Homework 3

Math 300 (section 901), Fall 2021

This homework is due on Wed., Sept. 15. (Turn in your answers to questions 1–11.)
You may cite results from class, as appropriate.

0. *(This problem is NOT to be turned in.)*

    (a) Read Sections 1.5–1.6 and 2.1–2.4.

    (b) How many partitions of the set $\{1, 2, 3, \ldots, n\}$ have cardinality n? Explain.

    (c) Section 1.6 #1.59, 1.66, 1.71

    (d) Section 2.1 #2.1, 2.3, 2.4

    (e) Section 2.2 #2.12

1. List all partitions S of $A = \{a, b, c, d, e\}$ for which $|S| \geq 4$.

2. Let A be a set. If $|A| = n$ (where n is a natural number), what is $|A \times \mathcal{P}(A)|$? Explain.

3. Let $A = \{0, 1, 2, 3\}$ and $B = \{1, 2\}$. Determine the following sets, and draw your answers (as subsets of $\mathbb{R}^2$).

    (a) $A \times B$

    (b) $B \times A$

    (c) $(A \times B) \cap (B \times A)$

    (d) $(A \cap B) \times (A \cap B)$

4. Consider the following open sentence with domain $\mathbb{Z}$:

    $$P(x): \qquad 3x - 2 > -10 \ .$$

    (a) For which values of x (in the domain) is $P(x)$ true? (Show your work.)

    (b) For which values of x is $P(x)$ false?

5. Consider the following open sentence with domain $S = \mathcal{P}(\{a, c, d\})$:

    $$Q(A): \qquad A \nsubseteq \{a, b\} \ .$$

    (a) List all $A \in S$ for which $Q(A)$ is true.

    (b) List all $A \in S$ for which $Q(A)$ is false.

6. Use a truth table to determine whether the following implications are true or false.

    (a) $P \Rightarrow (P \wedge Q)$

    (b) $(P \wedge Q) \Rightarrow Q$

    (c) $(P \wedge Q) \Rightarrow (P \vee Q)$

    (d) $\sim (P \wedge Q) \Rightarrow (P \vee (\sim Q))$

7. Suggest two problems for the first midterm exam (which is on Friday, October 8):

   - one from the Chapter 1 Supplementary Exercises (pg. 35), and
   - another one (on any topic covered so far in class).

8. Section 1.5 #1.48, 1.52

9. Section 1.6 #1.68 (for this problem, draw your answer as a subset of $\mathbb{R}^2$)

10. Section 2.1 #2.2

11. Section 2.2 #2.13

Writing Assignment 2

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This homework is due on Wed., September 15. *Complete this part on a separate piece of paper, not the same paper for Homework 3.*

1. Read Sections 0.3–0.5 in your textbook. Which rules (if any) surprised you?

2. Which topic did you pick for your final paper? Write two paragraphs describing why you picked it, what you know (so far) about the topic, and what you expect to learn.