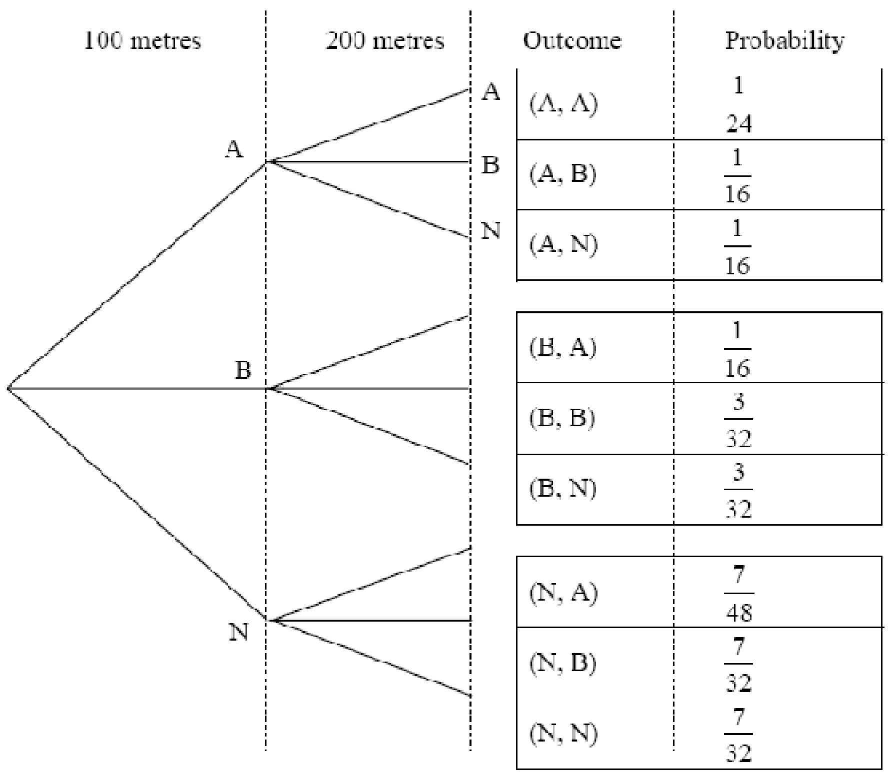
Module 3 – Solutions

3.1 Tree Diagrams

(i)

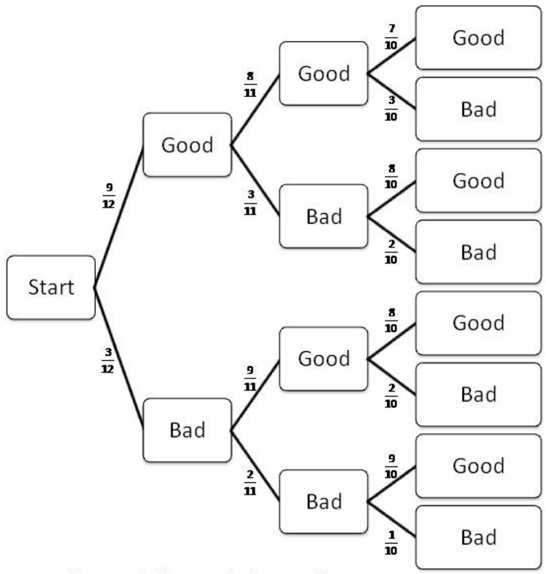
	Alex	Bobby	Neither
100 metre race	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{7}{12}$
200 metre race	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$

(ii)



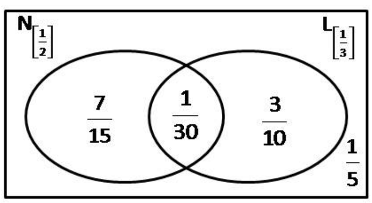
(iii) $\frac{1}{16}+\frac{1}{16}=\frac{1}{8}$

3.2



$$\left(\frac{9}{12}\times\frac{3}{11}\times\frac{2}{10}\right)+\left(\frac{3}{12}\times\frac{9}{11}\times\frac{2}{10}\right)+\left(\frac{3}{12}\times\frac{2}{11}\times\frac{9}{10}\right)=\frac{27}{220}$$

