## Tree Diagrams

Starter

1.   **(Review of last lesson)** Erik has a takeaway twice a week. The probability he has an Indian is 0.3, the probability he has Chinese is 0.5 and the probability he has a Thai meal is 0.2. Find the probability that he has the same type of meal on each day one week.

   Working: P(Indian, Indian) $= $ P(Indian) $\times$ P(Indian) $= 0.3 \times 0.3 = 0.3^2 = 0.09$
   P(same type of meal) $= 0.3^2 + 0.5^2 + 0.2^2 = 0.38$

2.   While driving to work, Sarah passes through 2 sets of traffic lights. The probability the 1st is green is 0.4 and the probability the second is green is 0.3.
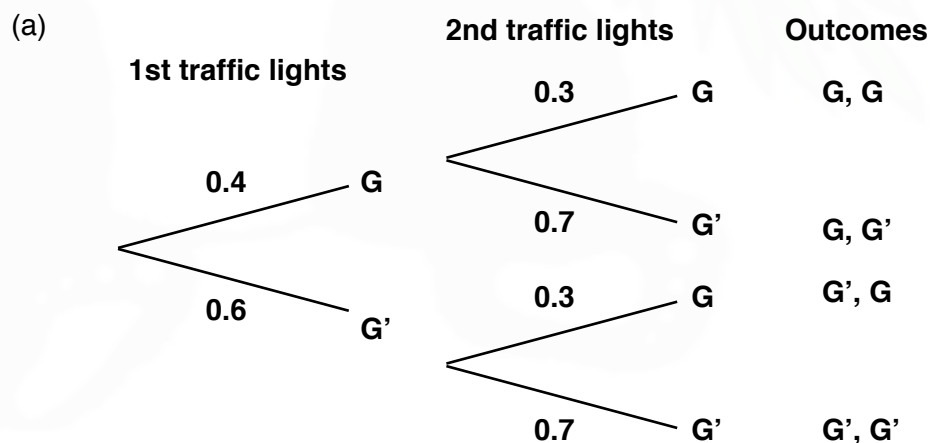   (a)   Copy and complete the tree diagram.
      N.B. G' means "not green"

2nd traffic lights   **Outcomes**

1st traffic lights

G   G, G'

G

G'

G

G'

G'
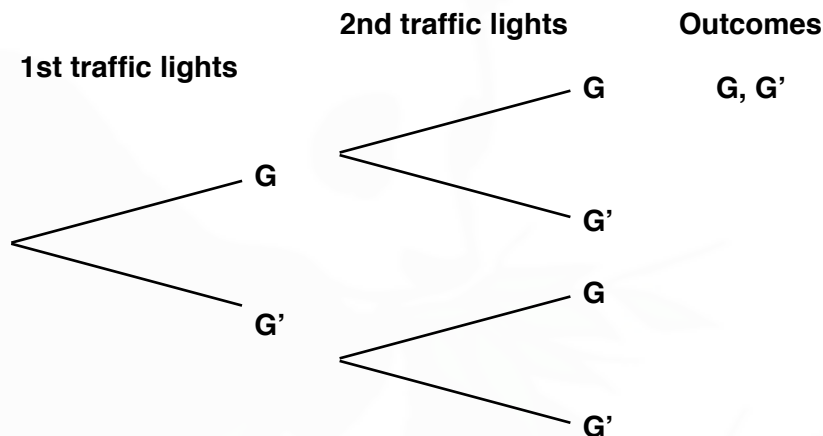
   (b)   Find:
      (i)   P(1st set is green but 2nd set is not green),
      (ii)   P(only one set of traffic lights is green),
      (iii)   P(at least one set of traffic lights is green)

   Working: (a)   **2nd traffic lights**   **Outcomes**
            1st traffic lights
                                          0.3   G   G, G
            0.4   G
                              0.7   G'   G, G'
            0.6   G'   0.3   G   G', G

