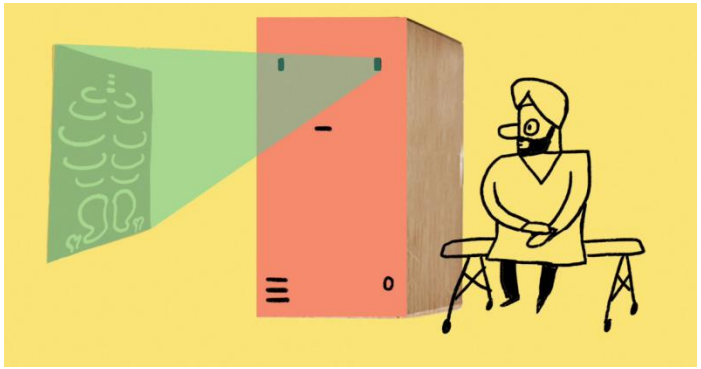
Key Stage 5

Testing, Testing

Student worksheet



Credit Card Fraud

A computer program that looks at credit card transactions has a 90% chance of correctly identifying credit card fraud and a 90% chance of correctly identifying normal transactions.

If detecting fraud is a POSITIVE result this table shows the four possible outcomes.

	Fraud Test Shows positive	Fraud Test shows negative
Normal transaction	**FALSE POSITIVE** Test shows fraud when it is a normal transaction	**Correct answer** The test does not detect fraudulent behaviour and there isn't any
Fraudulent Transaction	**Correct answer** The test correctly identifies fraud	**FALSE NEGATIVE** The test does not show fraud when there is

http://www.oxfordsparks.ox.ac.uk/content/what-machine-learning

If 1% of all credit card transactions are fraudulent, how likely is it that when the computer detects fraud that it has actually happened?

At first glance it looks like 90% of transactions flagged by the computer as fraudulent would actually be fraud, but this is far from the truth.

One way to work this out is to look at what happens for, say, 1000 transactions

1% of the transactions are fraudulent so we would expect:

10 fraudulent transactions and 990 normal transactions

If we just look at the fraudulent transactions it would detect 9 of the 10 fraudulent transactions and would have one false negative.

If we look at the normal transactions it would correctly identify 90% of them as negative i.e normal (90%x990=891) and 10% (incorrectly) as fraudulent (10%x990=99). We can add all these figures to the table below.

	Fraud Test shows positive	Fraud Test shows negative	Total
Normal transaction	99	891	990
Fraudulent Transaction	9	1	10

So just looking at the first column the computer would flag up a total of 108 cases of fraud, but only 9 of them (or approximately 8% would be correct). So most of the time when credit card fraud is detected it hasn't really happened.

1) SPAM! SPAM! SPAM! SPAM!

A spam filter has a 90% chance of correctly identifying SPAM emails and a 1% chance of identifying a 'proper' email as SPAM.

If 20% of all email is SPAM and a company receives 10,000 emails a day then complete the table below:

	SPAM filter blocks email (positive)	SPAM filter lets email through (negative)	Total
SPAM email			2000
Normal Email	80		

In this case, which of these describes as a false negative?

a) When a SPAM email is incorrectly identified a proper email.
b) When a 'proper' email is incorrectly identified as SPAM.

Users can often change their settings on their SPAM filter so that it blocks more SPAM. However this usually means that it also blocks more 'proper' email as well.

2) Medical Testing

A disease occurs in 0.01% of 20-24 year olds

There is a test for the disease and it is 99% accurate (both at detecting the disease correctly and detecting absence of the disease correctly)

If the UK has four million 20-24 year olds:

a) How many will have the disease?
b) How many will not have the disease?

If all of the people in the group are tested

c) How many test results will be false negatives? (i.e. the test for disease comes back negative when it should be positive)

d) How many test results will be false positives? (i.e. the test says they have the disease when they don't)

e) What percentage of all of the positive tests are false positives?

People wrongly diagnosed as having the disease (false positives) could become very anxious.

Do you think that it would be sensible to test every 20-24 yr old?

The same disease is much more common in older people with 25% of people aged 80 or over having the disease.

What percentage of people aged 80 years old or over would get wrongly diagnosed as having the disease when they hadn't?

You may find it useful to assume that a sample of one thousand 80+ year olds are tested.

If you could only test one of these age groups (20-24 year olds) or over 80 year olds, which would you test and why?