3.3



$$\left(\frac{1}{2}-x\right)+x+\left(\frac{1}{3}-x\right)=\frac{4}{5}$$

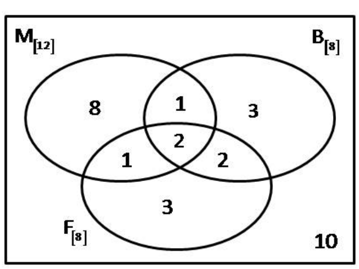
$$\frac{5}{6}-x=\frac{4}{5}$$

$$x=\frac{5}{6}-\frac{4}{5}$$

$$x=\frac{1}{30}$$

$$P(\text{both})=\frac{1}{30}$$

3.4



(a) $P(\text{at least one of the three subjects})=\frac{20}{30}=\frac{2}{3}$

(b) $P(\text{only one of the three subjects})=\frac{8+3+3}{30}=\frac{14}{30}=\frac{7}{15}$

(c) $P(\text{French but not boilogy})=\frac{4}{30}=\frac{2}{15}$

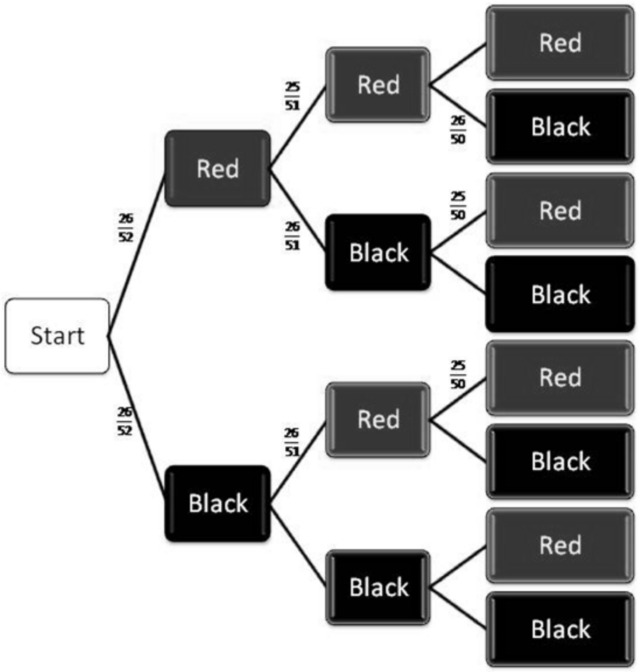
3.5 Counting Method:

$$P(\text{2 red and 1 black}) = \frac{{}^{26}C_2 \times {}^{26}C_1}{{}^{52}C_3} = \frac{13}{34}$$

Non Counting Method:

$$P(\text{2 red and 1 black}) = P(R).P(R).P(B) + P(R).P(B).P(R) + P(B).P(R).P(R)$$

$$P(\text{2 red and 1 black}) = \frac{26}{52}\cdot\frac{25}{51}\cdot\frac{26}{50} + \frac{26}{52}\cdot\frac{26}{51}\cdot\frac{25}{50} + \frac{26}{52}\cdot\frac{26}{51}\cdot\frac{25}{50} = \frac{13}{34}$$



3.6 Counting Method:

$$P(\text{4 Kings and 1 Queen}) = \frac{{}^{4}C_4 \times {}^{4}C_1}{{}^{52}C_5} = \frac{1}{659740}$$

Non Counting Method:

$$P(\text{4 Kings and 1 Queen}) = P(K).P(K).P(K).P(K).P(Q) + P(K).P(K).P(K).P(Q).P(K) + P(K).P(K).P(Q).P(K).P(K)$$
$$+ P(K).P(Q).P(K).P(K).P(K) + P(Q).P(K).P(K).P(K).P(K)$$

$$P(\text{4 Kings and 1 Queen}) = \frac{4}{52}\cdot\frac{3}{51}\cdot\frac{2}{50}\cdot\frac{1}{49}\cdot\frac{4}{48} + \frac{4}{52}\cdot\frac{3}{51}\cdot\frac{2}{50}\cdot\frac{4}{49}\cdot\frac{1}{48} + \frac{4}{52}\cdot\frac{3}{51}\cdot\frac{4}{50}\cdot\frac{2}{49}\cdot\frac{1}{48}$$
$$+ \frac{4}{52}\cdot\frac{4}{51}\cdot\frac{3}{50}\cdot\frac{2}{49}\cdot\frac{1}{48} + \frac{4}{52}\cdot\frac{4}{51}\cdot\frac{3}{50}\cdot\frac{2}{49}\cdot\frac{1}{48} = \frac{1}{649740}$$

3.7

$$\text{Probability} = \frac{\text{No. of favourable outcomes}}{\text{Total number of outcomes}} = \frac{{}^{6}C_4 \times {}^{1}C_1 \times {}^{38}C_1}{{}^{45}C_6} = \frac{19}{271502}$$