These questions are for practice. They are not assessed. Solution will be released online in Week 3.

0. Your lecturer says the following:

> "Defining a set must be done with care if it is to be effective. We described three ways to define a set: describe the set using precise language; use set-roster notation; use set-builder notation. Each way is well-suited to some situations and not others."

Suppose that a friend complains "Why can't we just stick to one way of defining sets?" Write a paragraph or two to help your friend understand why it is good that we have different ways of describing sets. Make up some examples of sets that are best described in each way, and explain why your method of definition is the right choice in each case. An excellent answer may explore the idea that different ways of defining a set make different information readily accesible.

1. Let $E = \{a, b, c, d, e, f\}$, $A = \{a, b, c\}$, $B = \{d, e\}$, $C = \{\{a, b, c\}, \{d, e\}\}$. Are the following statements true or false? Explain your answers.

(a) $A \subseteq E$.

(b) $B \subset E$.

(c) $C \subseteq E$.

(d) $A \subseteq C$.

2. Let $E = \{a, b, c, d, e, f\}$ be a universe of discourse. Let $A = \{a\}$, $B = \{b, c, d\}$, $C = \{f, a, d\}$. Compute the following.

(a) $A \cup B$.

(b) $B \cap C$

(c) B^c.

(d) $A \Delta C$.

(e) $C \backslash A$.

3. Let A, B, C be sets.
Prove that $(A \cap B)^c = A^c \cup B^c$.

4. Is $0 \in \varnothing$? Is $\{\varnothing\} \in \varnothing$?
Explain why.

5. Let $A = \{a, b, c, d\}$, $B = \{c, d, e\}$. Compute the following:

(a) $P(A)$.

(b) $P(A \cap B)$.

6. Let $A = \{a, b\}$, $B = \{1, 2\}$. Compute the following:

(a) $A \cap B$.

(b) $P(A \cap B)$.

7. Let $A = \{0, 1\}$. Compute $A \times A \times A \times A$.

8. Let $A = \{0, 1\}$ and $B = \{a, b, c\}$. Are the following partitions of $A \times B$? Explain why or why not.

(a) $\{A_1, A_2\}$ where $A_1 = \{(0, a), (0, b), (0, c)\}$ and $A_2 = \{(1, a), (1, b), (1, c)\}$.

(b) $\{A_1, A_2\}$ where $A_1 = \{(0, a), (0, b), (0, c), (0, 0)\}$ and $A_2 = \{(1, a), (1, b), (1, c), (1, 1)\}$.

(c) $\{A_1, A_2, A_3\}$ where $A_1 = \{(0, a), (1, a)\}$, $A_2 = \{(0, b), (1, b)\}$ and $A_3 = \{(0, c), (1, c)\}$.

(d) $\{A_1, A_2, A_3, A_4\}$ where $A_1 = \{(0, a), (0, b), (0, c)\}$, $A_2 = \{(0, a), (1, a)\}$, $A_3 = \{(0, b), (1, b)\}$ and $A_4 = \{(0, c), (1, c)\}$.

9. Prove or disprove that $A \cup (B \backslash A) = A \cup B$.

10. Find counterexamples to the following statements.

(a) $A \subseteq B \implies A^c \subseteq B^c$.

(b) $(A \notin B) \wedge (B \notin C) \implies A \notin C$.

(c) $(A \subseteq B) \wedge (B \notin C) \implies A \notin C$