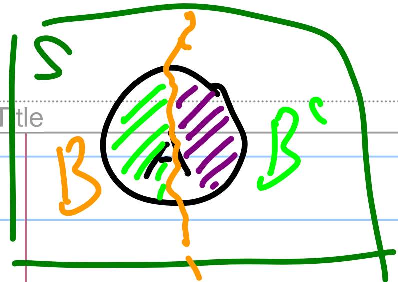


- $P(A) = P(AB) + P(AB^c)$
  $= P(A|B)P(B) + P(A|B^c)P(B^c)$

$p(A|B) = p(AB)/p(B)$

- A man shoots a target. When sunny day, he has 0.8 prob. to hit the target; when raining day, he has 0.4 prob. to hit. The weather has 0.7 prob. to be sunny, and 0.3 prob. to be raining.

#1 define event

A → today is sunny

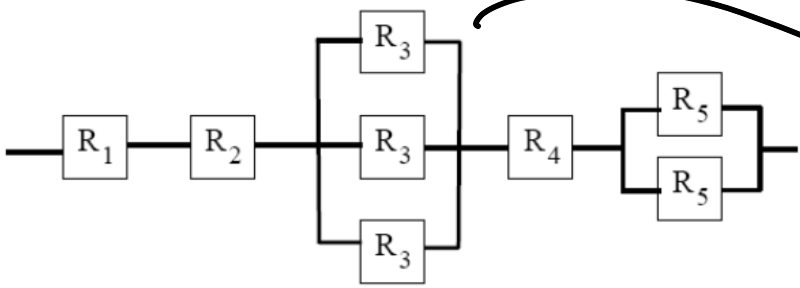
B → today is raining

$P(A) = 0.7 \quad p(B) = 0.3$

- P($\underbrace{\text{hit the target today}}_{E}$)?

$p(E|A) = 0.8, \quad p(E|B) = 0.4$

$$p(E) = p(E|A)\cdot p(A) + p(E|B)\cdot p(B)$$
$$= 0.8 \times 0.7 + 0.4 \times 0.3 = 0.56 + 0.12 = 0.68$$



$$R = P(\overbrace{\text{one}}^{\text{at least}} \text{ of three } R_3 \text{ works})$$
$$= 1 - P(\text{all 3 fail})$$
$$= 1 - (1-R_3)^3$$

$$R_{sys} = R_1 \cdot R_2 \cdot [1-(1-R_3)^3] \cdot R_4 \cdot [1-(1-R_5)^2]$$

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

$$= \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|A^c)P(A^c)}$$ $= p(B)$

$$p(A|B) = p(AB)/p(B)$$
$$\Rightarrow p(AB) = p(B|A) \cdot p(A)$$

$p(\text{hit}|\text{sun}) = 0.8$, $p(\text{hit}|\text{rain}) = 0.4$, $p(\text{sun}) = 0.7$, $p(\text{rain}) = 0.3$

Q: $p(\text{sun}|\overline{\text{hit}})$? $p(\text{rain}|\overline{\text{hit}}) = ?$

$$p(\text{sun}|\overline{\text{hit}}) = \frac{p(\overline{\text{hit}}|\text{sun}) \cdot p(\text{sun})}{p(\overline{\text{hit}})} = \frac{(1-0.8)\times 0.7}{1-0.68} = \frac{0.2\times 0.7}{0.32} = 0.4375$$

$p(D|E) = ?$ know: $p(D) = 0.005$ $p(E|D) = 0.95$

$$p(D|E) = \frac{p(E|D) \cdot p(D)}{\underset{\uparrow ?}{p(E)}}$$

$$= \frac{0.95 \times 0.005}{0.0147}$$

$$= 32.3\%$$

$$p(E) = p(E|D) \cdot p(D) + p(E|D^c) \cdot p(D^c)$$

$$= 0.95 \times 0.005 + 0.01 \times 0.995$$

$$= 0.0147$$

- $P(E|S)=\prod P(w_i|S)$, $P(E|H)=\prod P(w_i|H)$

{dollar, cheap, hurry, sex, ...}

$p(\text{dollar}|S) = 0.2$ $p(\text{dollars}|H) = 0.05$

$p(\text{cheap}|S) = 0.5$ $p(\text{cheap}|H) = 0.01$

$p(S) = 0.1$ $p(H) = 0.9$

new email → {dollar, cheap}

$p(S|E)$? $p(H|E)$?

$p(E|S) = 0.2 \times 0.5$

$$p(S|E) = \frac{p(E|S)\cdot p(S)}{p(E|S)\cdot p(S) + p(E|H)\cdot p(H)}$$

0.05×0.01

$$p(H|E) = \qquad \frac{p(S|E)}{p(H|E)} = 2.2$$