SET THEORY AND VENN DIAGRAM

This assignment covers basics of sets theory such as set notations, operations, and Venn diagrams. I employ these techniques in real life examples like health care data analysis and number sets to help understanding through applied examples.

Scenario 1: Hospital Survey Analysis

We are given:

- Total patients: 1000
- Set A: Patients with health insurance = 600
- Set B: Patients who had a recent health checkup = 500
- Patients in both sets (A ∩ B) = 200

1. Interpretation of Set Notations

a. A ∩ B: Represents patients who *have both* health insurance and recently had a health checkup.

b. B - A: Patients who *only had a checkup* but *do not* have health insurance.

c. A - B: Patients who *only have insurance* but *did not* have a recent checkup.

d. A ⊕ B (Symmetric Difference): Patients who *only belong to one set*, i.e., either have health insurance or had a checkup, but not both.

2. Cardinalities of the Above Sets

- **A ∩ B** = 200 (given)
- **B - A** = 500 - 200 = 300

- **A - B** = 600 - 200 = 400
- **A ⊕ B** = (A - B) + (B - A) = 400 + 300 = 700

3. Application of Principle of Inclusion and Exclusion (PIE)

PIE helps in avoiding double-counting of overlapping elements in sets. According to the formula:

$|A∪B|=|A|+|B|−|A∩B|$|A ∪ B| = |A| + |B| - |A ∩ B|$|A∪B|=|A|+|B|−|A∩B|$

So,

$|A∪B|=600+500−200=900$|A ∪ B| = 600 + 500 - 200 = 900$|A∪B|=600+500−200=900$

Therefore, 900 patients have either health insurance, a checkup, or both.

This result reflects the effectiveness of PIE in large datasets, ensuring accurate aggregation by accounting for overlaps (Rosen, 2019).

