PROBABILITY & COUNTING

18 AUGUST 2014

Lesson Description

In this lesson we:

- Revise:
  - Dependent and independent events;
  - The product rule for independent events: **P(A and B) = P(A) × P(B).**
  - The sum rule for mutually exclusive events A and B: **P(A or B) = P(A) + P(B)**
  - The identity: **P(A or B) = P(A) + P(B) – P(A and B)**
  - The complementary rule: **P(not A) = 1 – P(A)**
- Probability problems using Venn diagrams, Tree diagrams, two-way contingency tables and other techniques to solve probability problems (where events are not necessarily Independent).

- Apply the fundamental counting principle to solve probability problems.

Summary

Probability Rules

Mutually Exclusive Events

These are events that **cannot** both happen together. For example, drawing a club or drawing a red card.

Non Mutually Exclusive Events

These are events that **can** both happen together. For example, drawing a club or drawing an Ace.

Independent events

These are events where the likelihood of one happening is not influenced by the likelihood of the other happening

Test yourself

Simply write True or False, no working is required.

Question 1

The events "tossing a head on a coin" and "throwing an even number on a die" are independent of one another.

Question 2

The events "selecting a boy" and "selecting a left-hander" are mutually exclusive.

Question 3

If P(A) = 0.3, P(B) = 0,2 and P(A ∩ B) = 0.06 then events A and B are independent of one another.

Question 4

I toss a coin and it comes up heads 7 times in a row. The probability that it will come up heads on the 8th row is therefore slightly less than 0.5

Question 5

The complement of "at least one day of rain in the next 5" is "one day of rain in the next 5".

Determine the following probabilities using any method you prefer:

Question 6

The probability of drawing a red card from a well shuffled pack.

Question 7

The probability of throwing a multiple of 3 on a 20 sided-die.

Question 8

The probability of having 2 boys in a 2 child family.

Question 9

The probability of drawing a red card or an Ace from a well shuffled pack.

Question 10

The probability of drawing a red bead out of a bag containing red, blue and green beads if
$$P(blue \quad or \quad green) = 0.73$$

Improve your Skills

Question 1

A **play list** on my IPod has 15 songs on. 5 of them are by male artists and the balance by females. If I start playing the **play list** in random shuffle mode then what is the probability that the next three songs are all by male artists? Note that the IPod will not repeat a song before it has played the entire **play list**. Express your answer as a percentage to one decimal place.

Question 2

A card is chosen at random from a standard pack of 52 cards. It is then replaced. This experiment is carried out 520 times. Give the expected number of times for which the card is:

a.)	A club	(2)
b.)	An ace	(2)
c.)	Either an Ace or a Club?	(3)

Question 3

The probability that it will be sunny on Sunday is 70% and the probability that it will be cloudy, 30%. If it is sunny then I have an 80% chance of catching a fish and, if cloudy, only 60%.

a.) Draw a tree diagram to represent all possible outcomes. (4)
b.) Using your diagram, or otherwise, determine the probability that I catch a fish. (4)

Question 4

A British computer company, Hangalot, has been having problems with one of their laptop models. They had previously outsourced the assembly of some of these units to a company in Bangladesh. A sample of 483 laptops has revealed the following:

	Assembled in Britain	Assembled in Bangladesh	Totals
Faulty	14	x	98
Non Faulty	y	330	385
Totals	69	414	483

    a.) Complete the table by determining the values of x and y: (2)
    b.) By testing for independence, decide whether Hangalot should continue outsourcing the assembly of some units to the company in Bangladesh.   (4)

Question 5

At a school there are 120 grade 12 learners. A survey is conducted to see how many of them take the subjects Biology, Mathematics and Science.

