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Experiment : administer m1 to covid patients

$$S = \{ \underset{25}{r_{1-7}}, \underset{20}{r_{8-14}}, \underset{50}{r_{15+}}, \underset{5}{d} \}$$

E1 : recovered $\qquad P(E1) = \dfrac{25+20+50}{25+20+50+5} = \dfrac{95}{100}$

E2 : recovered in 14 days $\qquad P(E2) = \dfrac{25+20}{25+20+50+5} = \dfrac{45}{100}$

not an event

E3 : recovered in 20 days $\qquad \dfrac{45}{100} \le P(E_3) \le \dfrac{95}{100}$

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Dice:

$S = \{1, 2, 3, 4, 5, 6\}$

E1: odd $\{1, 3, 5\}$ $P(E1) = \frac{3}{6}$

E2: perfect sq $\{1, 4\}$ $P(E2) = \frac{2}{6}$

Coin toss

$S = \{H, T\}$ (Fair coin)

E : getting a head $\qquad P(E) = \frac{1}{2}$

Coin toss twice:

$$S = \{HH, HT, TH, TT\}$$

E1: getting at least one head

$$E1 = \{HH, HT, TH)$$

$$P(E1) = \frac{3}{4}$$

Dice two Times

$(D1, D2)$

$$S = \left\{ \begin{array}{l} (1,1),\ (1,2),\ (1,3) \cdots (1,6), \\ (2,1),\ (2,2),\ (2,3) \cdots (2,6) \\ \vdots \\ (6,1),\ (6,2),\ \cdots\ (6,6) \end{array} \right\}$$

36 outcomes

$D1 = 2 \quad D2 = 6$

E : $D1$ is 3 $\quad E = \{(3,1)\ (3,2) \cdots (3,6)\}$ $\quad P(E) = \frac{6}{36}$

F : $D1 + D2 = 7 \quad F = \{(1,6)\ (2,5) \cdots (6,1)\}$ $\quad P(F) = \frac{6}{36}$

G : $D1^2 + D2^2 = 5^2 \quad G = \{(3,4),\ (4,3)\}$ $\quad P(G) = \frac{2}{36}$

$E \cap F = \{(3,4)\}$

$P(E \cap F) = \frac{1}{36}$

$$P(E|F) = \frac{P(E \cap F)}{P(F)} = \frac{1/36}{6/36} = \frac{1}{6}$$

Joint prob

Intersection

U : All covid patients $\rightarrow$ 1000

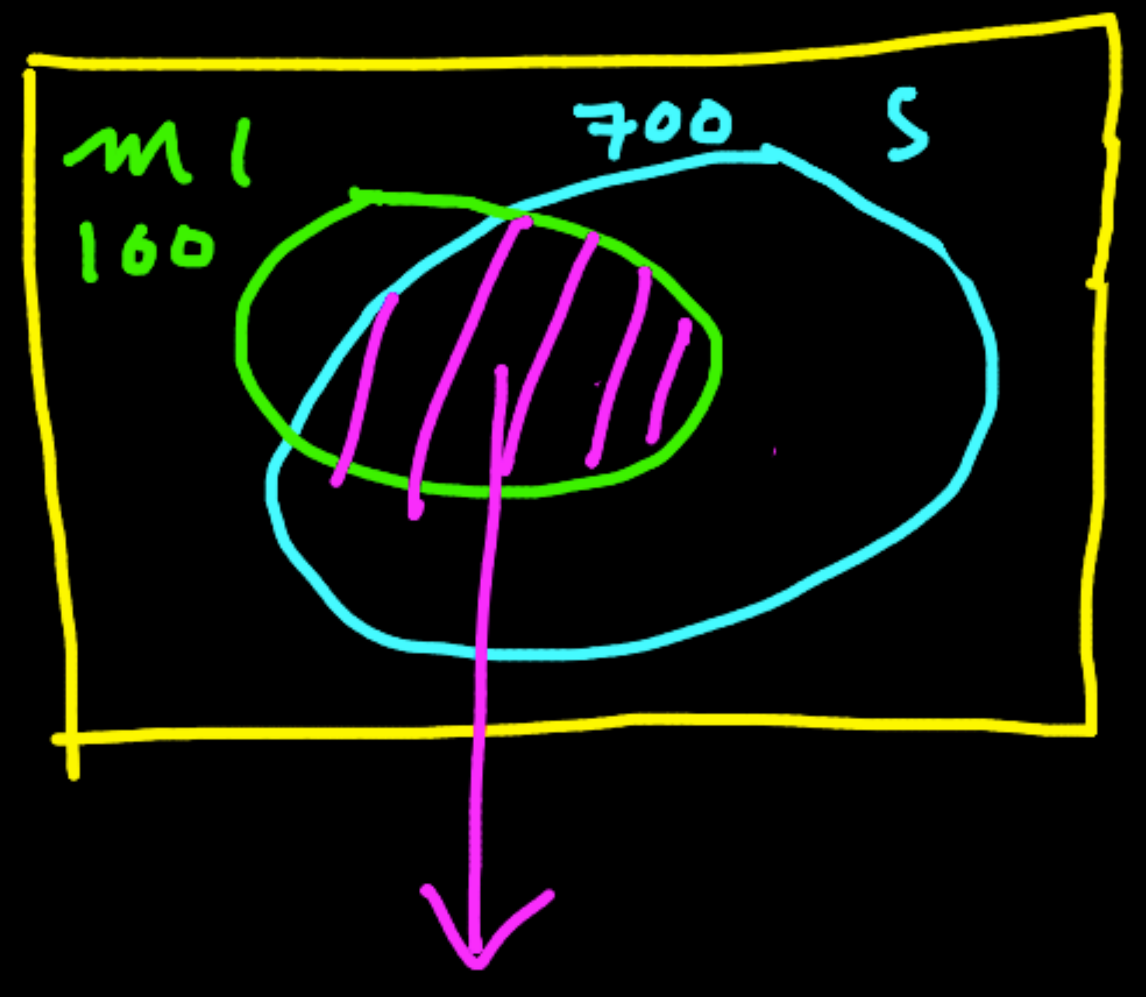
m_1 : patient is given medicine $\rightarrow$ 100

