Questions:

(A) Which of the following are sets:

$A = \{\text{apple}, 7\}$

$B = \{$gold medal winners from Rio 2016$\}$

$C = \{$good movies release this summer$\}$

(B) Which of the following sets are the same:

$D = \{1, 2, 3\}$

$E = \{$one, two, three$\}$

$F = \{\sum_{i=1}^{n} 1 | n \in D\}$

(C) Write a proof for the statement: $|A \times B| = |A| \cdot |B$ for finite sets A, B (Fact 1.1).

Book Exercises:

Hammack, Section 1.1: 15, 19, 25, 27, 29, 43

Hammack, Section 1.2: 2(f)(g), 7, 9

Takeaways:

- even things written in mathematical notation can be ambiguous
- goal for this course is to *understand* mathematics, not solve problems
- write proofs in complete sentences (more lessons in houston)
- what to include in a proof varies by person and situation, but when learning it's best to err on the side of completeness and formality.

Questions:

(A) What is the difference between $x \in A$ and $x \subseteq A$ (or $x \subset A$)? Can both be true?

(B) Prove or disprove: $\emptyset \subseteq A$ for any set A.

(C) Prove or disprove: $\emptyset \in A$ for any set A.

(D) Write a proof for the statement: $|\mathcal{P}(A)| = 2^{|A|}$ for a finite set A (Fact 1.4).

Book Exercises:

Hammack, Section 1.3: 3, 4, 5, 7, 14
3, 4, 5, 7: List all subsets of $\{\{\mathbb{R}\}\}$, $\emptyset$, $\{\emptyset\}$, $\{\mathbb{R}, \{\mathbb{Q}, \mathbb{N}\}\}$
14: True or false: $\mathbb{R}^2 \subset \mathbb{R}^3$. Explain.

Hammack, Section 1.4: 13, 17
13, 17: Say $|A| = m$. Find cardinalities of $|\mathcal{P}(\mathcal{P}(\mathcal{P}(A)))|$ and $|\,\{X \in \mathcal{P}(A) : |X| \leq 1\}\,|$.

Takeaways:

- for proofs, start with what you know, which at the beginning is just definitions
- to disprove something, a single counterexample suffices (and is usually required), though an example will not suffice for a proof (but it may give you the idea for a proof)
- details are important because many similar looking objects and notation have differences that matter (these differences are especially important when coding)

Note to self: remember to talk about OH, HW due days, active learning/feedback, group rotations

Questions:

(A) Let $A = \{0, 1, 2\}$ and $B = \{1, 2, 3\}$. Determine the following sets: $A \cap B$, $A \cup B$, $(A \times B) \cap (B \times A)$, $A^2 \cup B^2$ and $\mathcal{P}(A) \cap \mathcal{P}(B)$.

(B) Let A be a subset of a set X, and $\overline{A}$ the complement in X. Write a proof that $|A| + |\overline{A}| = |X|$.

(C) Let A, B be finite sets. What relations can you determine between $|A|$, $|B|$, $|A \cap B|$ and $|A \cup B|$?

(D) Houston's systematic method for reading (for long pieces) is: (i) skim, (ii) ask questions, (iii) read carefully, (iv) be active, (v) reflect? How does this compare with how you have been reading Hammack? Do you think that all of these steps are necessary or helpful?

Book Exercises:

Hammack, Section 1.5:
9: Is $(\mathbb{R} \times \mathbb{Z}) \cap (\mathbb{Z} \times \mathbb{R}) = \mathbb{Z} \times \mathbb{Z}$? What about $(\mathbb{R} \times \mathbb{Z}) \cup (\mathbb{Z} \times \mathbb{R}) = \mathbb{R} \times \mathbb{R}$?

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