

## Scrabble

In Scrabble, players pick letter tiles at random from a bag of 100 tiles.

Some letters are more common in English, so there are more of them in the game.

Events are **mutually exclusive** if they cannot happen at the same time. The chance of one or the other happening can be found by adding each probability.

*Eg: chance of an S or a Blank on the first tile:  $\frac{4}{100} + \frac{2}{100} = \frac{6}{100}$ .*

Events are **independent** if they do not affect one another. The chance of these events all happening can be found by multiplying their probabilities.

*Eg: chance of the first tile being an E for two games in a row:  $\frac{12}{100} \times \frac{12}{100} = \frac{144}{10000}$ .*

If events are **not independent** then a tree diagram can be used to work out what the different probabilities would be before multiplying.

*Eg: chance of the first four tiles drawn all being A:  $\frac{9}{100} \times \frac{8}{99} \times \frac{7}{98} \times \frac{6}{97} = \frac{3024}{94109400}$ .*

Tile	Frequency
Blank	2
A	9
B	2
C	2
D	4
E	12
F	2
G	3
H	2
I	9
J	1
K	1
L	4
M	2
N	6
O	8
P	2
Q	1
R	6
S	4
T	6
U	4
V	2
W	2
X	1
Y	2
Z	1
Total:	100

**1.** What is the chance of drawing a vowel for the first letter?

**2.** I play four games of scrabble. What is the chance of getting a vowel for the first letter in all four games?

**3.** I draw 7 tiles at the start of a game. What is the chance that they are all vowels?

**4.** Towards the end of the game, there are only 5 tiles left in the bag – a K, two Es, a blank and a T. I pick out two tiles. What is the chance that I get the blank? What is the chance that I don't?

**5.** I draw three tiles from the bag at the start of a game. What is the chance that one of them is a Z?  
Hint: First work out the chance of not getting a Z at all.

# Scrabble SOLUTIONS

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Total:	100

1. What is the chance of drawing a vowel for the first letter?

$$P(A \cup E \cup I \cup O \cup U) = P(A) + P(E) + P(I) + P(O) + P(U) \\ = 9\% + 12\% + 9\% + 8\% + 4\% = \mathbf{42\%}$$

2. I play four games of scrabble. What is the chance of getting a vowel for the first letter in all four games?

$$P(\text{vowel first for 4 games}) \\ = P(\text{vowel}) \times P(\text{vowel}) \times P(\text{vowel}) \times P(\text{vowel}) \\ = 0.42 \times 0.42 \times 0.42 \times 0.42 = 0.03111696 \approx \mathbf{3.1\%}$$

3. I draw 7 tiles at the start of a game. What is the chance that they are all vowels?

$$\frac{42}{100} \times \frac{41}{99} \times \frac{40}{98} \times \frac{39}{97} \times \frac{38}{96} \times \frac{37}{95} \times \frac{36}{94} \approx \mathbf{0.001685 \text{ or } 0.17\%}$$

4. Towards the end of the game, there are only 5 tiles left in the bag – a K, two Es, a blank and a T. I pick out two tiles. What is the chance that I get the blank? What is the chance that I don't?

$$\text{No blank: } P(\text{noblack} \cap \text{noblack}) = \frac{4}{5} \times \frac{3}{4} = \frac{3}{5}$$

$$\text{Blank: } 1 - \frac{3}{5} = \frac{2}{5}$$

5. I draw three tiles from the bag at the start of a game. What is the chance that one of them is a Z?

Hint: First work out the chance of not getting a Z at all.

$$P(\text{NotZ} \cap \text{NotZ} \cap \text{NotZ}) = \frac{99}{100} \times \frac{98}{99} \times \frac{97}{98} = \frac{97}{100}$$

$$P(\text{Z in first 3}) = 1 - P(\text{NotZ} \cap \text{NotZ} \cap \text{NotZ}) = 1 - \frac{97}{100} = \frac{3}{100} = \mathbf{3\%}$$