

CS394 R Homework 1

attachments and source available at
<https://github.com/alexskc/cs394r>

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1

$$U = \{1, 2, 3 \dots 10\}, A = \{1, 4, 7, 10\}, B = \{1, 2, 3, 4, 5\}, C = \{2, 4, 6, 8\}.$$

a

$$\bar{A} \cap C = \{2, 6, 8\}, |\bar{A} \cap C| = 3$$

b

$$B - \bar{C} = \{2, 4\}, |B - \bar{C}| = 2$$

c

$$B \cup A = \{1, 2, 3, 4, 5, 7, 10\}, |B \cup A| = 7$$

d

$$\bar{B} \cap (A - C) = \{1\}, |\bar{B} \cap (A - C)| = 1$$

e

$$(A - B) \cap (B - C) = \emptyset, |(A - B) \cap (B - C)| = 0$$

2

a

$$|A \cup B| = |A| + |B|$$

No. If there's any intersection between A and B, that will be counted twice.

b

$$|A \cup B| = |A| + |B| + |A \cap B|$$

No. If there's any intersection between A and B, that will be counted thrice.

c

$$|A \cup B| = |A| + |B| - |A \cap B|$$

Yes. This accounts for any overlap between A and B.

d

$$|A \cup B \cup C| = |A| + |B| + |C|$$

No. Once again, this doesn't account for overlap.

e

$$|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C|$$

Yes. The intersection between each set is erased once, which means that the intersection between all three is replaced thrice, leaving a "hole." The $|A \cap B \cap C|$ compensates for this.

f

$$|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C|$$

No, as mentioned above, this leaves a "hole" in the middle.

g

$$|A \cup B \cup C| = |A| + |B| + |C|$$

No, this is the same as (d)

3

a

$$A \cup B = A. \text{ Either } A = B, \text{ or } B = \emptyset.$$

b

$$B - A = B. \text{ Either } A \cap B = \emptyset, \text{ or } A = \emptyset.$$

c

$$A - B = B - A. \ A = B$$

d

$$A \cap B = A. \ A = B$$

e

$$A \cap B = B \cap A. \text{ Always true}$$

f

$$\bar{A} \cap U = \emptyset. \ A = U$$

g

$$A - B = \emptyset. \ A \subset B$$

h

$$A \cap B = A - B. \ A = \emptyset$$