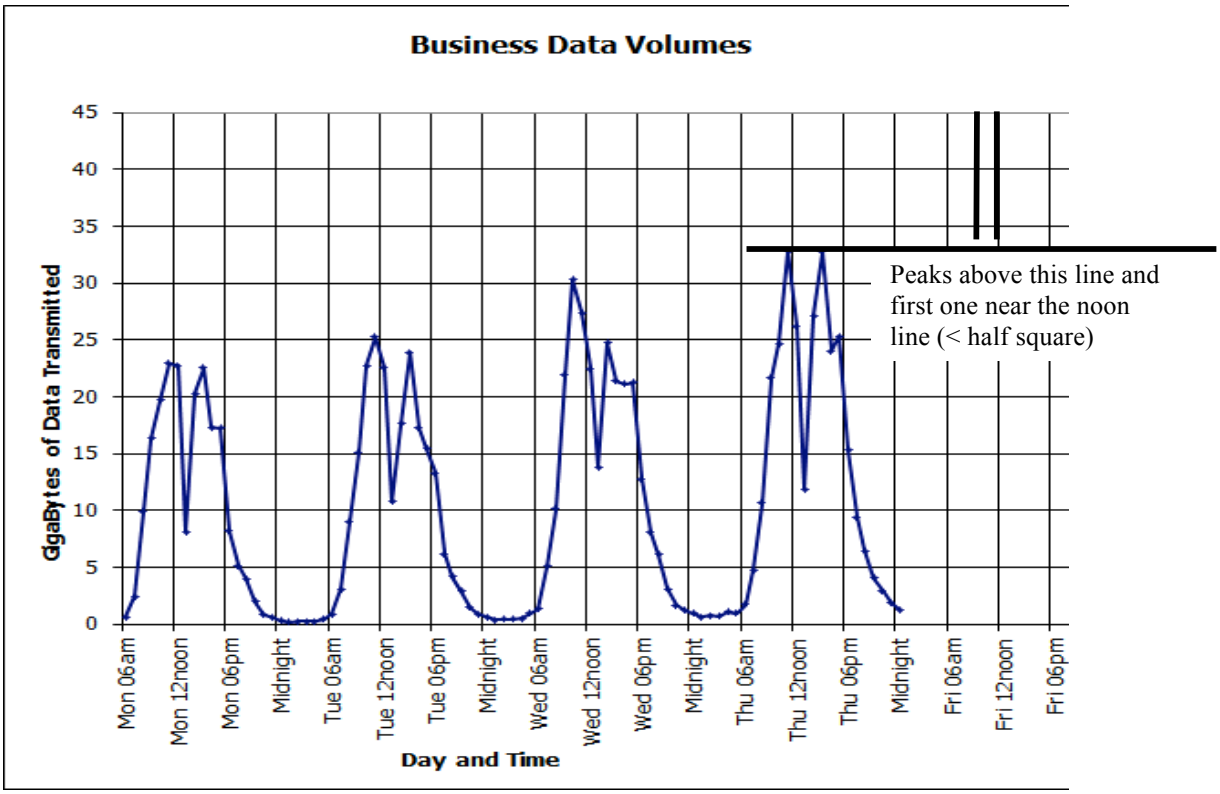
Assessment Schedule – 2013

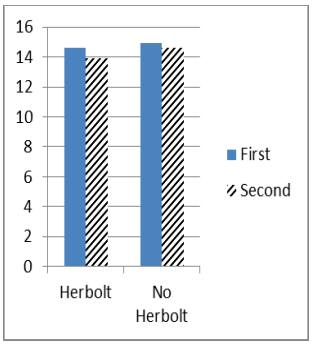
Mathematics and Statistics: Demonstrate understanding of chance and data (91037)

Evidence Statement

ONE	Expected coverage	Achievement	Merit	Excellence
(a)	• The amount of data transmitted is **increasing.** • **Peaks** going up steadily. • **Dips** probably going up but less clear increase. • **Troughs** increasing very slightly. • Increase is **more rapid** in the peaks than in the dips or troughs.	Makes ONE point clearly. (Trend is NOT increasing up and down each day).	Makes TWO points clearly.	Makes THREE points, including last bullet point, clearly.
(b)	• There is a peak each day around **midday** [trough each midnight]. • Peak actually composed of **2 peaks** (at noon and 3pm) and a **dip** (around 1pm). • First peak generally **taller** than second peak. • There is also a smaller **shoulder** on the right of each peak at about 6pm each day.	Makes ONE point clearly.	Makes TWO points clearly.	Makes THREE points, including last bullet point, clearly.



(c)(i)	Graph drawn for Friday must look similar at first glance to other days but generally shifted up: • Most key points shifted up above Thursday • First peak clearly sits on noon or slightly before (see graph). An alternative to this could be supported by evidence clearly presented in part c(ii).	Graph drawn which fulfils point 1 OR 2.	Graph drawn which fulfils points 1 AND 2. OR Alternative that fits their reasons given in c(ii), eg people leaving work early on a Friday.	
(ii)	The **trends** and **seasonal effects** are a strong pattern so I have continued them … I think my graph is a reasonable prediction. However, **Fridays may be different** (busier, or less busy) from the other weekdays on a regular basis that we don't know about from this graph, and this could make my prediction incorrect.	• Generic statement about following patterns. OR • Gives details of how the **seasonal effects** should be the same. OR • The **trends** should continue, so the prediction should be correct.	Gives details of how the **seasonal effects** should be the same AND the **trends** should continue, so the prediction should be correct.	Expresses doubt and gives a valid reason (for a Level 1 student): • Why Fridays may be different in nature from the other days OR • Why there is insufficient data to know what happens on Friday. OR • Justifies why Fridays should fit the prediction they have made.
Judgement:	NØ: no response, no relevant evidence. N1: 1u. N2: 2u.	A3: 3u. A4: 4u.	M5:1 of r AND 3 of u. M6: 2 of r.	E7: 1 of t OR 3 of r. E8: 2 of t.

