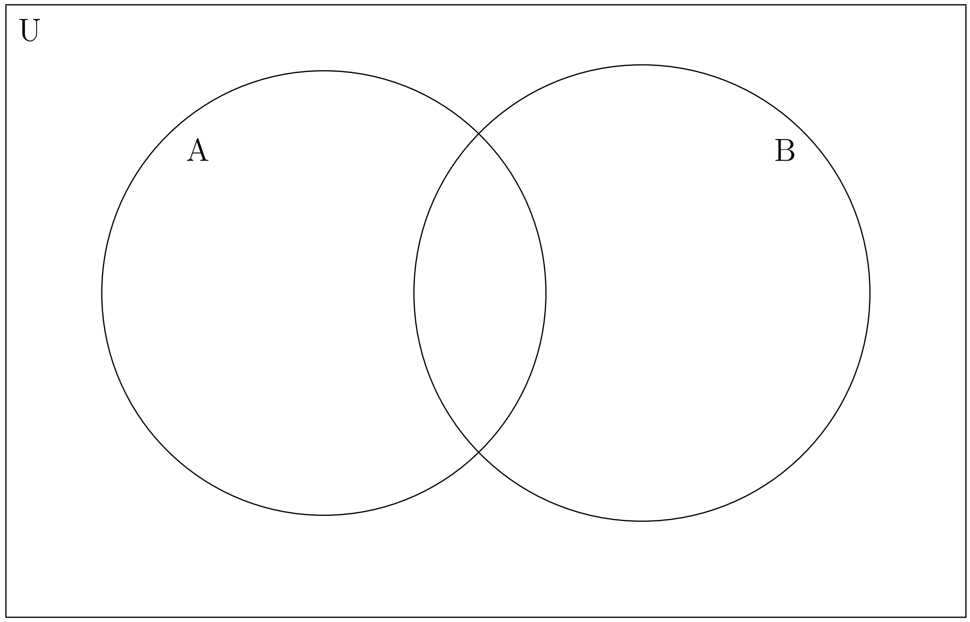
Activity 23 – Introduction to Proof

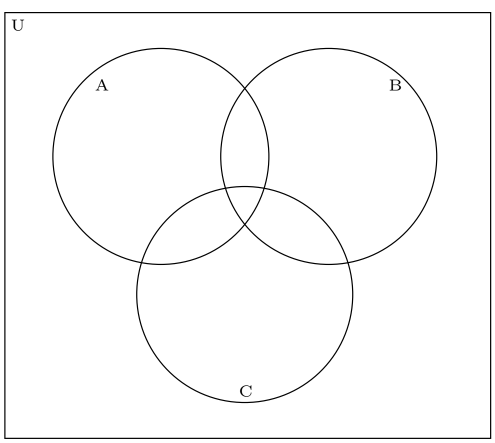
Venn diagrams

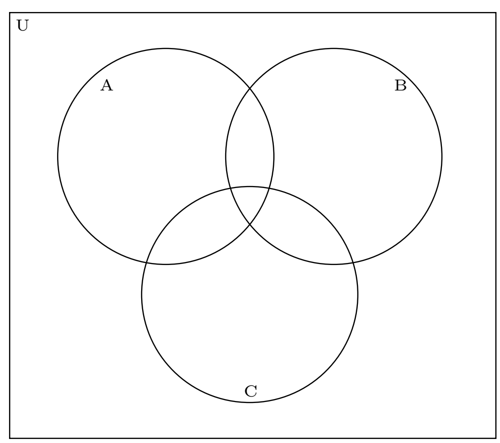
(1) Use the double inclusion strategy to prove that $A \setminus (B \cap C) = A \setminus B \cup A \setminus C$

(2) Let $A = \{1, 2, 3, 4, 5, 6, 7\}$ and $B = \{2, 4, 6, 8, 10\}$. Write these element in the appropriate regions in a Venn diagram for two sets.

