

Probability Book 1

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Edition 1



Probability

Probability theory is the mathematics which assigns a numerical value (between 0 and 1) to the chance or likelihood of an event occurring. The probability of an event E occurring is written as $\Pr(E)$ and it is defined as :

$$\Pr(E) = \frac{\text{The number of ways event E can occur}}{\text{Total number events that can occur}} = \frac{n(E)}{n(S)} \text{ where } 0 \leq \Pr(E) \leq 1$$

Most of the two unit problem questions and many of the three unit questions can be answered by drawing up a sample space and actually counting all the events in that space.

e.g. Tossing a coin or coins, rolling dice, drawing balls from and urn, etc. More complicated examples occur when there are composite events, such as rolling a dice and tossing a coin. With composite it is important to correctly enunciate the conjunction between the two events.

E1 and E2 means that the probabilities are multiplied.

E1 or E2 means that the probabilities are added.

Note the theory of total probability :

$$\Pr(A \text{ or } B) = \Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(AB)$$

This theorem could be demonstrated with the simple example of tossing a coin and rolling a dice simultaneously. The sample space is as follows :

	Dice	1	2	3	4	5	6
Coin	Heads	H,1	H,2	H,3	H,4	H,5	H,6
	Tails	T,1	T,2	T,3	T,4	T,5	T,6

Consider the sample space for rolling two fair dice :

1,6	2,6	3,6	4,6	5,6	6,6
1,5	2,5	3,5	4,5	5,5	6,5
1,4	2,4	3,4	4,4	5,4	6,4
1,3	2,3	3,3	4,3	5,3	6,3
1,2	2,2	3,2	4,2	5,2	6,2
1,1	2,1	3,1	4,1	5,1	6,1

There are many past HSC questions that could have been answered using this sample space.

a $\frac{4}{52} \times \frac{3}{51} \times \frac{2}{50} = \frac{1}{5525}$

b $\frac{1}{8}$

c $\frac{1}{20}$

d $\frac{1}{8}$

e $\frac{4}{11} \times \frac{3}{10}$

f $\frac{12}{51} = \frac{4}{17}$

g $\frac{1}{4} \times \frac{1}{4}$

h (i) $\frac{3}{7} \times \frac{2}{6} \times \frac{1}{5}$ (ii) $\frac{4}{7} \times \frac{3}{6} \times \frac{2}{5}$

i (i) $\frac{2}{5}$ (ii) $\frac{3}{5}$

j $SSC \times 3 = \frac{12}{35}$

k $\frac{3}{8}$

l (i) $\frac{4}{17}$ (ii) $\frac{13}{17}$

m $\left(\frac{5}{6}\right)^3$

n $1 - \frac{3}{7} \times \frac{2}{6} = \frac{6}{7}$

o $\left(\frac{3}{6} \times \frac{2}{5}\right)^2 = \frac{1}{25}$

p $\frac{5}{35} = \frac{1}{7}$

q $\frac{2}{5} \times \frac{1}{4} = \frac{1}{10}$