S : patient survived $\rightarrow$ 700

$$P[m_1] = \frac{100}{1000}$$

$$P[s] = \frac{700}{1000}$$

$U = 1000$



$m_1 \cap s \rightarrow 95$

$$P[m_1 \text{ and } S] = \frac{95}{1000}$$

Conditional Probability

Prob of surviving given m_1

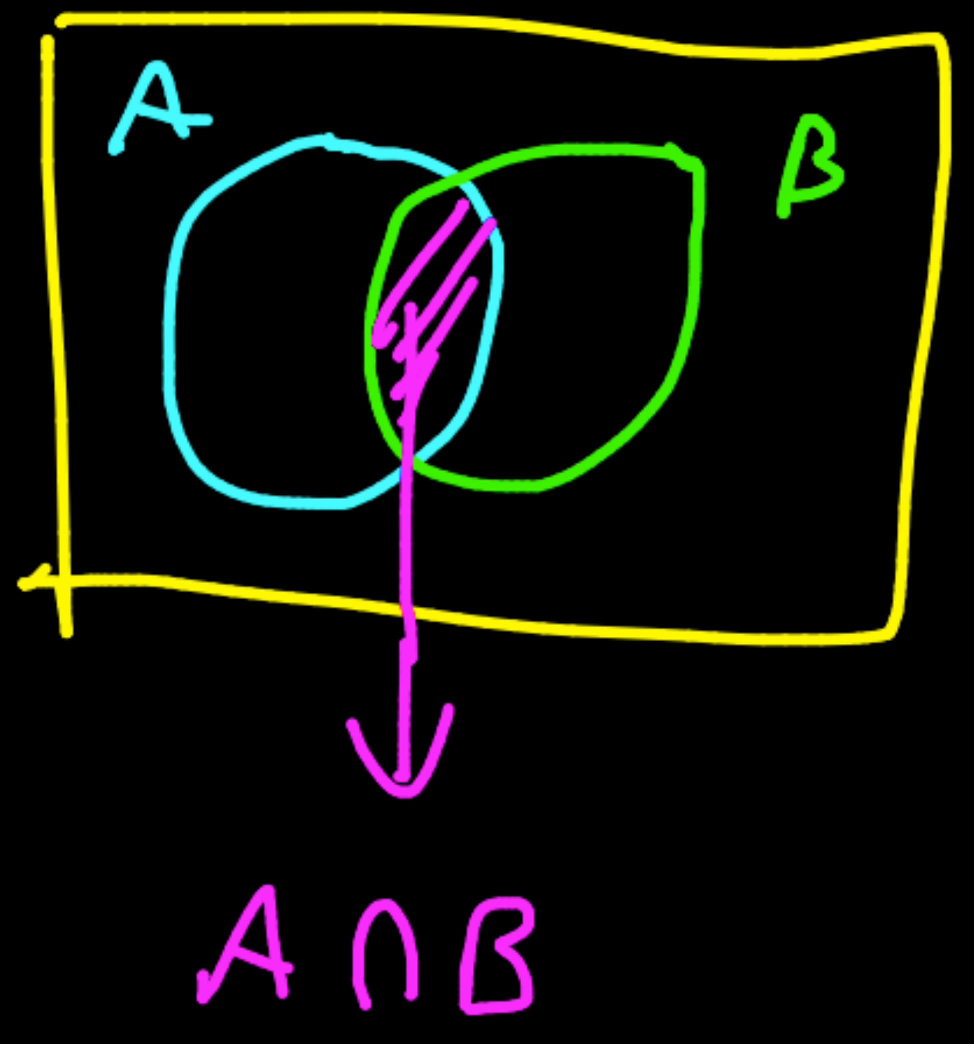
$$P[s \mid m_1] = \frac{95}{100} = \frac{P[s \cap m_1]}{P[m_1]}$$

