NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 1 Mathematics and Statistics, 2012

91037 Demonstrate understanding of chance and data

9.30 am Wednesday 14 November 2012
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of chance and data.	Demonstrate understanding of chance and data, justifying statements and findings.	Demonstrate understanding of chance and data, showing statistical insight.

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

The questions in this paper are about reaction times.

Reaction times are measured in milliseconds (1000 milliseconds = 1 second).

A reaction time is the time it takes for your body to move after your eyes see a signal.

The reaction time tests on the internet ask you to click on a button on the screen as quickly as you can after the button turns green.

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

QUESTION ONE

Ella is investigating reaction times.

She poses the problem: Do Canadians have lower reaction times (react faster) than Australians?

She uses international CensusAtSchools websites to randomly select 200 students from Canada, and 200 from Australia.

Ella's analysis of her data is below:

Do Canadians have lower reaction times than Australians?

Reaction times (in milliseconds)
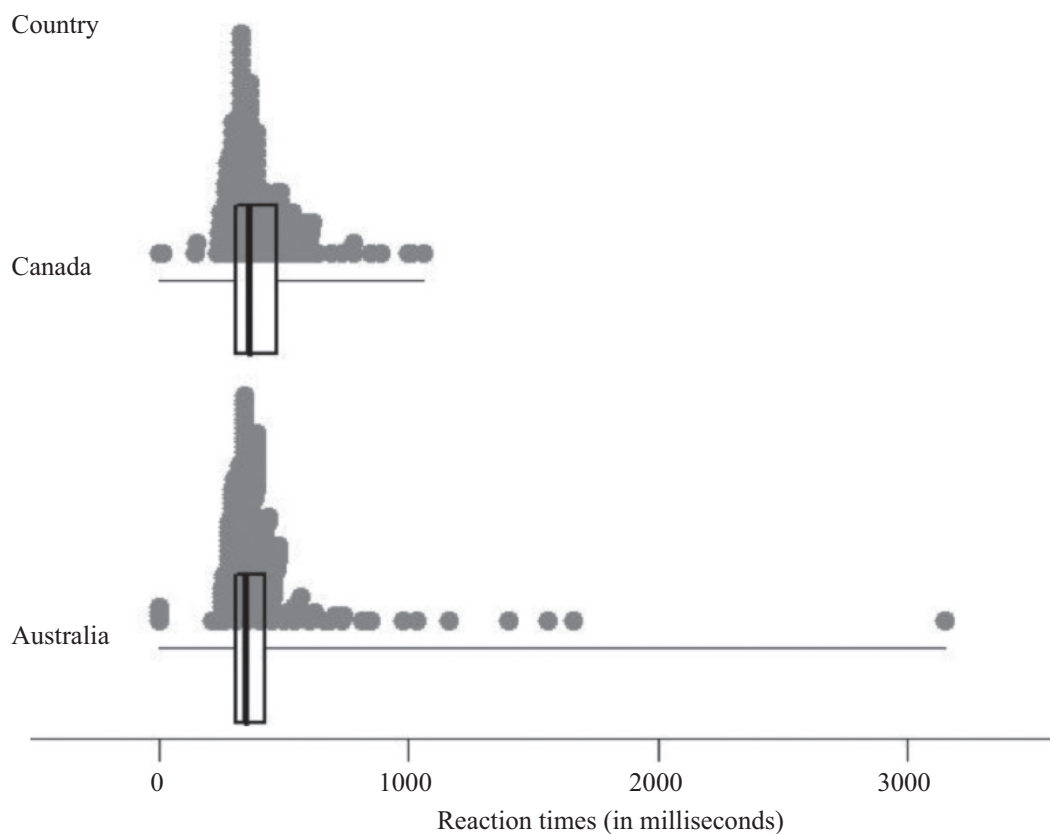
Statistic	Reaction Times for Canadians	Reaction Times for Australians
Minimum	0	0
Lower Quartile	306	310
Median	359	350
Upper Quartile	468	420
Maximum	1062	3150
Mean	400	409
Inter-Quartile Range	162	110

From her graphs and statistics, Ella thinks that Canadians have **higher** reaction times than Australians.

(a) (i) What is the difference between the medians?

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(ii) When you consider the **medians**, do you agree with Ella's conclusion?

Give statistical reasons for your answer.

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(b) When you consider the **means and medians**, do you agree with Ella's conclusion?

Give statistical reasons for your answer.

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(c) When you consider the **graphs**, do you agree with Ella's conclusion?

Give statistical reasons for your answer.

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QUESTION TWO

(a)   Ella now poses a new problem: Do males and females have different reaction times?

She uses the same set of data, but cleans it by removing any scores over 1000 milliseconds.

She thinks there might have been some reason for some of the long times (such as the mouse not working properly).

