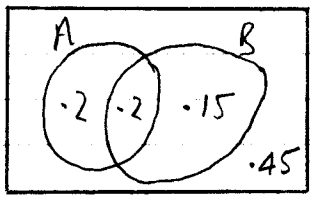
A-LEVEL PROBABILITY MIXED EXERCISE 2

1) $P(A) = 0.4$
$P(B) = 0.35$
$P(A \cap B) = 0.2$



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

$= 0.4 + 0.35 - 0.2$

$= 0.55$

b) $P(A' \cap B') = 0.45$

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

$= \dfrac{0.2}{0.4}$

$= 0.5$

d) $P(A' \mid B) = \dfrac{P(A' \cap B)}{P(B)}$

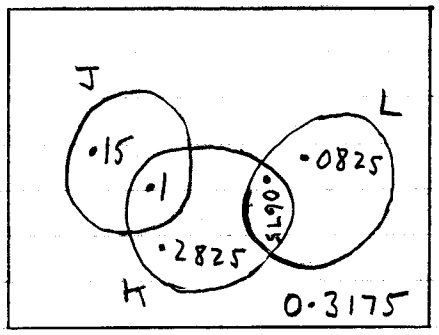
$= \dfrac{0.15}{0.35}$

$= \dfrac{3}{7} = 0.429$

2) $P(J) = 0.25$
$P(K) = 0.45$
$P(L) = 0.15$
$P(J \cap K) = 0.1$

K, L independent
J, L mutually exclusive

a)



K, L independent so

$P(K) \times P(L) = P(K \cap L)$
$·45 \times ·15 = P(K \cap L)$
$0.0675 = P(K \cap L)$

b) i) $P(J \cup K) = P(J) + P(K) - P(J \cap K)$
$= ·25 + ·45 - ·1$
$= 0.6$

ii) $P(J' \cap L') = 0.2825 + 0.3175$
$= 0.6$

iii) $P(J \mid K) = \dfrac{P(J \cap K)}{P(K)}$

$= \dfrac{0.1}{0.45} = \dfrac{2}{9} = 0.222$

iv) $P(K \mid J' \cap L')$

$= \dfrac{P(K \cap (J' \cap L'))}{P(J' \cap L')}$

$= \dfrac{0.2825}{0.6} = 0.471$

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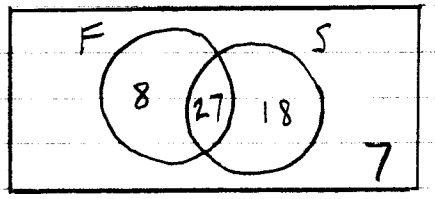
3)



a) $P(\text{Study one}) = \frac{8+18}{60} = \frac{13}{30}$

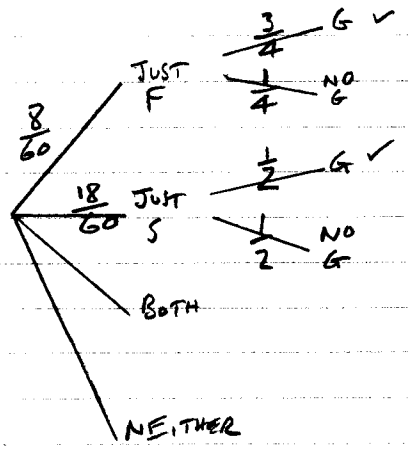
or 0.433

b) $P(F \mid S) = \frac{27}{45} = 0.6$

c) $P(S \mid F') = \frac{18}{18+7} = \frac{18}{25}$

$= 0.72$

d)



$P(\text{studies one lang and has glasses}) = \frac{8}{60} \times \frac{3}{4} + \frac{18}{60} \times \frac{1}{2}$

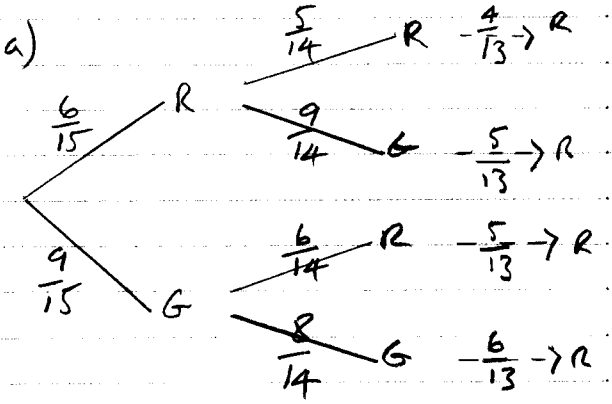
$= \frac{1}{4}$ or 0.25

e) $P(\text{Glasses} \mid \text{One lang}) = \frac{P(\text{One lang} \cap \text{Glasses})}{P(\text{one language})}$

$= \frac{0.25}{\frac{13}{30}} = \frac{15}{26}$

$= 0.577$

4) a)



b) i) $P(\text{Both Green}) = \frac{9}{15} \times \frac{8}{14} = \frac{12}{35}$

$= 0.343$

ii) $P(\text{Different Colours})$

$= \frac{6}{15} \times \frac{9}{14} + \frac{9}{15} \times \frac{6}{14} = \frac{18}{35}$