Prob of m_1 given that patient survived

$$P[m_1 \mid s] = \frac{95}{700} = \frac{P[s \cap m_1]}{P[s]}$$

Definition: [Conditional Prob]

$$P[A|B] = \frac{P(A \cap B)}{P(B)}$$



$$P[B|A] = \frac{P[A \cap B]}{P(A)}$$

Covid example new medicine m2

Independence

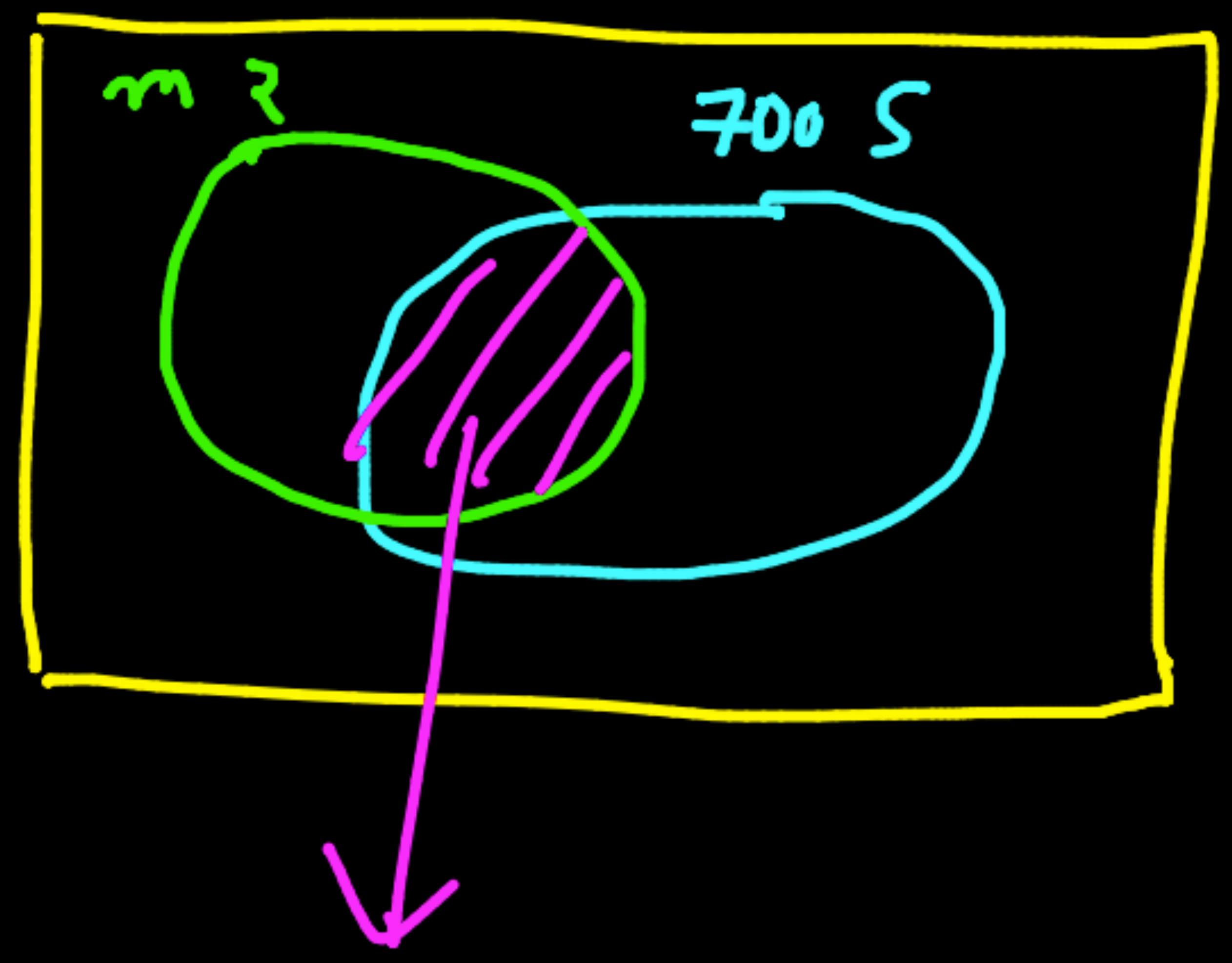
U : all covid patient — 1000

m2 : patient given m2 — 100

S : patients who survived — 700

$$P[m1] = \frac{100}{1000} = 0.1$$

$$P[S] = \frac{700}{1000} = 0.7$$



$m_2 \cap S \rightarrow 70$

Prob of surviving given m2

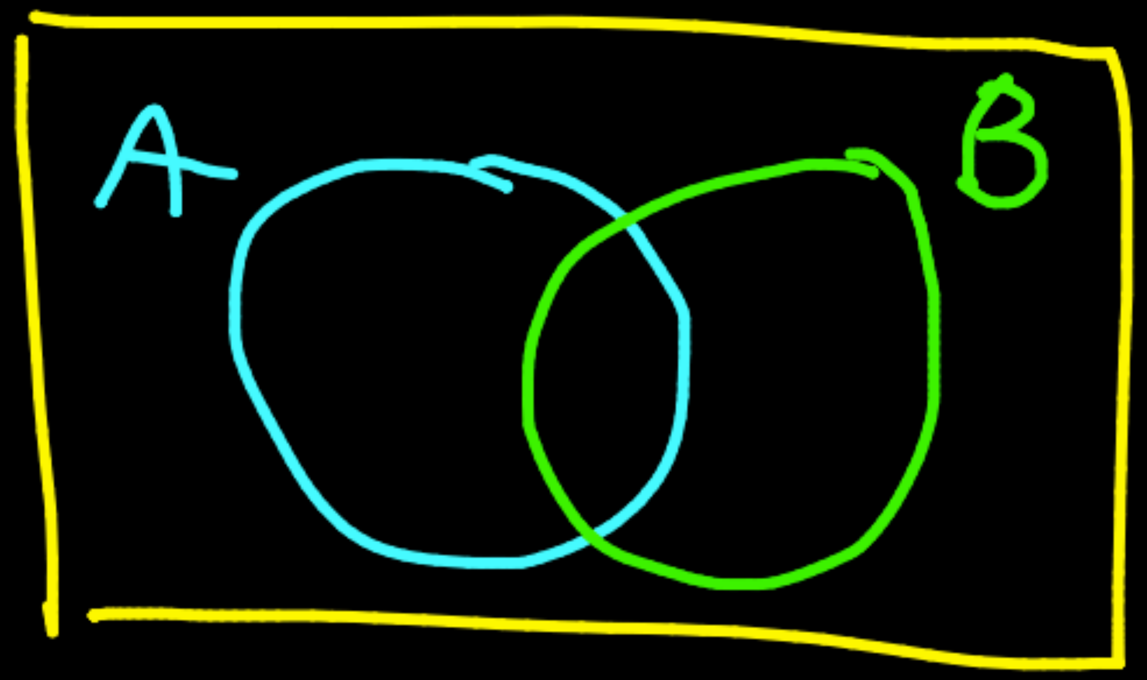
$$P[S \mid m_2] = \frac{70}{100} = 0.7$$

Prob of m2 given survived

$$P[m_2 \mid S] = \frac{70}{700} = 0.1$$

Definition : [Independence]

We say that A and B are independant



if $$P[A|B] = P[A]$$

Coin + Dice

$$S = \left\{ \begin{matrix} (H,1), & (H,2), & \dots & (H,6) \\ (T,1), & (T,2), & \dots & (T,6) \end{matrix} \right\}$$ 12 outcomes

E : Coin is Heads

F : dice is 3

$E = \{(H,1), (H,2) \dots (H,6)\}$ $P(E) = \frac{6}{12} = \frac{1}{2}$

$F = \{(H,3), (T,3)\}$ $P(F) = \frac{2}{12} = \frac{1}{6}$

$E \cap F = \{(H,3)\}$

$P(E \cap F) = \frac{1}{12}$

$$P[E \mid F] = \frac{P[E \cap F]}{P[F]} = \frac{1/12}{2/12} = \frac{1}{2} = P[E]$$

$$P[F \mid E] = \frac{P[E \cap F]}{P[E]} = \frac{1/12}{1/2} = \frac{1}{6} = P[F]$$