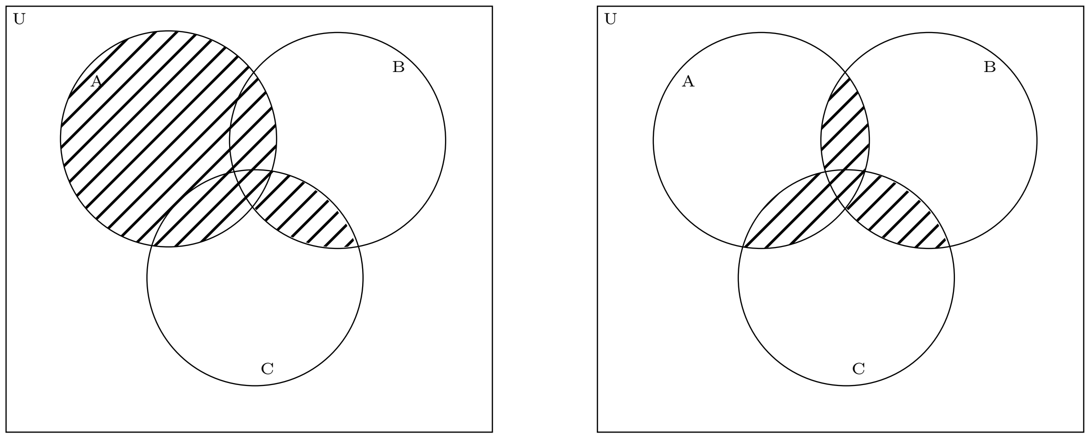


(3) On the 3-set Venn diagrams below shade the regions that correspond to $A \cap (B \cup C)$ on the left and $(A \cap B) \cup (A \cap C)$ on the right.



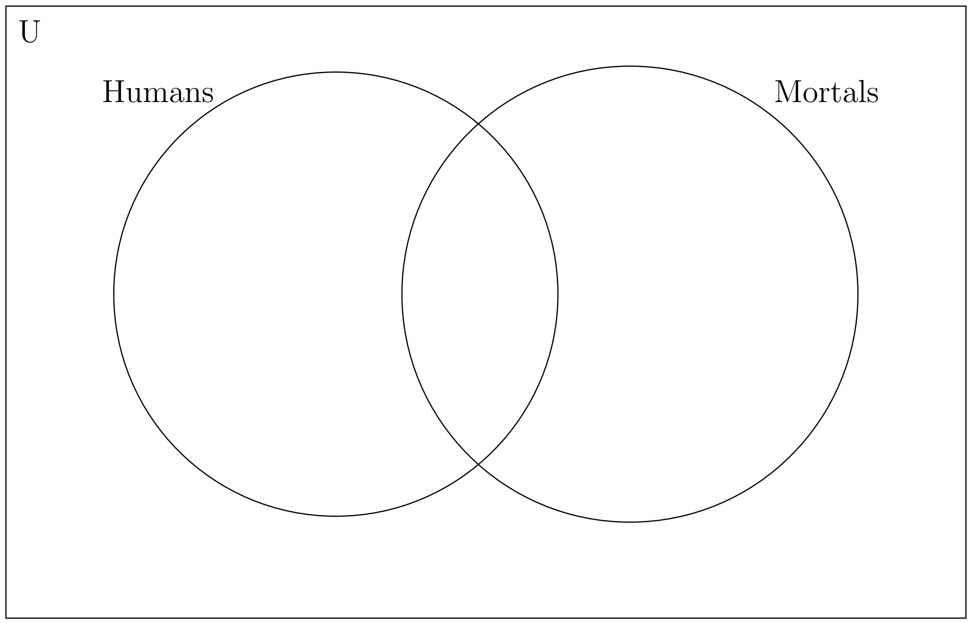


(4) Determine set-theoretic expressions for the shaded regions in the Venn diagrams below.



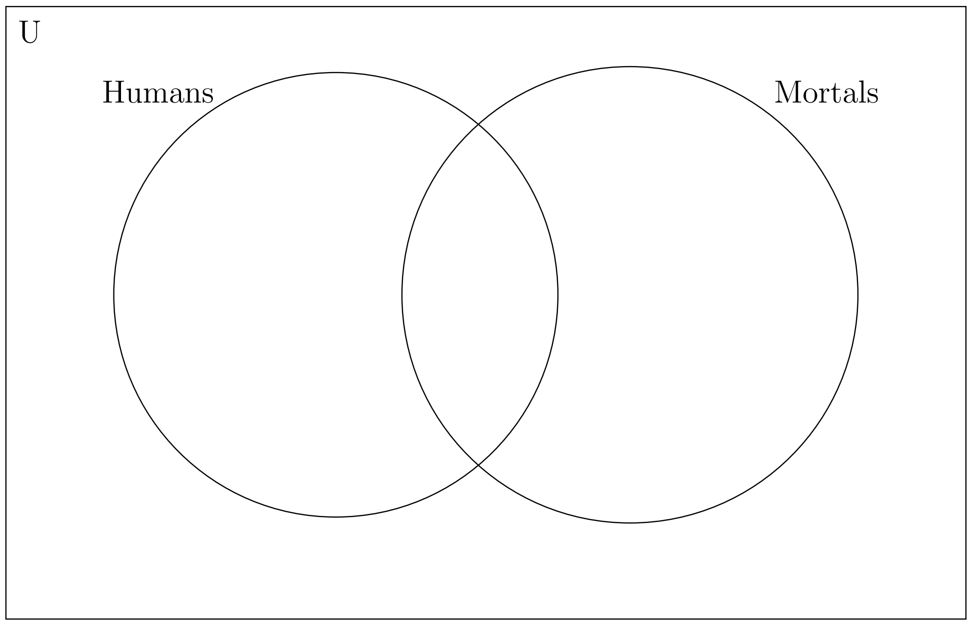
(5) Use rectilinear Jordan curves (simple closed curves made up of horizontal and vertical line segments) to create a Venn diagram for 4 sets in general position.

