1 \sim P_2$ means that $x_1^2 + y_1^2 = x_2^2 + y_2^2$

(a) Show that $\sim$ is an equivalence relation on the set $\mathbb{R}^2$.

(b) What is [(1,0)]? [(0,1)]? [(2,2)]? [(0,0)]?

In the Problem Sets throughout the textbook, "Part B" of each Problem Set has unhelpful instructions:

"Prove" may mean "find a counterexample".

More helpful instructions would be:

"Prove or disprove".

Here is such a problem, from Problem Set 1.2 Part B. I will use the instructions that I find more helpful.

[5] (Study Video 1.2b) *Prove or Disprove:*
Let X be the set of all people. Define a binary relation set X by saying that $p_1 \sim p_2$ means that p_1 and p_2 live within 100 kilometers of each other. Then $\sim$ is an equivalence relation.