Then she groups the data by gender and by country. Her analysis is below:
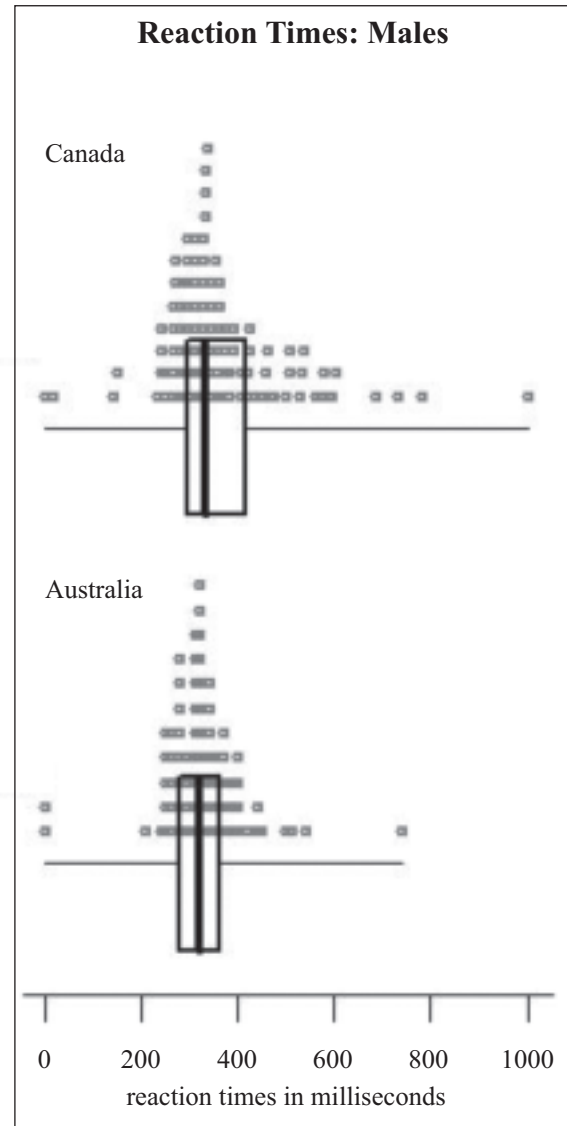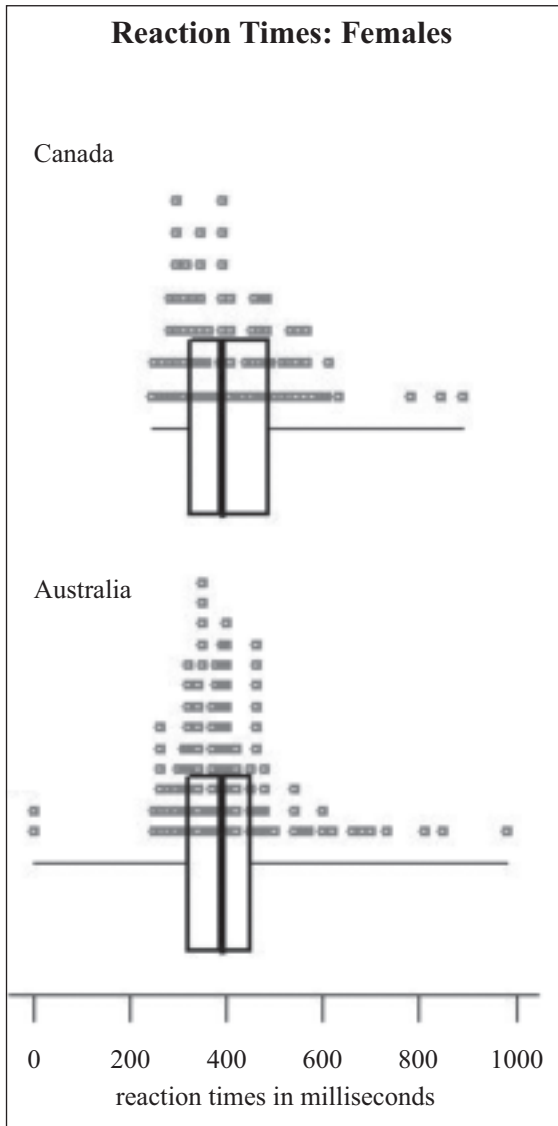
(i)   Out of the groups shown on the graphs opposite, which group has the most **consistent** times?

Give statistical reasons for your answer.

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(ii) How could Ella improve her investigation further?

Give at least TWO suggestions that are based on statistical considerations.

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(b) Ella analyses the data to see how many Australian students in a sample had a reaction time under 500 milliseconds.

She summarises the data in the table below.

Time (milliseconds)	Female	Male
Under 500	97	77
Over 500	18	8

(i) What is the probability that a student, chosen randomly from this sample, had a reaction time of under 500 milliseconds?