(6) We can visualize the modus ponens argument form by placing Socrates in the appropriate region and imposing the “All men are mortal” condition by indicating a region on the diagram that must be empty. Do it.



(7) In a similar fashion, create a visualization for the modus tollens argument form:

$$\begin{array}{c} \text{All men are mortal} \\ \text{Zeus is not mortal} \\ \hline \therefore \text{Zeus is not a man} \end{array}$$



(8) Construct a Venn diagram for 4 sets using rectangles. (This is slightly tougher than problem 5.)

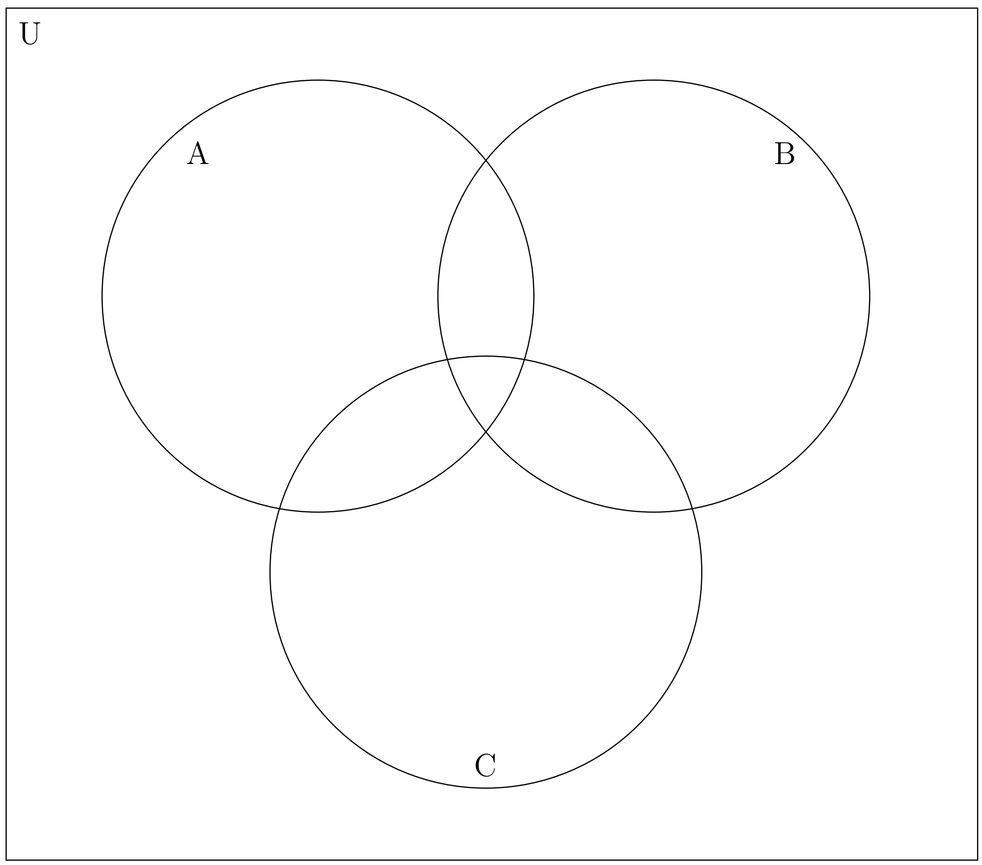
(9) Use a Venn diagram for 4 sets to convince yourself of the validity of the following containment statement

$$(A \cap B) \cup (C \cap D) \subseteq (A \cup C) \cap (B \cup D).$$

(10) Use a Venn diagram to show that the following proposed set identity is false.

$$\overline{A} \cap (B \cup C) = (B \cup C) \setminus (A \cap C)$$

How could we use the intuition we developed from the Venn diagram to construct a legitimate disproof?



(11) Illustrate the absorption laws for sets on Venn diagrams.