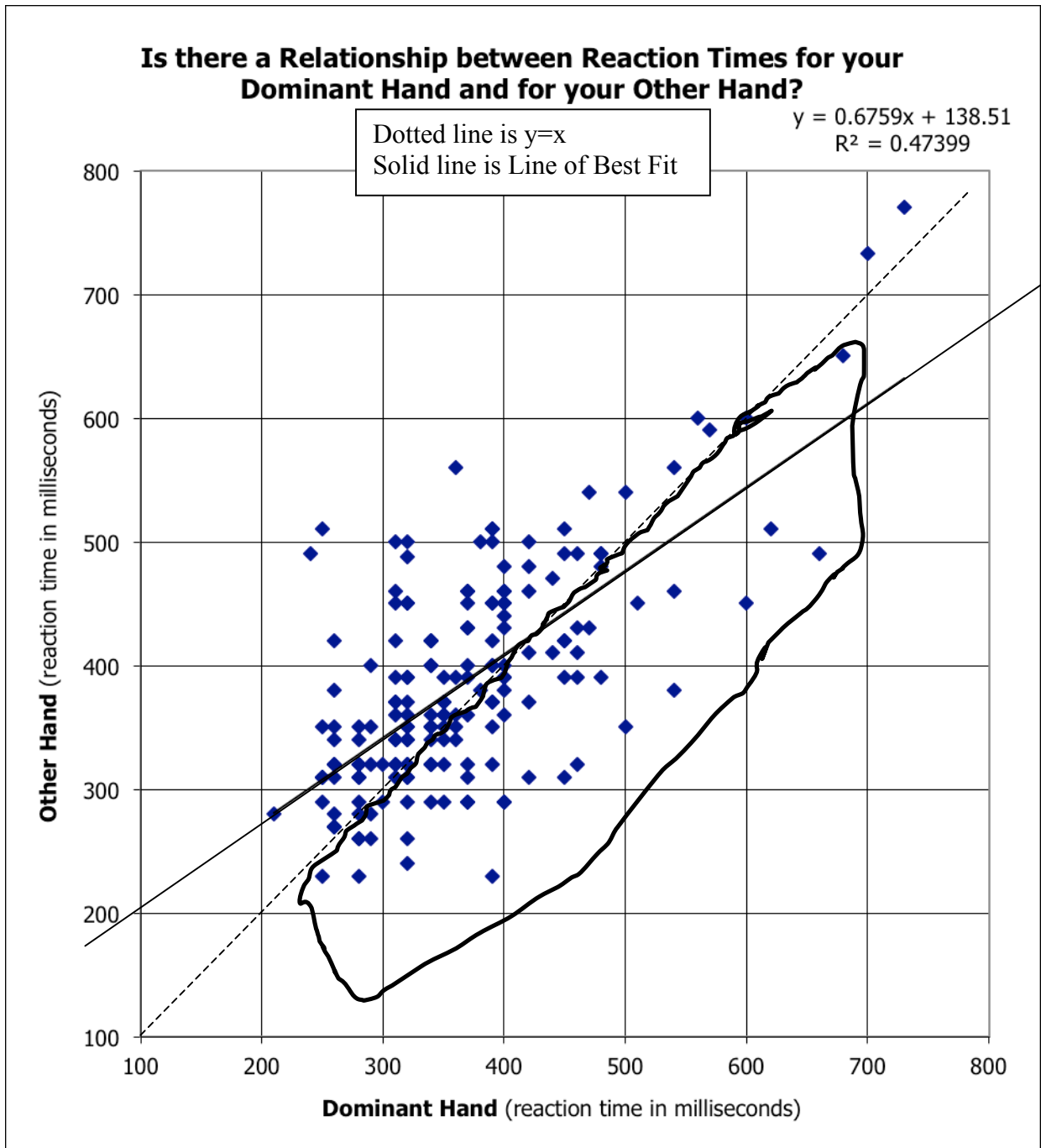## Assessment Schedule – 2012

Mathematics and Statistics: Demonstrate understanding of chance and data (91037)

Evidence Statement

		Expected coverage	Achievement	Merit	Excellence
ONE (a)(i)		9 milliseconds.	Mentioning that there is a difference, based on the medians which says that the Canadians have a higher reaction time [or converse].	… but notes that the difference is too small to say that there really is a difference at the population level (or in truth).	… but mentions how the medians relate to the other box and how this means that there is unlikely to be a true difference at the population level (or in truth).
(ii)		Yes, for the sample she got, there is a small difference, and yes, the Canadians have slightly higher reaction times than Australians, because the Canadian median is higher. However, the medians for each group are within the box of the other group, so the difference is too close to call back in the population (ie, is not significant).			
(b)		(No) On the other hand, the mean for the Canadians is lower than that for the Australians, so this makes one pretty uncertain about what conclusion to draw. However, this may simply have been caused by some of the very high times recorded, which could have dragged the mean upwards.	Mentioning that there is a difference, based on the means AND that it disagrees with her conclusion …	… but the mean is not a good average to use for the Australians because the high outliers will have pulled the mean upwards.	
(c)		The graphs suggest that the Australian reaction times are shifted slightly to lower values. The peaks are at the same point and the distributions are very similar on the left of the peak. On the right of the peak, the Canadians have a more pronounced bump while the Australians have data more tightly contained against the peak (although there is data dribbling out further to the right). The box for the Australians is also shifted left slightly. When the outliers are removed, the distributions for both countries are very similar so it is very difficult to come to a conclusion based on the shapes alone. Spread is irrelevant in this context. Response must relate to the distribution.	The shapes of the dot plots being similar but there is no mention of the outliers.	The gist of a valid point about the position of the box is there but the argument is not well expressed. OR Makes a valid but unclear point about the distribution and uses it to support Ella's claim	Clearly makes a valid point about the position of the box in support of Ella's claim. OR Clearly makes a valid point about the distribution and uses it to support Ella's claim. OR Clearly describes the similarity in the shapes of the distributions, without outliers, and how this is inconclusive.
		The responses in this question must be related to Ella's hypothesis that Canadians have higher reaction times (ie slower reactions).			
Judgement:		N1: 1ai correct N2: 1u	A3: 2u A4: 3u	M5: 1r + 1u M6: 2r	E7: 1t E8: 2t