The following Venn diagram represents the results.
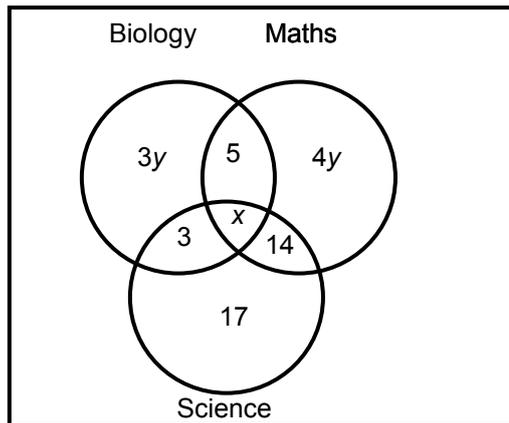
    a.) If it is known that a total of 44 learners take Biology and a total of 65 take maths then solve for x and y.   (5)
    b.) Use your Venn diagram to calculate the probability that a student selected at random:
       i.   Takes Biology but not Maths or Science.   (2)
      ii.   Takes none of the three subjects   (2)

Question 6

A group of 33 learners was surveyed at a school. The following information from the   survey is given:

- 2 learners play tennis, hockey and netball

- 5 learners play hockey and netball

- 7 learners play hockey and tennis

- 6 learners play tennis and netball

- A total of 18 learners play hockey

- A total of 12 learners play tennis

- 4 learners play netball ONLY

a.) A Venn diagram representing the survey results is given below. Use the   information provided to determine the values of *a, b, c, d* and *e.*   (5)
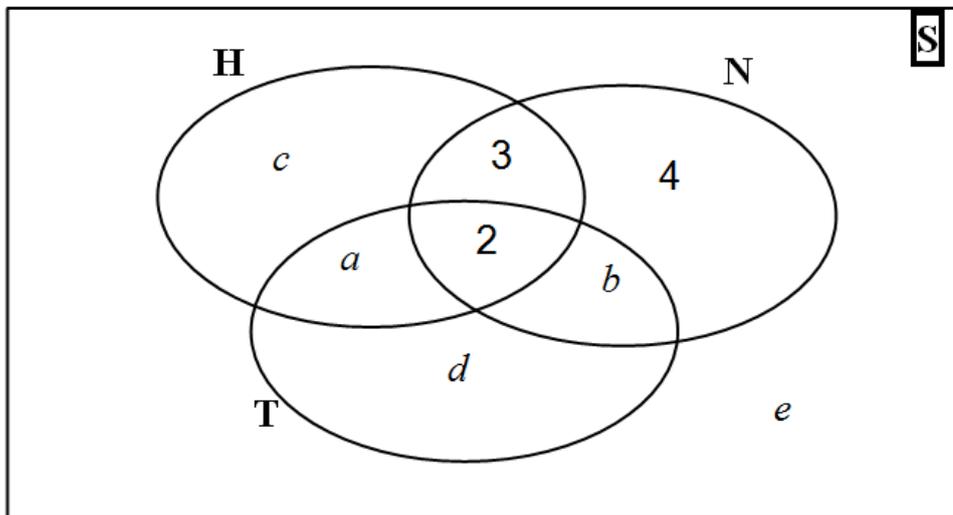
b.) How many of these learners do not play any of the sports on the survey (that is netball, tennis or hockey)?   (1)

c.) Write down the probability that a learner selected at random from this sample plays netball ONLY.   (1)

d.) Determine the probability that a learner selected at random from this sample plays hockey or netball.   (1)

Question 7

a.) Chris wants to buy a car. He can buy a Toyota, Nissan or Ford. He can choose a two-door, four-door or hatch-back model. The cars are available in red, white, silver or black. How many options can he choose from?

b.) Nkuli has 3 T-shirts (Red, white, yellow); 2 pair of jeans (black, blue) and two pairs of shoes (takkies, sandals). How many different outfit combinations can she put together?

c.) Use the counting principle to determine the number of choice/ combinations/ outcomes if: a) you roll a fair dice twice.

    i.   you choose a 3 digit pin number, where repetition is allowed.

    ii.   you choose a number plate for your car which must have 3 letters (no vowels A,E, I, O, U and repetition is allowed) followed by 3 digits, where repetition is allowed.

    iii.   you choose a 6 digit computer password and no repetition is allowed.

    iv.   you choose a 9 digit cell phone number which has the first digit being odd, no digit may be a zero, and repetition is not allowed.