F Summer Probability Tree Diagrams

1. Mr Stone gets breakfast in the morning with probability $\frac{1}{3}$, else he has nothing. If he has breakfast there is a $\frac{3}{4}$ chance he will be in a good mood. If he has not had breakfast there is a $\frac{1}{5}$ chance he will be in a good mood. On a randomly chosen day what is the probability Mr Stone will be in a good mood? $\boxed{\frac{23}{60}}$

2. A darts player is aiming for trebles. If his pervious throw is a treble then the probability his next throw is a treble is $\frac{2}{3}$. If his previous throw is not a treble then the probability his next throw is not a treble is $\frac{3}{4}$. On his first throw of three he has a $\frac{1}{2}$ probability of hitting a treble. On a round of three throws, find the probability he hits exactly two trebles. $\boxed{\frac{17}{72}}$

3. There are 4 red, 2 green and 5 black counters in a bag. Two are taken from the bag at once. Find the probability they are

   (a) the same colour. $\boxed{\frac{17}{55}}$

   (b) different colours. $\boxed{\frac{38}{55}}$

   What do you notice about your answers to parts (a) and (b)? Explain.

4. There are 3 red, 4 yellow and 5 green balls in a bag. Three balls are taken *without replacement*. Find the probability that the three balls contain exactly two of one colour and one of another. $\boxed{\frac{29}{44}}$

5. There are 3 red, 4 yellow and 5 green balls in a bag. Three balls are taken one at a time *with replacement*. Find the probability that the three balls contain exactly two of one colour and one of another. $\boxed{\frac{2}{3}}$

6. There are r red beads and 3 blue beads in a bag. Two beads are taken at once from the bag. The probability they are both blue is $\frac{3}{28}$. Find r. $\boxed{r = 5}$

7. I have 44 socks in my drawer, each sock either red or black. In the dark I randomly pick two socks. The probability they do not match is $\frac{192}{473}$. How many of the 44 socks are red? [Maclaurin 2011] $\boxed{r = 12 \text{ or } r = 32}$

8. A bag contains 3 red, 4 blue and g green beads. Two balls are taken from the bag at once. The probability they are different colours is $\frac{13}{18}$. Find g. $\boxed{g = 2}$

9. A prisoner is brought in front of the Emperor. The Emperor tells the prisoner he must distribute 100 white beads and 100 black beads into two urns as he wishes (there must be at least one bead in each urn). He is told that he will then be blindfolded and he will then pick one of the urns at random and pick a bead at random from the selected urn. If the bead is white he will be set free. Otherwise he will have to listen to Justin Bieber songs for all eternity (i.e. a fate worse than death). Find the maximum probability that he is set free (if he is smart and comes up with the best possible solution). $\boxed{\frac{149}{199}}$

10. A pack of seeds tells me that each seed has a $\frac{2}{3}$ chance of flowering (independent of each other).

    (a) If I plant three seeds, what is that probability that two of them flower? $\boxed{\frac{4}{9}}$

    (b) If I plant six seeds, what is the probability that four of them flower? [Here you don't want to draw the tree diagram, but visualise it and try to count the number of routes through the diagram with the desired properties.] $\boxed{\frac{80}{243}}$

11. There are r red beads and b blue beads in a bag. Two beads are taken from the bag *with replacement*. The probability they are both different colours is $\frac{12}{25}$. Find $\frac{b}{r}$. $\boxed{\frac{b}{r} = \frac{2}{3} \text{ or } \frac{b}{r} = \frac{3}{2}}$