MATH301 Homework 2

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1 Section 1.5 Problems:4a,4e,4f,4g,8

Suppose$A = \{b, c, d\}$ and $B = \{a, b\}$ Find :

1.5:4a +++

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

$$\begin{aligned} (A \times B) &= \{(b, a), (b, b), (c, a), (c, b), (d, a), (d, b)\} \\ (B \times B) &= \{(a, a), (a, b), (b, a), (b, b))\} \\ &\therefore \\ (A \times B) \cap (B \times B) &= \{(b, a), (b, b)\} \end{aligned}$$

For this assignment I feel that I understood the task at hand and writing out the complete cartesian product makes it very easy to identify the intersection of the two sets.

1.5:4e+++

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

$$\begin{aligned} (A \times B) &= \{(0, 1), (0, 2), (1, 1), (1, 2)\} \\ 1, 2 \notin (A \times B) &\therefore (A \times B) \cap B = \emptyset \end{aligned}$$

This problem is very similar to the previous and I found that becuase there are no ordered pairs within B the intersection should be the empty set.

1.5:4f +++

$$\mathcal{P}(A) \cap \mathcal{P}(B)$$

$$\mathcal{P}(A) = \{\emptyset, \{b\}, \{c\}, \{d\}, \{b,c\}, \{b,d\}, \{c,d\}, \{b,c,d\}$$
$$\mathcal{P}(B) = \{\emptyset, \{a\}, \{b\}, \{a,b\}$$
$$\therefore \mathcal{P}(A) \cap \mathcal{P}(B) = \{\emptyset, \{b\}$$

Like problem 1 I found that a complete expansion of the sets being examined really assists the action of identifying the intersection between the two sets.

1.5:4g +++

$$\mathcal{P}(A) - \mathcal{P}(B)$$

$$\mathcal{P}(A) = \{\emptyset, \{b\}, \{c\}, \{d\}, \{b,c\}, \{b,d\}, \{c,d\}, \{b,c,d\}$$
$$\mathcal{P}(B) = \{\emptyset, \{a\}, \{b\}, \{a,b\}$$
$$\therefore \mathcal{P}(A) - \mathcal{P}(B) = \{x | x \in \mathcal{P}(A), x \notin \mathcal{P}(B)\} = \{\{c\}, \{d\}, \{b,c\}, \{b,d\}, \{c,d\}, \{b,c,d\}$$

This problem was very fun to type in and I think that the set builder notation expressed at the end of my work is a nice description of the problem. here I am attempting to describe the set of elements in the powerset of A that are not within B.

1.5:8 +++
See attached illustration, figure 1
This problem was very graphically intuitive and examining the regions described by the sets led to clear decision making for which sections I felt needed to be shaded.

2 Section 1.7 Problems 6,8,12,14

1.7.6+++
See attached illustration, figure 2
1.7.8+++
See attached illustration, figure 3
For problems 1.7.6 and 1.7.8 I found that focusing on building the section procedurally really helped my work. By methodically shading the regions described by the set algebra I found that both of these examples were equivilant.

1.7.12+++
The expression that describes this set it:

$$(A - B) \cup (B \cap C)$$

For this problem I found that it was very useful to first about how I would shade just the set of A. doing so made the intersection with the intersection of B and C very easy and then it was evident that I needed to subtract B from the set A.

1.7.14+++
The expression that describes this set is :

$$(A \cap B \cap C) \cap \Big((A - C) \cap (A - B)\Big)$$

This problem required quite alot of thinking for me compared to the others. I found that the best way to conceptualize this problem was to start with the full intersection of the three sets and then find a concise description of just the are within set A to union with the intersection.

3 4 dimensional cube illustration+++

See attached illustration, figure 4.
I really enjoyed watching this video and feel that the powerset does seem to naturally want to exist as a cube or higherdimensional object with objective structure.

4 Bonus ++++