(ii) What is the probability that a student, chosen randomly from this sample, was a female with a reaction time of under 500 milliseconds?

(iii) What is the probability that a male student, chosen randomly from this sample, had a reaction time of under 500 milliseconds?

(iv) If two students were randomly chosen from this sample, what is the probability that **both** of them had reaction times of under 500 milliseconds?

This page has been deliberately left blank.

The examination continues on the following page.

QUESTION THREE

The original Australian data contained reaction times where the students used their dominant hand and then their other hand to click the mouse.

"Dominant Hand" means the hand you usually use the mouse with.
"Other Hand" means the hand you do not usually use the mouse with.

Ella wondered if there was some relationship between the two times each student recorded so she drew the scatterplot given below.

> *If you need to redraw your answers to (a) and (b), use the graph on page 10.*

Is there a Relationship between Reaction Times for your Dominant Hand and for your Other Hand?
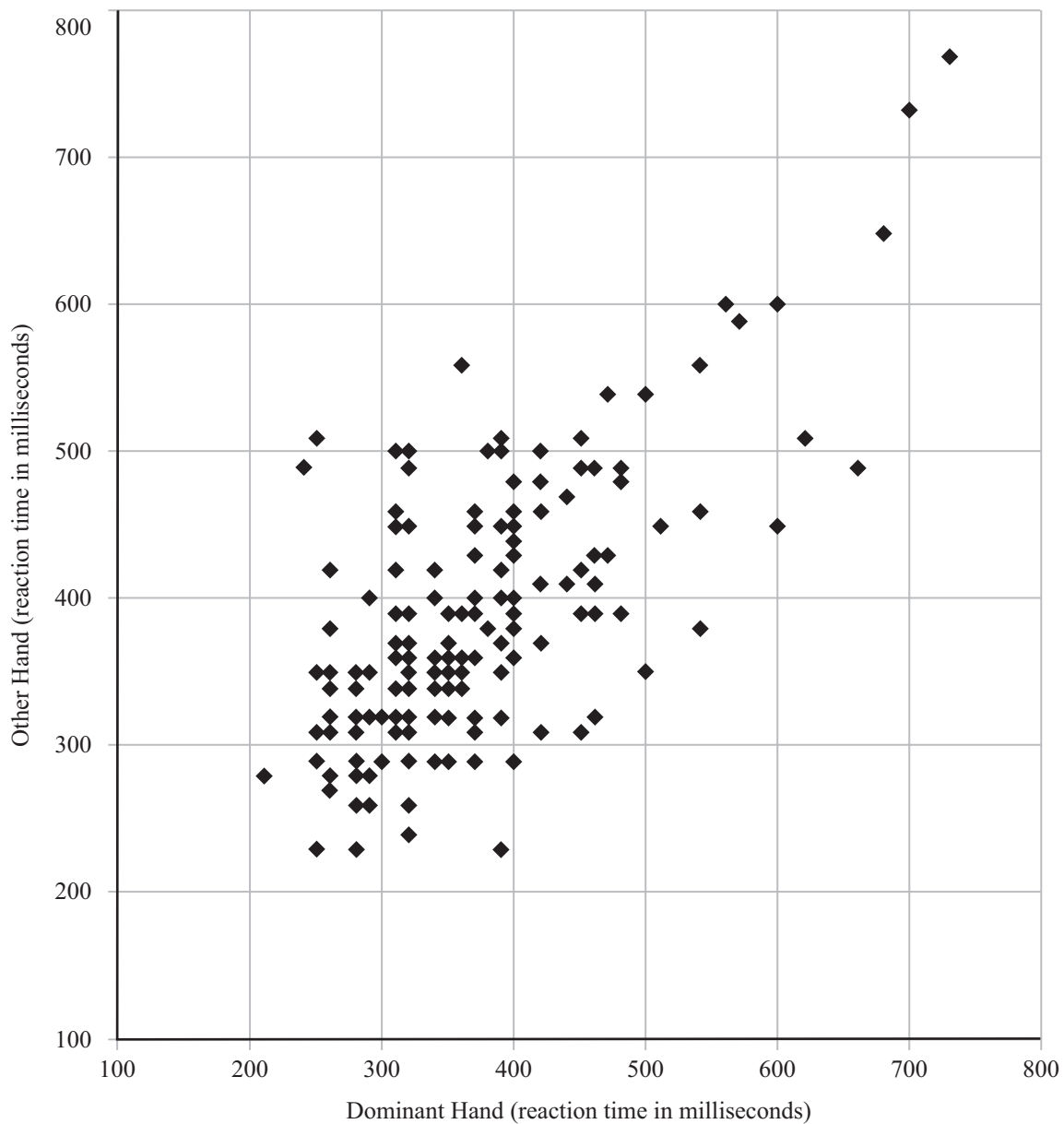
(a)   On the scatterplot, show the group of points where the reaction time with the Other Hand is **less than or equal to** the reaction time with the Dominant Hand.
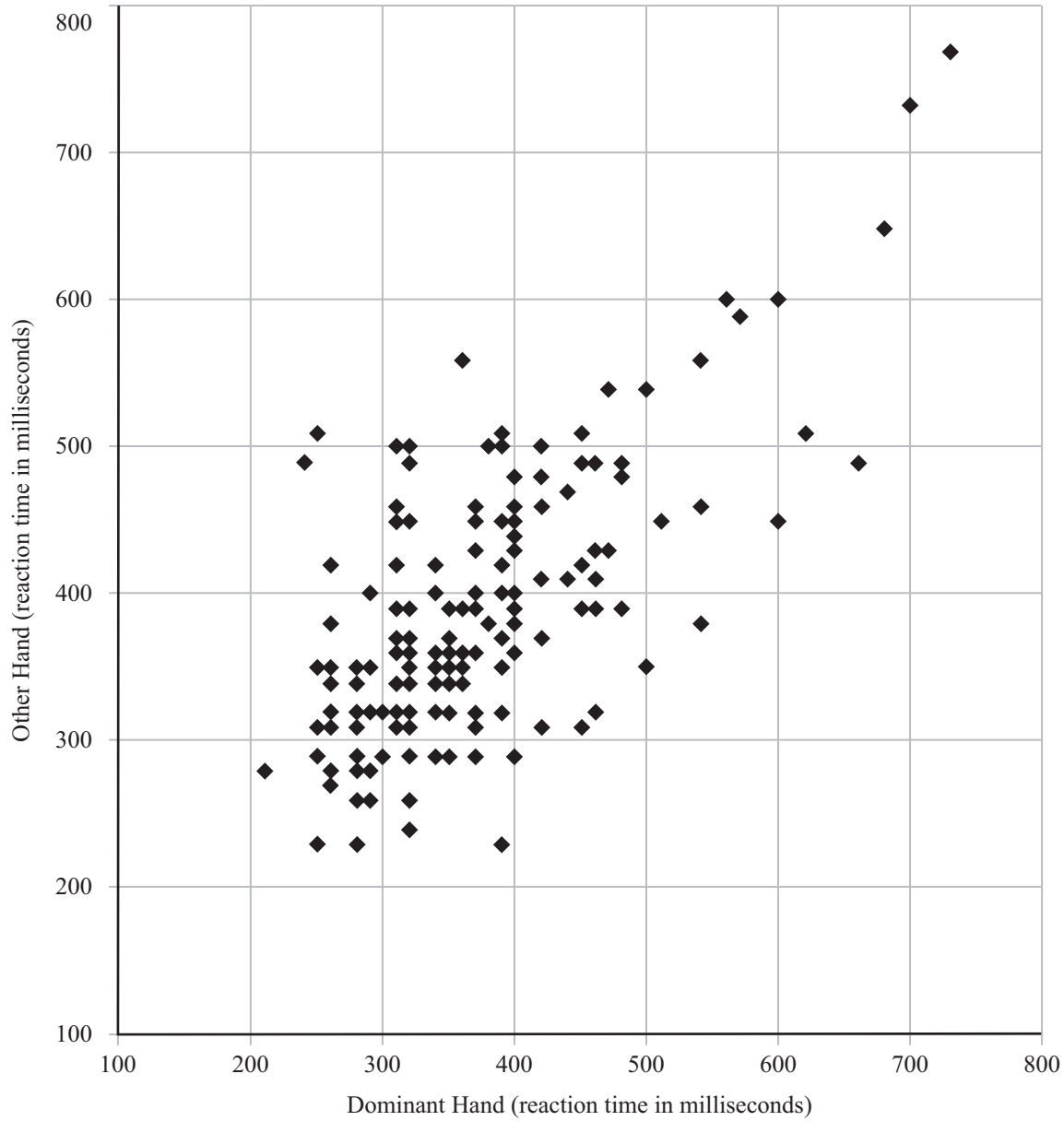
(b)   Draw a line of best fit on to the scatterplot.

(c) (i) What relationship, if any, does the scatterplot show between the reaction time recorded with the Dominant Hand and the reaction time recorded with the Other Hand?

(ii) How confident can you be in your answer to part (i)?

Give statistical reasons for your answer.
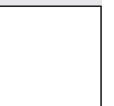
If you need to redraw your answers to Question Three (a) and (b), draw them on the graph below. Make sure it is clear which graph you want marked.

**Is there a Relationship between Reaction Times for
your Dominant Hand and for your Other Hand?**

QUESTION NUMBER	Extra paper if required. Write the question number(s) if applicable.