$= 0.514$

c) $P(\text{Third is Red})$

$= \frac{6}{15} \times \frac{5}{14} \times \frac{4}{13}$

$+ \frac{6}{15} \times \frac{9}{14} \times \frac{5}{13}$

$+ \frac{9}{15} \times \frac{6}{14} \times \frac{5}{13}$

$+ \frac{9}{15} \times \frac{8}{14} \times \frac{6}{13}$

$= \frac{2}{5} = 0.4$

4d) $P(4 \text{ green}) = \frac{9}{15} \times \frac{8}{14} \times \frac{7}{13} \times \frac{6}{12} = \frac{6}{65}$

$= 0.0923$

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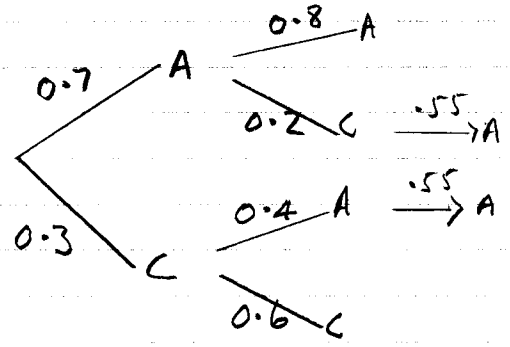
5) a)



$P(\text{Only 2 sets}) = 0.7 \times 0.8 + 0.3 \times 0.6$

$= 0.74$

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b) $P(A \text{ wins} \mid \text{only 2 sets}) = \frac{P(A \text{ wins} \cap \text{only 2 sets})}{P(\text{only 2 sets})}$

$= \frac{0.7 \times 0.8}{0.74}$

$= \frac{28}{37} = 0.757$

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c) $P(A \text{ wins})$

$= P(A \text{ wins in 2 sets}) + P(A \text{ wins in 3 sets})$

$= 0.7 \times 0.8 + 0.7 \times 0.2 \times 0.55 + 0.3 \times 0.4 \times 0.55$

$= 0.703$

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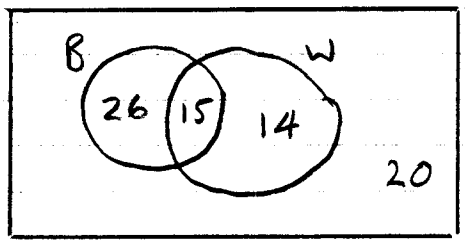
6)



a) $P(\text{Neither white nor black}) = \frac{20}{75} = \frac{4}{15} = 0.267$

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b) $P(B \cap W \mid B) = \frac{P(B \cap W)}{P(B)} = \frac{\frac{15}{75}}{\frac{41}{75}}$

$= \frac{15}{41} = 0.366$

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c) $P(\text{2 with all black paws}) = \frac{26}{75} \times \frac{25}{74} = \frac{13}{111}$

$= 0.117$

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d) $P(\text{2 with some white paws}) = \frac{29}{75} \times \frac{28}{74} = 0.146$

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7) $P(A) = 0.4$, $P(A \cap B) = 0.12$

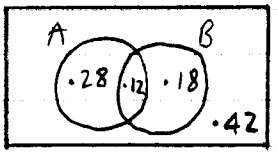
a) Independent so

$$P(A) \times P(B) = P(A \cap B)$$

$$P(B) = \frac{P(A \cap B)}{P(A)} = \frac{0.12}{0.4}$$

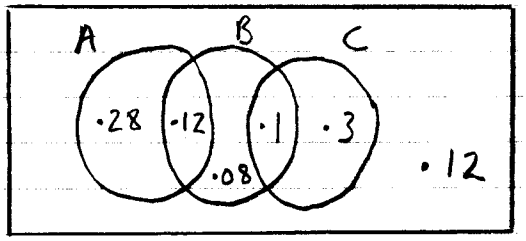
$$P(B) = 0.3$$

b)



$$P(A' \cap B') = 0.42$$

c)



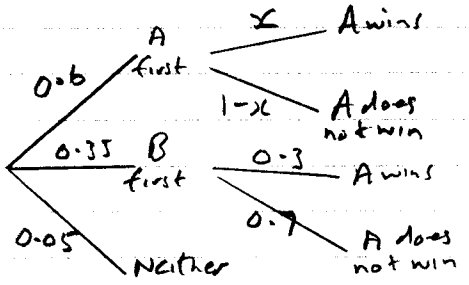
d)

i) $P(B \setminus C) = \frac{0.1}{0.4} = 0.25$

ii) $P(A \cap (B' \cup C)) = 0.28$

8) a) Possibility of 0-0 draw

b)



$P(A \text{ scores first} \cap \text{Wins Match})$

$$0.6 \times x = 0.48$$

$$x = \frac{0.48}{0.6} = 0.8$$

$$\Rightarrow \quad 1 - x = 0.2$$

$P(A \text{ scores first} \cap \text{does not win})$

$$= 0.6 \times 0.2 = 0.12$$

c) Find $P(B \text{ scores first} \setminus A \text{ wins})$

$$= \frac{P(B \text{ first} \cap A \text{ wins})}{P(A \text{ wins})}$$

$$= \frac{0.35 \times 0.3}{0.6 \times 0.8 + 0.35 \times 0.3}$$

$$= \frac{0.105}{0.585} = \frac{7}{39}$$

$$= 0.179$$