**Lesson 5E Extension material**

**A-Level Applied Mathematics : Statistics : Year 2**

**Set Theory and Probability II**

## 5E.1 Turning around the tree

In this Lesson some 'surprising results' are discovered.

## 5E.2 A useful example for those thinking of moving into the LEGAL profession

### The Question

Suppose that 70% of defendants brought to trial for a certain type of crime are guilty. Moreover, historical data shows that a jury will convict guilty persons 80% of the time, and convict innocent persons 10% of the time.

**( i )** Clarify the meaning of the following legal words used.

- **( a )** defendant :
- **( b )** 'brought to trial' :
- **( c )** crime :
- **( d )** jury :
- **( e )** convict :
- **( f )** innocent :

**( ii )** Draw a tree diagram to clarify the information given.

**( iii )** What is the probability that someone brought to trial is convicted.

**( iv )** Redraw the tree diagram 'the other way around'.

**( v )** What is the probability that a person not convicted, was guilty ?

### The Answer

**( i )** **( a )** defendant :

**( b )** 'brought to trial' :

**( c )** crime :

**( d )** jury :

**( e )** convict :

**( f )** innocent :

**( ii )**

**( iii )**

## 5E.3 A useful example for those in the MEDICAL profession

**The Question**

A certain medical disease occurs in 1% of the population.
A simple screening procedure is available and in 8 out of 10 cases where the patient has the disease, it produces a positive result.
If the patient does not have the disease there is still a 0.05 chance that the test will give a positive result.

**( i )** Draw a tree diagram to clarify the information given.

**( ii )** Find the probability that a randomly selected individual:

- **( a )** Does not have the disease but gives a positive result in the screening test
- **( b )** Gives a positive result on the test.

**( iii )** Ann has taken the test and her result is positive.

- **( a )** Find the probability that she has the disease.

**( iv )** Redraw the tree diagram 'the other way around'.

**( v )** Comment.

**The Answer**

## 5E.4 Exercise

**Question 1**

*S1 Examination Question from January 2007 Q2*

In a factory, machines, *A*, *B* and *C*, are all producing metal rods of the same length.
Machine *A* produces 35% of the rods.
Machine *B* produces 25% of the rods.
The rest of the rods are produced by machine *C*.

Of their production of rods, machines *A*, *B* and *C* produce 3%, 6% and 5% defective rods respectively.

**( a )** Draw a tree diagram to represent this information.

**[ 3 marks ]**

**( b )** Find the probability that a randomly selected rod is

**( i )** produced by machine *A* and is defective

**( ii )** is defective

**[ 5 marks ]**

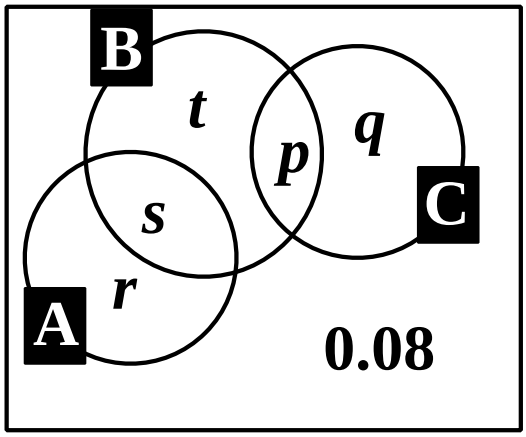
**( c )** Given that a randomly selected rod is defective, find the probability that it was produced by machine *C*

**[ 3 marks ]**

**Question 2**

*S1 Examination Question from June 2017 Q3*

The Venn diagram shows three events $A$, $B$ and $C$, where $p$, $q$, $r$, $s$ and $t$ are probabilities.




$P(A) = 0.5$, $P(B) = 0.6$ and $P(C) = 0.25$

Events $B$ and $C$ are independent

**( a )** Find the value of $p$ and the value of $q$

**[ 2 marks ]**

**( b )** Find the value of $r$

**[ 2 marks ]**

**( c )** Hence write down the value of $s$ and the value of $t$

**[ 2 marks ]**

**( d )** State, giving a reason, whether or not the events $A$ and $B$ are independent.

**[ 2 marks ]**

**( e )** Find $P(B \mid A \cup C)$

**[ 3 marks ]**