Level 1 Recall

1. Define a set and give an example of a finite set

set any collection of items (nouns) in which the collection has no duplicates and is unordered; could have no items, a finite amount of items, or an infinite amount of items

Reflection

I remembered the properties of sets both from memory of the reading and by remembering the properties of sets in python, since I've used them in python before. I forgot to include that they could be empty, finite, and infinite, and I added that to my definition after checking wikipedia

2. State the difference between a subset and a proper subset

A proper subset cannot be equal to the set it's a subset to. However, a non-proper subset could still be a subset to a set even if the subset and the set are equal.

Reflection

I couldn't immediately recall the difference between the difference within thirty seconds, so I went to my notes that I took while reading Chapter 2 of Brisk Walk. From those notes, I identified the differences.

3. What is a power set and how do we write it?

Given a set of elements, the power set of that set is a set that contains sets that represent all combinations of the original set, including all the elements, all combinations of the elements, and none of the elements (empty set)

Example of Power Set

Given set: $F = \{\text{Dad},\ \text{Mom}\}$

Power set of F is:

$\mathbb{P}(F) = \{\{\text{Dad}, \text{Mom}\}, \{\text{Dad}\}, \{\text{Mom}\}, \emptyset\}$

Reflection

I did remember what I wrote down for power set from memory, but I also double checked my notes for Brisk Walk just to make sure I wasn't forgetting anything. I made up the example based on the example in Brisk Walk that I remembered.

4. What is cardinality and give an example of cardinality of an empty set and an example finite set

Cardinality the size of a set, or the number of elements in a set

Since an empty set by definition has no elements, it's cardinality is 0 (0 elements)

For a finite set like this:

$F = \{\text{Me},\ \text{Dad},\ \text{Mom}\}$

The cardinality (surrounding the set with ||) is 3 because there are three elements in the set

$|F| = 3$

Reflection

I remembered the definition for cardinality from memory of reading Cool Brisk. I double checked my notes just to make sure the notation was correct

Level 2 Skill

1. Use set theory to answer:

Description:
Use set theory to answer Each student in a class of 40 plays at least one game. 18 play LOL, 20 play DOTA, and 27 play D&D. 7 play LOL and D&D, 12 play DOTA and D&D, and 4 play all three. Find the number of students who play LOL and DOTA and the number of students who play LOL and DOTA but not D&D.

Work:
$L = \{k : k \text{ is a student who plays LOL}\}$

$D = \{k : k \text{ is a student who plays DOTA}\}$

$A = \{k : k \text{ is a student who plays D\&D}\}$

$|\Omega| = 40$

$|L| = 18$

$|D| = 20$

$|A| = 27$

$|L \cap A| = 7$

$|D \cap A| = 12$

$|L \cap D \cap A| = 4$

Part 1
Need: Number of students who play LOL and DOTA

Need: $|L \cap D|$

$|L \cup D \cup A| = |L| + |D| + |A| - |L \cap D| - |D \cap A| - |L \cap A| + |L \cup D \cup A|$

$|L \cup D \cup A| = |\Omega|$

$40 = 18 + 20 + 27 - |L \cap D| - 12 - 7 + 4$

$|L \cap D| = 10$

Reflection
I googled: "operations on cardinalities of sets" and got to this page, where I learned about the inclusion-exclusion principle. It had a formula for three sets, so I plugged in my values and used algebra to find the intersection

Part 2
Need: Number of students who play LOL and DOTA but not D&D

Need: $|L \cap D \cap \overline{A}|$

Conceptually: take people who who play L and D and subtract people who play all three to get the ones who only play L and D

$|L \cap D \cap \overline{A}| = |L \cap D| - |L \cap D \cap A|$

$|L \cap D \cap \overline{A}| = 10 - 4$

$|L \cap D \cap \overline{A}| = 6$

Reflection
This one really stumped me. I had to ask ChatGPT, and although it got a different answer, I understood it's conceptual intention, which I explained above. I'm not confident I got the correct answers for these, so I would appreciate if you verified my answers, and if I got them wrong, provide the correct work.

2. Use set theory to answer:
Question: Given the universal set U = {10,20, 30, 40, 50} and sets A={10, 20}, B = {20, 30}, and C={30, 40} find $(A \cup B) \cap \overline{C}$

First, union of A and B
$D = A \cup B = \{10, 20, 30\}$

Second, complement of C
$\overline{C} = U - C = \{10, 20, 50\}$

Finally, intersection
$D \cap \overline{C} = (A \cup B) \cap \overline{C} = \{10, 20\}$

Reflection
Compared to the first question, this was much easier because we were given all of the elements of the three sets. I just broke the question down bit by bit and did it myself using what I learned about AND and OR from previous units.

3. Determine subsets:
Given the sets P ={x|x is a prime number} and Q = {2,3,5} determine if P is a subset of Q or if Q is a subset of P and justify it.

P is not a subset of Q. For $P \subset Q$ to be true, all elements in P must be found in Q. However, prime numbers above 5 such as 7 are not found in Q, therefore,

$P \not\subset Q$

On the other hand, all elements of Q could be found in P (since 2, 3, and 5 are all prime numbers and would be elements of P). Therefore,

$Q \subset P$

Reflection
I also did this one mostly by myself. I went back to my notes to double check the definition for subset

Level 3 Strategic Thinking