TWO (a)(i)	A statement is made about the spread of one group based on a relevant characteristic, namely the IQR or the range.	Canadian females, based on the range. OR Australian males, based on the compact dot-plot or an unclear explanation related to the IQR.	Australian males: they have the smallest IQR (or equivalent).	
(ii)	A statement is made about possible areas to investigate. **Sample Size**: She could try surveying more students to be more confident in her results. **Reaction Time tester**: She should also check that the methods used to test reaction time are comparable since perhaps they operate differently and this is what has led to the very small differences we see here. **Outliers**: She could get rid of the zero times, as they could not realistically be valid as it must take some time to click the button. Perhaps people just skipped this question in the survey. **Ages**: She should check what age-groups the students in her sample come from … In fact, if she wants to compare Canadians to Australians, she needs to survey a much wider range than just school children (on the assumption that age makes a difference to reaction time). In a similar vein, could discuss **ethnic** composition or suggest she samples from **other countries** to make the conclusion more valid.	Makes clear suggestion about improvements involving sample size. OR Makes a clear suggestion about improvements involving the testing method.	Makes a clear, justified suggestion for improvements involving the zeroes. OR Makes a clear suggestion about improvements involving the composition of the sample.	Makes a clear, justified suggestion for improvements involving the zeroes. AND Makes a clear suggestion about improvements involving the composition of the sample. *Any comments for Merit or Excellence made need to relate to an improvement that would allow Ella to draw a more valid conclusion with which to answer her question: "Do males and females have different reaction times?"*

(b)								

Time	Female	Male	
Under 500	97	77	*174*
Over 500	18	8	*26*
	115	*85*	*200*

(i)	$\dfrac{174}{200} = \dfrac{87}{100}$ or equivalent or consistent with table.	Correctly or consistently determining the probability.		
(ii)	$\dfrac{97}{200}$ or equivalent (0.485) or consistent with table.	Correctly or consistently determining the probability.		
(iii)	$\dfrac{77}{85}$ or equivalent (0.9059 to 4dp) or consistent with table.		Correctly or consistently determining the probability.	
(iv)	$\dfrac{174}{200} \times \dfrac{173}{199} = \dfrac{30102}{39800}$ $= 0.7563\,(4\,\text{dp})$ CAO must be given to 3dp or greater accuracy.			Correctly evaluating the probability.
Judgement:	**N1: a correct denominator used** **N2: 1u**	**A3: 2u** **A4: 3u**	**M5: 1r + 1u** **M6: 2r**	**E7: 1t** **E8: 2t**

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

Dotted line is y=x
Solid line is Line of Best Fit

$y = 0.6759x + 138.51$
$R^2 = 0.47399$

Other Hand (reaction time in milliseconds)

Dominant Hand (reaction time in milliseconds)

	Expected coverage	Achievement	Merit	Excellence
THREE (a)	Approximate ring around all data below or on the line $y = x$.	Ring includes most points which satisfy the statement, but also does not include any points that do not satisfy it.	Ring follows $y = x$ closely and includes almost all points that satisfy the statement. Some indication of line $y = x$ is present.	
(b)	Line of best fit drawn on to the graph as per the graphic above.	Line goes through (400,400) (±40) OR would hit y-axis between 100 and 300.	Line goes through (400,400) (±40) AND hits y-axis between 100 and 300. Slope must be less than 1.	
(c)(i)	The Other Hand generally records a higher reaction time than the Dominant Hand. As the reaction time recorded with the Dominant Hand increases, so does the reaction time with the Other Hand, as a general rule. However, if the time with the Dominant Hand goes up by 100, the time with the Other Hand goes up by less than 100.	Notes that the relationship is positive but does not connect with the context. Accept strong.	Notes that the relationship is positive and does connect it with the context. Do not accept strong. OR Notes the overall static relationship in the context.	Notes the relationship, mentioning how as one variable increases, so does the other (a dynamic relationship) …
(c)(ii)	One cannot be very confident that there is a relationship between the 2 variables because there is a lot of scatter among the points and the points do not follow the line of best fit very closely. Certainly, if there is a relationship, it is not strong although there is a general trend along a diagonal on the graph. Accept correctly reasoned alternative answer.	Mentions that the relationship is not strong.	Mentions that the relationship is not strong, as seen by scatter or points not following the LOBF.	Mentions that the relationship is not strong, as seen by scatter or points not following the LOBF, but that there is a general trend along the diagonal (or, equivalently, that there are few dots in the top left or bottom right corners).
Judgement:	**N1: one question attempted in the right direction** **N2: 1u**	**A3: 2u** **A4: 3u**	**M5: 1r + 1u** **M6: 2r**	**E7: 1t** **E8: 2t**

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 8	9 – 12	13 – 18	19 – 24