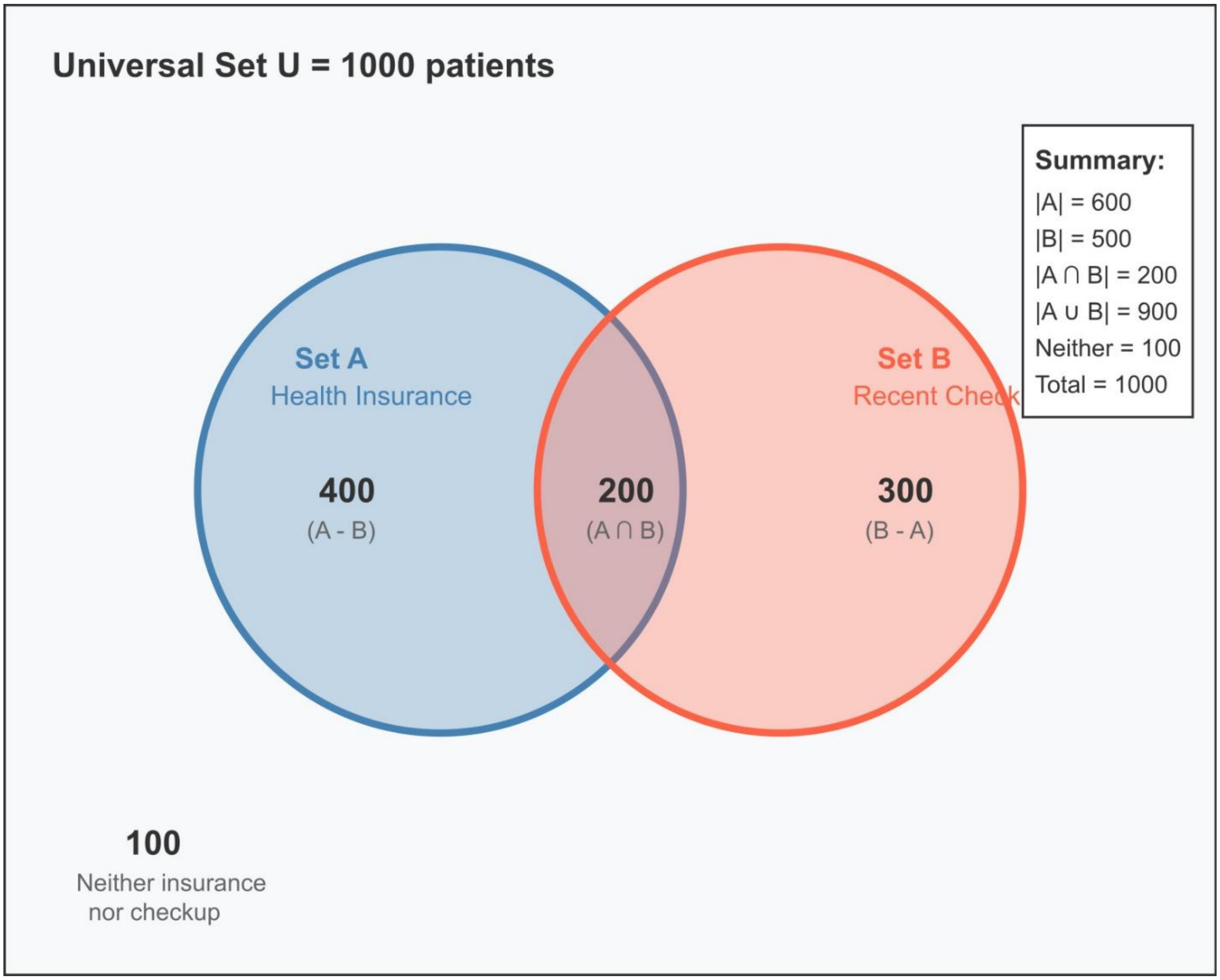
4. Using Venn Diagrams to Analyze Data

a. Number of patients with neither insurance nor checkup = Total - (A ∪ B) = 1000 - 900 = 100

b. Number of patients with either no insurance or no checkup (complement of A ∩ B) =

= Total - (A ∩ B) = 1000 - 200 = 800

While part (a) identifies complete exclusions from both sets, part (b) highlights broader gaps in healthcare coverage or checkup behavior. These insights are valuable for policy interventions.



Scenario 2: Set Operations with Numbers

Let:

- Set C = {2, 4, 6, 8, 10, 12, 14, 16, 18, 20}
- Set D = {3, 6, 9, 12, 15, 18}
- Universal Set U = {1, 2, 3, ..., 20}

5. Calculations

a. C ∩ D = Common elements in C and D = {6, 12, 18}

b. C ∪ D = All unique elements in either C or D

= {2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20}

c. D - C = Elements in D but not in C = {3, 9, 15}

d. C ⊕ D = Elements in either C or D but not both

= (C ∪ D) - (C ∩ D)

= {2, 3, 4, 8, 9, 10, 14, 15, 16, 20}

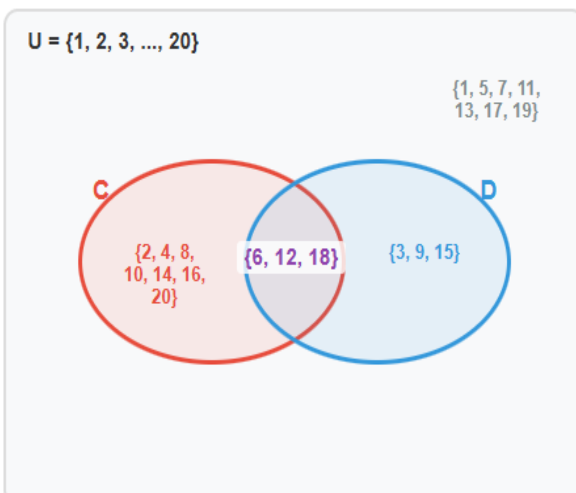
e. Complement of C (C') in U = All elements in U not in C

= {1, 3, 5, 7, 9, 11, 13, 15, 17, 19}

Scenario 2: Venn Diagram

Sets C and D within Universal Set U = {1, 2, 3, ..., 20}

Set C: {2, 4, 6, 8, 10, 12, 14, 16, 18, 20} (Even numbers)
Set D: {3, 6, 9, 12, 15, 18} (Multiples of 3)



Intersection (C ∩ D)

Elements in both C and D: {6, 12, 18}
These are even numbers that are also multiples of 3

Only in C (C - D)

Even numbers not divisible by 3: {2, 4, 8, 10, 14, 16, 20}

Only in D (D - C)

Odd multiples of 3: {3, 9, 15}

Outside both sets

Numbers that are neither even nor multiples of 3: {1, 5, 7, 11, 13, 17, 19}

Conclusion

The assignment showed that set theory is not only useful as a fundamental concept in mathematics but also as a day-to-day analytical tool. In Scenario 1: I had to use sets/pie/ to extract valuable insights from patient data to help in planning the strategy for health care. In Scenario 2, I used the ideas we have already learned about sets in dealing with numeric data, consolidating our understanding of unions, intersections, differences and complements. Understanding how to process Venn diagrams and work with set identities supports the development of a powerful problem-solving strategy applicable in myriad applications.

References

Rosen, K. H. (2019). *Discrete Mathematics and Its Applications*. McGraw-Hill Education. https://www.mheducation.com/highered/product/Discrete-Mathematics-and-Its-Applications-Rosen.html

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