

Cambridge International AS & A Level

Mathematics

9709/52

Paper 5 Probability & Statistics 1

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Question No (4)

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Question No (4)

Vehicles approaching a certain road junction from Bromley must go either left, right or straight on. Over time, it is known that 30% turn left, 25% turn right and 45% go straight on. The driver of each vehicle chooses a direction independently of all other drivers.

- (a) Find the probability that the next three vehicles approaching this junction from Bromley all go in different directions.
- (b) Find the probability that, from the vehicles approaching this junction from Bromley today, the 1st vehicle to go left is before the 9th vehicle.
- (c) Find the probability that, from the vehicles approaching this junction from Bromley today, the 2nd vehicle to go left is the 7th vehicle.

Solution:

$$(a) \quad \text{Turn left, } L = 30\% \\ = \frac{30}{100} = 0.3$$

$$\text{Turn right, } R = 25\% \\ = \frac{25}{100} = 0.25$$

$$\text{straight on, } S = 45\% \\ = \frac{45}{100} = 0.45$$

$$p = 6 \times (0.30) \times (0.25) \times (0.45)$$

↓
options

↓
L

↓
R

↓
S

[options = 6, as for first vehicle, there are three options (L, R, S) and for second vehicle there is 2 options (R, S) and for third vehicle there is 1 option (S), so total options are $3 \times 2 \times 1 = 6$]

$$p = 0.2025$$

⑥

Left, 0.3

$$\text{Not Left} = 1 - 0.3 \\ = 0.7$$

so the probability none of the first 8 turn left is $(0.7)^8$. Therefore the desired probability is

$$1 - (0.7)^8 \\ = 0.942$$

⑦

Left, $L = 0.3$ not left, $= 0.7$

For 2nd left occurs at 7th vehicle

$$P = \frac{\binom{6}{1} (0.3)^1 (0.7)^5 \times (0.3)}{\downarrow \quad \downarrow}$$

in first 6 vehicle 7th vehicle
only 1 turn left turn left

$$P = 6 \times (0.3)^2 (0.7)^5 = 0.0908$$

