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HW 0

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1. $N = 500$ seniors. 300 boys & 200 girls

Events: D: senior fails B: senior is a boy

A: senior passes G: senior is a girl

a) $P(D) = P(\text{senior fails}) = \frac{28+10}{500} = \frac{38}{500} = 0.076$

b) $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$

$= \frac{272+190}{500} + \frac{300}{500} - \frac{272}{300}$

$= \frac{490}{500} = 0.98$

c) $P(A \cap B) = P(\text{senior passes} \cap \text{senior is a boy}) = \frac{272}{500} = 0.544$

d) $P(B \mid A) = P(\text{senior is a boy} \mid \text{senior passes})$

$$= \frac{P(B \cap A)}{P(A)} = \frac{272/500}{462/500}$$

$$= \frac{272}{462} \approx 0.59$$

e) $P(D \mid G) = \frac{P(D \cap G)}{P(G)} = \frac{10/500}{200/500} = \frac{10}{200} = \frac{1}{20} = 0.05$

f) $P(A \mid \text{not } G)$

G = senior is a girl $\Rightarrow \sim G = B$ = senior is a boy

$P(A \mid \sim G) = P(A \mid B)$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{272/500}{300/500} = \frac{272}{300} \approx 0.91$$

g) D and G

If D ∩ G are independent events, then $P(D \cap G) = P(D) \cdot P(G)$

Note that $P(D \cap G) = 10/500 = 1/50 = 0.02$

and $P(D) \cdot P(G) = \left(\frac{38}{500}\right) \cdot \left(\frac{200}{500}\right) = \frac{7600}{250,000} = \frac{76}{2,500} = 0.0304$

$\Rightarrow P(D \cap G) \neq P(D) \cdot P(G)$ ∴ D and G are not independent events.

- This means that if the event D or G occurs, it will affect the probability of the other event happening. i.e. if D happens, then P(G) changes, and vice versa.

h) are A and G independent events?

A and B are independent $\Leftrightarrow P(A|B) = P(A)$.

Note that $P(A) = \frac{462}{500} = 0.924$ and $P(A|B) = \frac{P(A \cap B)}{P(B)}$

$= \frac{272/500}{300/500} = \frac{272}{300} = 0.544$. $\therefore$ $A \cap B$ are not independent.

this means that $P(A|B) \neq P(A)$ and $P(B|A) \neq P(A)$

i.e. if event A occurs, $P(B)$ will change, and vice versa.