union and intersection: operator rules

Let E_1, E_2, E_3 denote events in Ω

- Commutative

  $E_1 \cup E_2 = E_2 \cup E_1$

  $E_1 \cap E_2 = E_2 \cap E_1$

- Associative

  $(E_1 \cup E_2) \cup E_3 = E_1 \cup (E_2 \cup E_3)$
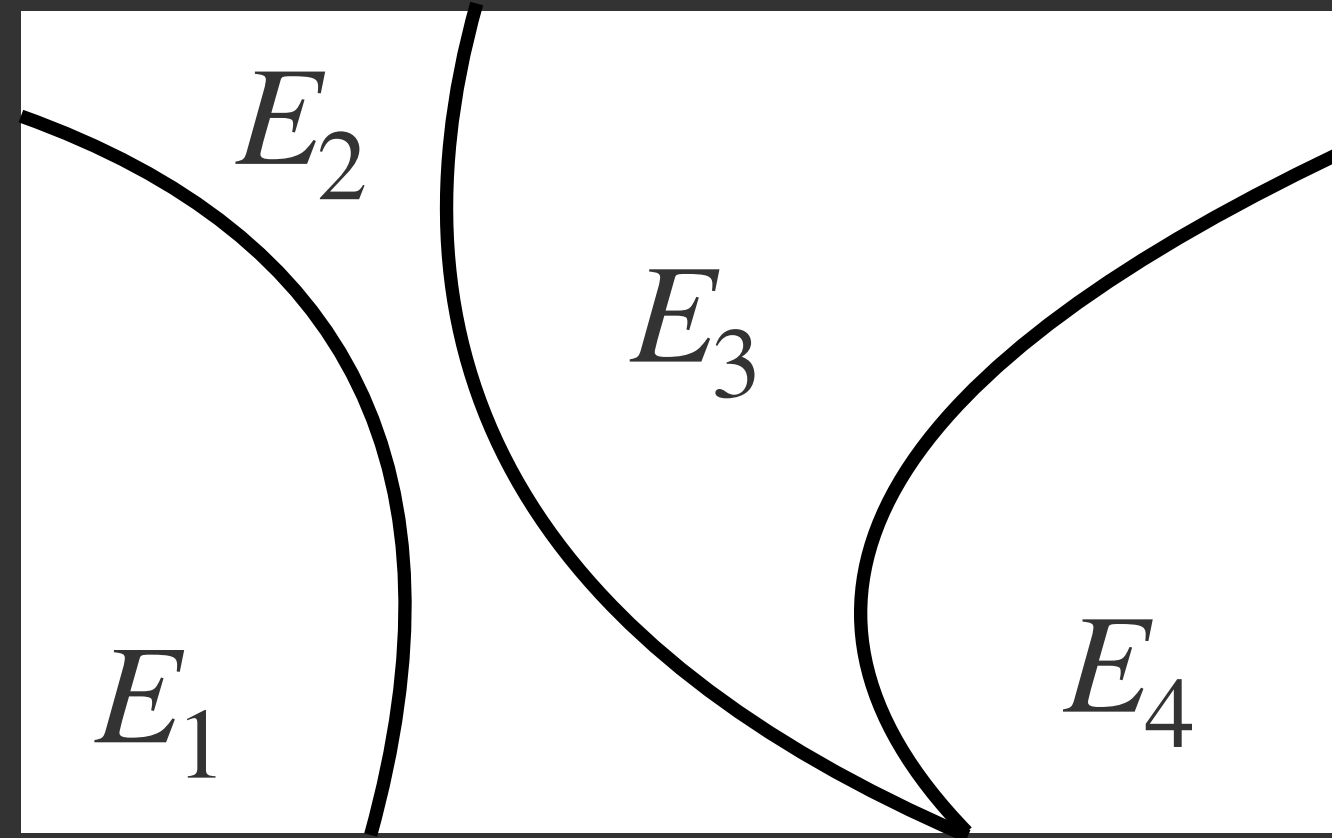
  $(E_1 \cap E_2) \cap E_3 = E_1 \cap (E_2 \cap E_3)$