                                          0.7   G'   G', G'

   (b) $P(G, G') = 0.4 \times 0.7 = 0.28$

   (c) $P(G, G') + P(G', G) = 0.4 \times 0.7 + 0.6 \times 0.3$
         $= 0.28 + 0.18 = 0.46$

   (d)   Use answer to (c)
      $P(\text{at least 1 green}) = P(1 \text{ green}) + P(2 \text{ greens})$
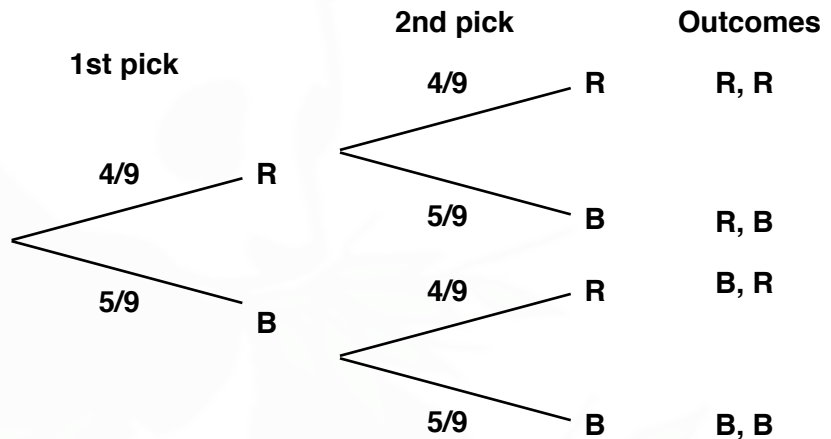 $= 0.46 + 0.4 \times 0.3$
      $= 0.46 + 0.12 = 0.58$

Alternatively: $P(\text{at least 1 green}) = 1 - P(\text{no greens})$
$$= 1 - 0.6 \times 0.7$$
$$= 0.58$$

N.B. "One green light" means **G, G'** *or* **G', G** — *THIS IS IMPORTANT*

E.g. 1 A bag has 9 discs — 4 red and 5 blue. A disc is chosen at random from the bag and the colour is noted. The disc is then replaced before another disc is chosen.
    (a)   Draw a tree diagram to represent the above..
    (b)   Use your tree diagram to find:
        (i)   P(R, R)
        (ii)   P(only 1 red disc)
        (iii)   P(at least 1 red disc)

Working: (a)

		2nd pick	Outcomes
	1st pick	4/9 R	**R, R**
4/9 **R**		5/9 B	**R, B**
		4/9 R	**B, R**
5/9 **B**		5/9 B	**B, B**

N.B.   4/9 means $\dfrac{4}{9}$

    (b) $P(R, R) = P(R) \times P(R) = \dfrac{4}{9} \times \dfrac{4}{9} = \dfrac{16}{81}$

    (c)   Only 1 red disc means R, B *or* B, R
$$P(1 \text{ red disc}) = P(R, B) + P(B, R)$$
$$= \dfrac{4}{9} \times \dfrac{5}{9} + \dfrac{5}{9} \times \dfrac{4}{9} = \dfrac{40}{81}$$

    (d)   There are two ways to do this:
        1.   P(at least 1 red disc) = 1 — P(no red discs)
$$= 1 - P(B, B)$$
$$= 1 - \dfrac{5}{9} \times \dfrac{5}{9}$$
$$= \dfrac{56}{81}$$
        2.   P(at least 1 red disc) = P(1 red disc) + P(2 red discs)
$$= \dfrac{40}{81} + \dfrac{4}{9} \times \dfrac{4}{9}$$
$$= \dfrac{56}{81}$$

Video: **Tree diagrams**

Solutions to Starter and E.g.s

Exercise
9-1 class textbook: p253 M8.10 Qu 2-12 (even)
A*-G class textbook: p216 M8.7 Qu 2-12 (even)
9-1 homework book: p87 M8.7 Qu 1-5
A*-G homework book: p62 M8.7 Qu 1-5 (qu 3 - draw a tree diagram)

Homework book answers (only available during a lockdown)