Applications of Venn Diagrams

Objectives:

- Use Venn diagrams to answer questions about survey results.
- Apply De Morgan's laws to find complements of unions and intersections.
- Solve logic problems

Vocabulary:

- De Morgan's Laws:
  \[(A \cup B)' = \]
  \[(A \cap B)' = \]

Possible Classroom Examples:

A survey of 300 workers yielded the following information: 231 belonged to a union, and 195 were Democrats. If 172 of the union members were Democrats, how many workers were in the following situations?

- a. belonged to a union or were Democrats
- b. belonged to a union but were not Democrats
- c. were Democrats but did not belong to a union
- d. neither belonged to a union nor were Democrats

A recent transportation survey of \(w\) urban commuters (that is \(n(U) = w\)) yielded the following information: \(x\) rode neither trains nor busses, \(y\) rode trains, and \(z\) rode only trains. How many people rode the following?

- a. trains and buses
- b. only buses
- c. buses
- d. trains or busses
Given the sets
\( U = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \} \)
\( A = \{ 0, 2, 4, 5, 9 \} \)
\( B = \{ 1, 2, 7, 8, 9 \} \)
use DeMorgan's laws to find:

a. \((A \cap B')'\)
b. \((A \cup B')'\)

A nonprofit organization's board of directors, composed of four women (Angela, Betty, Carmine, and Delores) and three men (Ed, Frank, and Grant), holds frequent meetings. A meeting can be held at Betty’s house, at Delores’s house, or at Frank’s house.

- Delores cannot attend any meetings at Betty’s house.
- Carmine cannot attend any meetings on Tuesday or on Friday.
- Angela cannot attend any meetings at Delores’s house.
- Ed can attend only those meetings that Grant also attends.
- Frank can attend only those meetings that both Angela and Carmine attend.

If the meeting is held on Tuesday at Betty’s, which of the following pairs can be among the board members who attend?

1. Angela and Frank
2. Ed and Betty
3. Carmine and Ed
4. Frank and Delores
5. Carmine and Angela