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AMA1104 Assignment 1

1. $P(A) = 3/5 \quad P(B) = 1/6 \quad P(A \cup B) = 7/10$

a) $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= 3/5 + 1/6 - 7/10 = 2/30 = 1/15$

b) $P(A|B) = \dfrac{P(A \cap B)}{P(B)} = \dfrac{1/15}{1/6} = \dfrac{\cancel{6}\,2}{\cancel{15}\,5}$

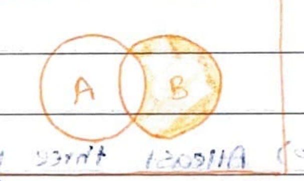
2. $P(A) = 2/7 \quad P(B) = 1/2 \quad P(A|B) = 1/5$

a) $P(B|A) = \dfrac{P(B \cap A)}{P(A)}$

$P(A|B) \cdot P(B) = P(A \cap B)$

$\therefore P(A \cap B) = \dfrac{1}{5} \times \dfrac{1}{2} = \dfrac{1}{10}$

$\therefore P(B|A) = \dfrac{1/10}{2/7} = \dfrac{7}{20}$



b) $P(B|A') = \dfrac{P(A' \cap B)}{P(A')}$

$P(A' \cap B) = P(B) - P(A \cap B)$

$P(A') = 1 - P(A) = 1 - 2/7 = 5/7$

$= 1/2 - 1/10 = 4/10$

$P(B|A') = \dfrac{4/10}{5/7} = \cancel{\dfrac{20}{70}} \quad \dfrac{28}{50}\ \dfrac{14}{25} = \dfrac{14}{25}$

c) $P(B'|A') = \dfrac{P(B' \cap A')}{P(A')}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A \cup B) = 2/7 + 1/2 - 1/10 = 48/70 = 24/35$

$P(B' \cap A') = P(\overline{A \cup B}) = 1 - 24/35 = 11/35$

$P(B'|A') = \dfrac{11/35}{5/7} = \dfrac{11}{25}$

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3. Yellow balls (Y) = 6

Green balls (G) = 9

a) Y G G

$$\frac{6}{15} \times \frac{9}{14} \times \frac{8}{13} = \frac{432}{2730} = \frac{72}{455}$$

b) Both Yellow + Both Green

$$\left(\frac{6}{15} \times \frac{5}{14} \times \frac{9}{13}\right) + \left(\frac{9}{15} \times \frac{8}{14} \times \frac{6}{13}\right)$$

$$= \frac{270}{2730} + \frac{432}{2730} = \frac{702}{2730} = \frac{117}{455} = \frac{9}{35}$$

4. a) Exactly two black cards : two black and two red

total number of black cards : 26

total Number of red cards : 26

$\therefore$ Probability = $\dfrac{\binom{26}{2}\binom{26}{2}}{\binom{52}{4}} = \dfrac{325 \cdot 325}{270725} = 0.3902$

b) Atleast three kings : P(3 kings) + P(4 kings)

Probability = $\dfrac{\binom{4}{3}\binom{48}{1}}{\binom{52}{4}} + \dfrac{\binom{4}{4}}{\binom{52}{4}} = \dfrac{(4 \times 48) + 1}{270725} = \dfrac{193}{270725} = 0.0007$

c) Exactly 2 black cards are drawn given that atleast three kings are drawn.

let P(A) = Getting exactly 2 black cards

let P(B) = Getting atleast three kings

P(A|B) = $\dfrac{P(A \cap B)}{P(B)}$ = [P(Getting 1 black king, 1 black card, 2 red ~~cards~~ kings)

+ P(Getting 2 black kings, 1 red king, 1 red card)

+ P(Getting 2 black kings, 2 red kings)] / P(B)

P(Getting 1 black king, 1 black card, 2 red kings) = $\dfrac{\binom{2}{1} \times \binom{25}{1} \times \binom{\cancel{26}\,2}{2}}{\binom{52}{4}}$

$= \frac{2 \times 25 \times 1}{270725} = \frac{50}{270725}$

P(Getting 2 black kings, 1 red king, 1 red card) $= \frac{\binom{2}{2} \times \binom{2}{1} \times \binom{25}{1}}{\binom{52}{4}}$

$= \frac{1 \times 2 \times 25}{270725} = \frac{50}{270725}$

P(Getting 2 black kings and 2 red kings) $= \frac{\binom{2}{2} \times \binom{2}{2}}{\binom{52}{4}} = \frac{1}{270725}$

$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{50+50+1 \,/ 270725}{270725} = \frac{101}{(270725)^2}$

$= \frac{101}{73292025625} =$

5. a) A and B : dependent
   b) A and C : independent
   c) B and D : dependent
   d) C and D : dependent

6.

	Age	Number	Can Swim (S)
let (A)	<30	45%	90%
let (B)	30-50	30%	60%
let (C)	>50	25%	70%

(a) $P(B|S) = \frac{P(S|B)P(B)}{P(S|A)P(A) + P(S|B)P(B) + P(S|C)P(C)}$

$= \frac{0.6 \times 0.3}{0.45 \times 0.9 + 0.3 \times 0.6 + 0.25 \times 0.7} = \frac{0.18}{0.405 + 0.18 + 0.175} = \frac{0.18}{0.76}$

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$P(B|S) = 0.237$

b) $$P(A|\bar{S}) = \frac{P(\bar{S}|A)P(A)}{P(\bar{S}|A)P(A) + P(\bar{S}|B)P(B) + P(\bar{S}|C)P(C)}$$

$$= \frac{0.1 \times 0.45}{0.1 \times 0.45 + 0.4 \times 0.3 + 0.3 \times 0.25} = \frac{0.045}{0.045 + 0.12 + 0.075} = \frac{0.045}{0.24}$$

$\therefore P(A|\bar{S}) = 0.188$