NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 2 Mathematics and Statistics, 2012

91267 Apply probability methods in solving problems

2.00 pm Monday 19 November 2012
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability methods in solving problems.	Apply probability methods, using relational thinking, in solving problems.	Apply probability methods, using extended abstract thinking, in solving problems.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

ASSESSOR'S USE ONLY

You are advised to spend 60 minutes answering the questions in this booklet.

QUESTION ONE

Nutty Snack Bars are produced on machines operated by shift workers.

The weights of the bars are normally distributed, with a mean of 41 grams and standard deviation of 0.8 grams.

(a)   What is the probability that a Nutty Snack Bar weighs between 41 and 42.2 grams?

(b)   What percentage of Nutty Snack Bars weigh more than 42 grams?

(c)   Between what weights will the middle 60% of Nutty Snack Bars lie?

(d)   During Jamie's shift, 18 000 Nutty Snack Bars are produced by the machine.

What is the expected number of Nutty Snack Bars produced on Jamie's shift that weigh less than 40 grams?

(e) The stated weight on the Nutty Snack Bars packaging is 40 g.

A machine was set up to produce Nutty Snack Bars so that theoretically 96% of the bars produced would weigh at least 40 g.

Jamie thinks the machine was not set up correctly.

(i) What evidence supports Jamie's claim?

Justify your comments.

(ii) The machine can be reset by altering either the mean or the standard deviation of the weights of Nutty Snack Bars (but not both).

If the machine was not set up correctly, then it should be reset.

If the machine needs to be reset, give a possible way in which this may be done.

Show your calculations.

(f) When a machine producing nutty snack bars is working properly, the weights of the nutty snack bars are normally distributed with a mean of 41 grams and a standard deviation of 0.8 grams.

Sara buys a box of 300 Nutty Snack Bars to investigate if the machine is working properly.

She weighs each bar and records the results.

These weights are shown in the graph below.

Weights of Nutty Snack Bars
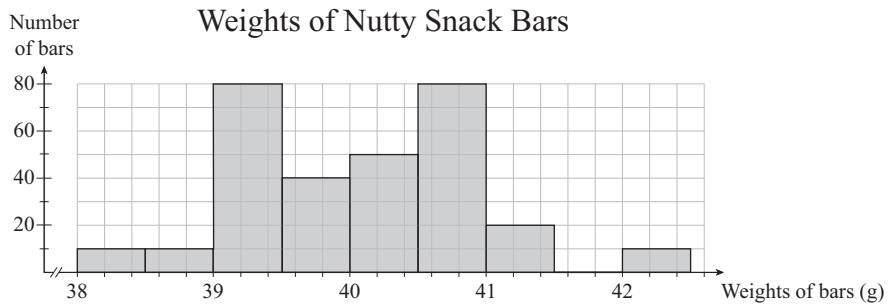
Compare the distribution of the weights of Sara's box of Nutty Snack Bars with the expected distribution of the weights if the machine is working properly.

Use statistical terms to explain your answer.

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QUESTION TWO

(a)   There is a special team's award presented at a school assembly.

There is no prior warning about the award.

The hockey team is to receive the award.

The award must be accepted by the Captain or, if the Captain is absent, by the Vice Captain.

The Captain of the hockey team is present at assembly 95% of the time.

The Vice Captain of the team is present at assembly 93% of the time that the Captain is present and 75% of the time the Captain is absent.

Some of the information is shown on the probability tree below.
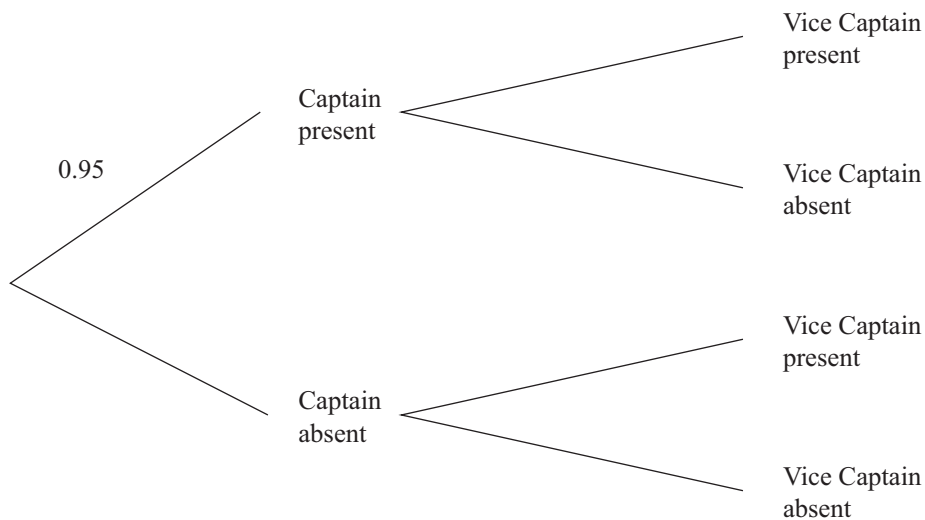
(i)   Calculate the probability that both the Captain and the Vice Captain of the hockey team will be present at the assembly when the award is being presented.