TWO	Expected coverage	Achievement	Merit	Excellence
(a)	0.7 (seconds)	Equivalent answer given. Accept 0.7 without units.		
(b)	Reasons must be statistical and include: • The **sample size** is only 20 – too small to make a conclusion. • **Bias**: the people might all be male, for **example**, or all from the same region. • The graph is **misleading**, magnifying the difference, so I can't trust the authors. • They may have improved their times anyway **without** the Herbolt just by re-running the 100 m. • It is not clear **which average** they have used, or even if they used the same one in each case.	Makes ONE point clearly.	Expresses doubt and makes TWO points clearly.	Expresses doubt and makes THREE points clearly.
(c)	 A valid graph will have a vertical axis starting at zero.	Draws a valid graph showing the difference, but pairs the bars according to the **sprint-order**. OR Graph would have been acceptable for merit, except for the scale (which makes it invalid) Do NOT accept a scattergraph.	Draws a valid graph showing the difference, and pairs the bars according to **consumption** of Herbolt. OR Draws a valid graph showing the difference, pairs the bars according to the sprint-order, **but** makes the difference obvious (eg using a clear key).	

(d)	1. **Yes**: It looks like the Herbolt does lower the time more than nothing, since the differences are 0.7 and 0.3 seconds, respectively. 2. However, the data shows that **even without** Herbolt, athletes improved a bit, so it makes you doubt that all of the improvement came from Herbolt. 3. There is always **variation** between samples so it may be that the results look quite different the next time they try it, even with the same people sprinting. 4. The use of an **average** may hide the actual variation. 5. The samples may be **biased** so it is doubtful that the results really apply in general.	Makes a conclusion giving 1 point clearly	Expresses doubt and makes 2 points clearly	Expresses doubt and makes 3 points clearly
(e)	The **median** is always in the middle so it is not affected by extreme values. The mean uses all data values so it is affected by extreme times. In this case there might have been an exceptional time in the Herbolt group which would have dragged the mean down and caused it to be lower than the non-Herbolt group's mean, but it was really only because of that one sprinter's time; (and vice versa) Accept that the **mean** might be the better for the Herbolt company to use, as it may support their claim better if it were skewed downwards by one very fast time.	Gives **generic** comment about outliers not affecting the median, therefore the median is better.	Gives generic comments on the effect of outliers on the mean and why this might be good or bad.	Clear, detailed comments on the effect of outliers on the median AND The effect of outliers on the mean in this context. AND Gives a recommendation. This could favour the median, but it could also favour the mean from the company's perspective.
Judgement	NØ: no response, no relevant evidence N1: 1u N2: 2u	A3: 3u A4: 4u	M5:1 of r AND 3 of u M6: 2 of r	E7: 1 of t OR 3 of r E8: 2 of t

THREE	**Expected coverage**	**Achievement**	**Merit**	**Excellence**
(a)	$\frac{2}{4}$ or $\frac{1}{2}$ or equivalent.	Correct probability obtained.		
(b)	$\frac{9}{50}$ or equivalent.	Correct probability obtained.		
(c)	**Yes**: • Implies that 50 is big enough to trust the result. **No:** • The sample size is too small to trust. • If he **repeats** the experiment he will almost certainly get different results. • If he did **more trials** he should get a more reliable and trustworthy result. • An experimental probability is compared to the corresponding theoretical one, in order to decide whether or not to trust the experimental results.	Makes ONE point clearly.	Expresses doubt and makes TWO points clearly.	Expresses doubt and makes THREE points clearly.

Total	3	5	7	9	11	13
Probability	1 / 12	2 / 12 = 1 / 6	3 / 12 = 1 / 4	3 / 12 = 1 / 4	2 / 12 = 1 / 6	1 / 12

(c) or (d)	Evidence of investigating the theoretical probabilities for the game, such as by drawing a tree diagram, leading to p(total > 10) = ¼ or equivalent.		Investigates theoretical probabilities, and calculates p(total > 10) = 0.25.	
(d)	No: In theory, the chance of winning is 3/12 = 0.25. So if 100 people play, he will pay out \$10 25 times, costing him \$250. But he will get only \$200 in entry fees, so he will expect to lose \$50. Do not penalise, for any grade, misunderstanding about whether winners pay \$2 to play or not.	CAO of losing \$50 OR Finds probability of winning \$10 to be 0.25.	Consistently uses probabilities from the experiment to obtain expected profit (\$20 or consistent). OR Shows no evidence of probabilities in working shown, but obtains correct answer.	Uses the correct theoretical probability to establish a correct expected payout and conclusion.
Judgement	NØ: no response, no relevant evidence. N1: 1u. N2: 2u.	A3: 3u. A4: 4u.	M5:1 of r AND 3 of u. M6: 2 of r.	E7: 1 of t OR 3 of r. E8: 2 of t.

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 7	8 – 12	13 – 18	19 – 24