

INTRODUCTION TO PROBABILITY

© Nick Lee and Mike Peters 2016.

QUESTION 1.

A couple of things I hated about introductory statistics books: they always used dice and playing cards to explain basic probability. So, not to break the mould:

Below is one way of representing the sample space of two six sided dice. In the diagram the combination of throwing one die first and throwing another die second, is indicated by a *. In the blank representation show the actual combinations.

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

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

QUESTION 2.

Using the diagram from question 1 for the two dice, complete the following questions:

The probability of throwing a 4 on one die and a 5 on the other is: $\frac{2}{36}$

$\frac{1}{6}$ is the probability of throwing a total of: 2 or 12

The probability of throwing a total of 1 is 0

The probability of throwing a 5 on the first die and a 6 on the second is $\frac{1}{36}$

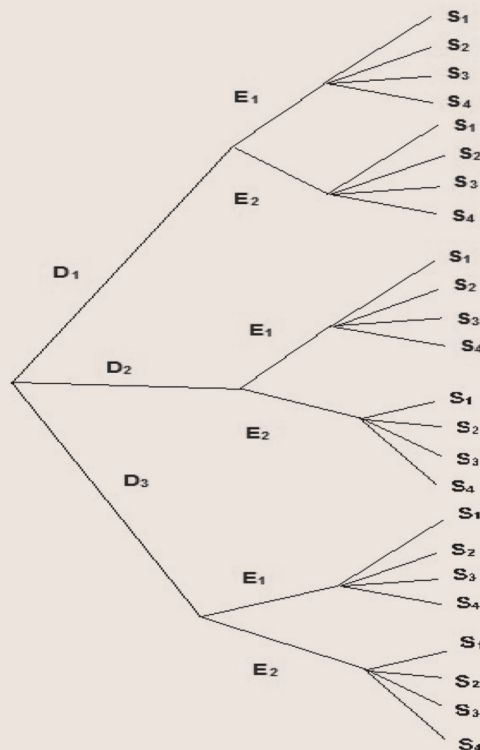
1 is the probability of getting a total!

QUESTION 3.

The company you are working for wants to launch a new product. You have been asked to set up some working groups comprised of 3 people. You have to select one person from the design team, a production engineer and a sales representative. The company employs 3 designers, 2 production engineers and 4 sales representatives.

The number of working groups would be (use the counting rule): 24

Draw a tree diagram below to verify your answer



QUESTION 4.

The new product identified in question 3 requires a 4 digit identifier.

The number of unique 4 digit identifiers	
- allowing repetitions is:	9000
- without repetitions is:	4536
- where the last digit is 0 and repetitions are not allowed is:	504

QUESTION 5.

You have been asked by your line manager to set up a product review team. Twelve employees have asked to be considered and you need to select five. You have interviewed all of them and must now decide who to appoint to ensure the team will work effectively (you have classified five applicants as pragmatists and seven as organisers)

The number of possible team arrangements:	
- allowing any combination is:	350
- where you want one member to be a particular organiser is:	150
- where you don't want two particular pragmatists is:	105

QUESTION 6.

You have been asked to analyse the results of a customer satisfaction survey. The survey showed that 30% of customers were dissatisfied due to poor customer service, 20% due to lack of product information and 12% due to problems with the electronic payment system.

The probability of a customer being dissatisfied because of	
- poor customer service is:	0.3
- the lack of product information is:	0.2
- the problems with the electronic payment system is:	0.12
- poor customer service and poor product information is:	0.06

QUESTION 7.

Complete the following table:

The independence of two events can be defined as $P(A B) = P(A)$
Two events are mutually exclusive if $P(A) + P(B) = P(A \cup B)$
The multiplication rule for two independent events is $P(A \cap B) = P(A) \times P(B)$

QUESTION 8.

The company you work for produces a paper based catalogue and an online version. 75% of the customers receive the paper based version, and you know if they receive the paper based catalogue 60% also use the online version.

The probability of a customer having the paper based catalogue and the online version is: 0.45

The probability of the next two customers wanting the paper based catalogue only is: 0.2

The probability of the next three customers wanting the online catalogue is: 0.09

QUESTION 9.

On a production line there are two component bins. Bin 1 is known to contain three faulty components and two good components and bin 2 contains two faulty components and eight good ones. A quality control inspector has identified a faulty component.

The probability the component came from bin 1 is:	0.6
---	-----

MINI PROJECT

The company you work for receives components from two different suppliers. The purchasing manager wants to rationalise the supplier list and has asked you to recommend which of these two suppliers should be awarded a contract as the sole provider.

70% of the components come from Screwifixings Ltd., and the remaining 30% from Upurs Ltd. In the past, 98% of the components from Screwifixings Ltd. have been good and 95% of the components from Upurs Ltd. have been good.

In a recent fatal car crash, a component manufactured by your company was identified as the cause of the failure of the braking system, resulting in the crash. You have been asked to produce a report identifying who was the most likely supplier of the faulty component.

The audience for your report has a good knowledge of statistics and can interpret tree diagrams, probability trees and Bayes' Theorem.

And finally...

Knowing what you know now, what is the probability you would have studied basket weaving instead?