(ii)   Calculate the probability that the award will be presented to the hockey team at the assembly (ie at least the Captain or the Vice Captain is present at the assembly).

(iii) If the Vice Captain of the hockey team is absent from assembly, there is a 40% chance that he is sick.

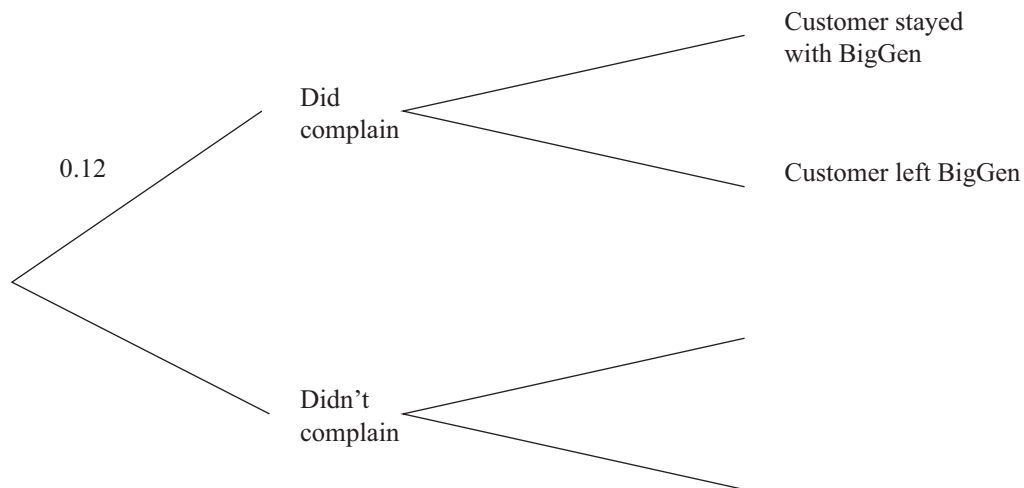If the Captain is absent, what is the probability that the Vice Captain will also be absent and he is not sick?

(b) BigGen power company keeps track of complaints made to the company by its customers.

- 12% of customers have made a complaint in the last 12 months.

- If a customer made a complaint, there was a 0.7 chance that they left BigGen.

(i) What proportion of customers complained and left BigGen?

(ii) There were 250 000 customers of BigGen at the beginning of the year.

How many would be expected to complain, but stay with BigGen?

(iii) The percentage of customers leaving BigGen over the last 12 months was 10%.

   •   Find the probability that a customer who didn't complain left BigGen.

   •   If a customer left BigGen, find the probability that they complained.
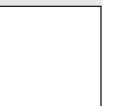
QUESTION THREE

A pilot study investigated if people showed some symptoms of arthritis.
The results were summarised in the table shown below.

Gender	No symptoms of arthritis shown	Some symptoms of arthritis shown	Total
Male	167	33	200
Female	405	195	600
Total	572	228	800

(a) (i) What proportion of people in the pilot study showed no symptoms of arthritis?

(ii) What proportion of people in the pilot study that showed symptoms of arthritis were male?

(iii) Using the results of the pilot study, how many people would you expect to show symptoms of arthritis in a similar community with a population of 2000 people?

(iv) Show that for the people in the pilot study, the risk of showing some symptoms of arthritis is approximately two out of seven.

(v)   A newspaper headline on the report stated "Pilot study shows females are three times more likely than males to show symptoms of arthritis."

Show whether or not you agree with this headline, stating full reasons and calculations.

(b)   The **same** pilot study of 800 people was further analysed.

This showed:

There were 299 people aged 40 years and over, of whom 121 showed a symptom of arthritis.

There were 501 people aged under 40 years.

You may like to use the table below.

	No symptoms of arthritis shown	Some symptoms of arthritis shown	Total
Under 40			
40 and over			
Total			

(i)   What proportion of people in the trial, aged under 40 years, showed symptoms of arthritis?

(ii) Some researchers claimed that the risk of people over the age of 40 years having arthritis symptoms is twice that of people under the age of 40 years.

Comment on this claim.

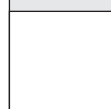You should provide suitable reasons supported by calculations from data in this pilot study.

QUESTION NUMBER