- Distributive

  $(E_1 \cup E_2) \cap E_3 = (E_1 \cap E_3) \cup (E_2 \cap E_3)$

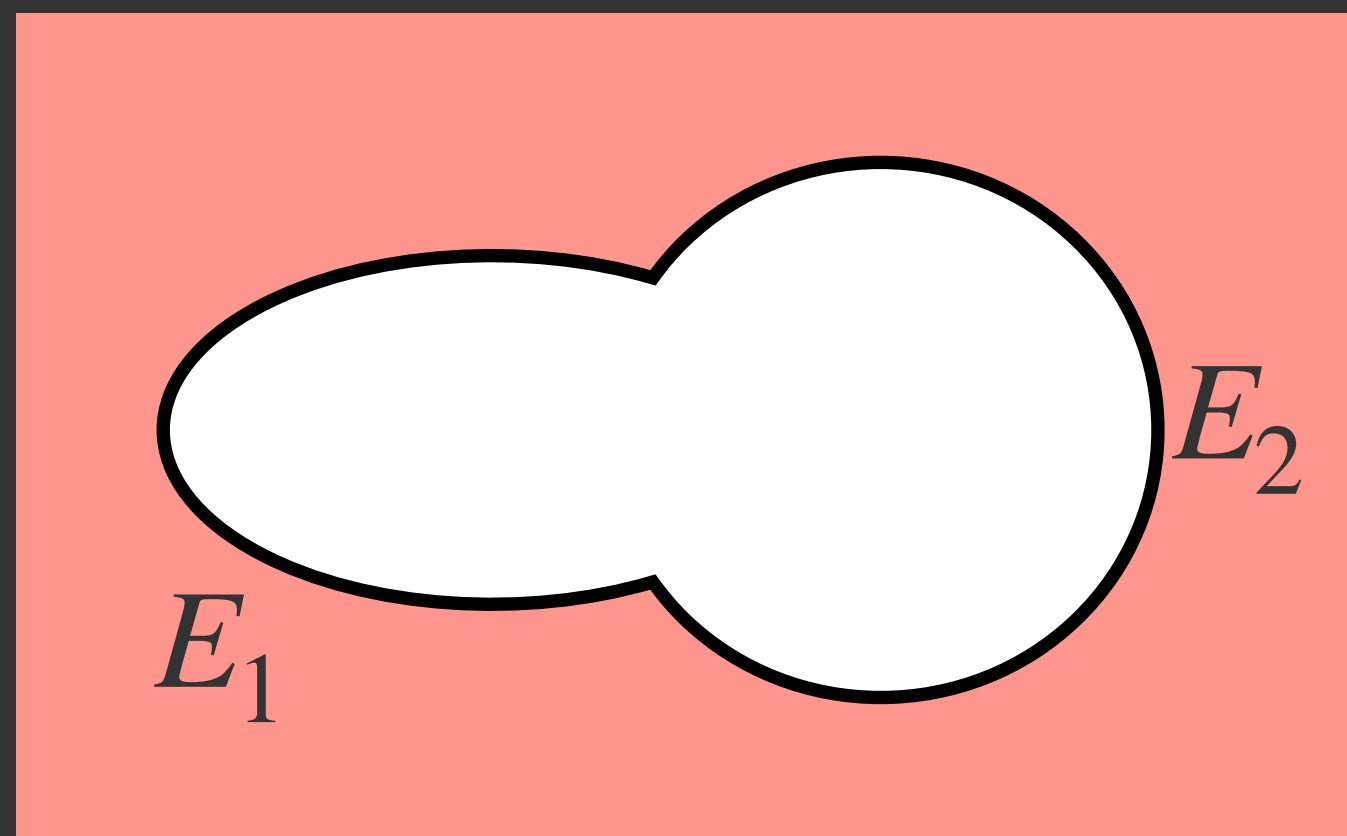 $(E_1 \cap E_2) \cup E_3 = (E_1 \cup E_3) \cap (E_2 \cup E_3)$

the complement

MECE = mutually exclusive and collectively exhaustive events

E_2

E_3

E_1

E_4

de Morgan's Rules

$$\overline{E_1 \cup E_2} = \overline{E_1} \cap \overline{E_2}$$

E_2

E_1

$$\overline{E_1 \cap E_2} = \overline{E_1} \cup \overline{E_2}$$

E_2

E_1