Assessment Schedule – 2016

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

Evidence Statement

One	Expected coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	100 Accept values between about 80 and 180 (the number of medals won in the Olympic Games on either side). The (a)(ii) justification could support other values.	Any sensible answer accepted.		
(ii)	Examples: 1. I **drew a line of best fit and 100 was on the line** for Moscow, 1980. 2. I had the value **dip for Moscow since the medal count dipped in 1928, Amsterdam, the Olympics prior** to the 1932 LA Olympics. 3. I increased the value of the 1980 Moscow Olympics because from **the previous 4 Olympics, the medal count for USA had been increasing**. 4. I **followed the pattern of the other countries** for that year.	Any valid justification made.		
(iii)	Examples: 1. A large **spike up** in medals won for the USA at the 1904 St. Louis Olympics. 2. A large **spike up** in medals won for GBR at the 1908 Olympics. 3. A large **spike down** in medals for GBR at the 1904 St Louis Olympics. 4. A **gap** in medals won in the 1980 Moscow Olympics indicate that USA did not participate (boycotted). 5. The upward spikes seem **to occur when a country is a host** nation.	1 valid **unusual feature** is identified	2 valid **unusual feature are** identified: For either TWO countries **OR** TWO different features	3 valid **unusual feature are** identified: For either TWO countries **AND** TWO different features

(iv)	The trend is overall **increasing / decreasing / steady** over the time frame. A **split trend** is acceptable, but not a running commentary of multiple changes. Examples: 1. USA – over the 116 years of Olympics, the USA medal count has tended to increase, on average, in the years leading to 2012. 2. GBR – their medal count increased slightly over the 116 years of the Olympics. 3. NZL – medal count was steady until about 1980, after which it has had an increasing trend. 4. NZL – medal count has been fairly steady for the 116 years of Olympics. Examples of acceptable comparisons: 5. USA – had the greatest increasing trend in medals won. 6. NZL – had the flattest trend in medals won.	1 aspect related to **trend** identified.	2 aspects related to **trends** identified.	3 aspects related to **trends** identified **and a comparison** made.
(v)	1. USA – they have hosted the Olympics four times, 1904, 1932, 1984 and 1996. In 1904, 1932 and 1984, there were significant spikes in medals gained in these years. However, this is not evident in 1996, where they did worse than in 1992, Barcelona. 2. GBR – they have hosted the Olympics three times, in 1908, 1948 and 2012. In 1908 and 2012 they showed significant improvement in medals won over the previous Olympics. In 1948, there was an increase in medals won but it was not so significant as the others (effect of the war?) 3. So it would seem that there is enough evidence to suggest that host countries do perform better when they host an Olympics. *Candidate evidence added to the graph can be used.*		A valid comment on one country made. *This would acknowledge at least two instances of host data in making an overall evaluation of a country or countries with some doubt implies by words such as:* *- tends to….* *- maybe….* *- generally…*	A comment on USA and GBR made with a justification on whether a host country performs better. *This would acknowledge a more comprehensive analysis of the data in making an overall evaluation using both countries with evidence to support the implied doubt:* *- tends to….* *- maybe….* *- generally…*

(b)	1. Even though USA won the most medals (104) in 2012, when looked at as medals per million of the population, this total became only 0.34, due to their large population, and thus became the least value. 2. GBR went from winning 65 medals to 1.05 medals per million of the population, which still ranked them in between the other two countries. 3. NZL went from 13 medals overall to 2.98 medals per population, which meant they were the most successful of these three countries when compared using this process.	1 simple **comparative** statement made about 1 of the countries. *This could be:* *a comparison of two countries using one graph* *OR* *a comparison for one country using both graphs.*	Comparison explored in greater depth. *The comparison would be supported with:* *(approximate) quantitative evidence* *OR* *- qualitative evidence.*	Clear statement which clearly **compares the 3 countries** with reasons. *The comparison(s) would involve BOTH graphs and be supported with:* *(approximate) quantitative evidence* *AND* *- qualitative evidence.*

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; insufficient relevant evidence.	1 of u	2 of u	3 of u	4 of u	2 of r	3 of r	1 of t	2 of t

Two	Expected coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	Athletics had the most competitors, as most of its bars on the dot-plots are **taller** than those for Swimming, indicating a **greater count** at each particular age.	Athletics mentioned with weak explanation. E.g. "bigger bars" or "bigger graph"	Athletics mentioned with a very good explanation. E.g. most of the bars are taller OR there are more bars and they are taller	
(ii)	**Significant features of the GRAPHS stand out.** These are expected to relate to: 1.**Shape** 2.**Symmetry** OR **skew** 3. **Shift** 4.**Overlap** 5.**Centre** 6.**Spread** e.g. 1. **Shape** – similar because both dotplots are unimodal 2. **Symmetry** –both dotplots are reasonably symmetrical, but both have a few older competitors which skews the distributions slightly to the right 3. **Shift** – the peak on the Athletics graph is located higher up the age scale than that for Swimmers. 4. **Overlap** – the ages of the middle 50% of the competitors are much the same. 5. **Centre** – The median age of swimmers is younger than the median age of Athletics competitors. 6. **Spread** – The age range for Athletics is wider than that for Swimmers.	ONE valid **comparison** statement about ONE significant feature.	TWO valid **comparison** statements about TWO significant features.	THREE valid **comparison** statements about THREE significant features.

<table>
<tr>
<td>(iii)</td>
<td>I believe that there is likely to be a difference, and that the Athletes are taller than the Swimmers.
OR
It is too close to make a conclusive decision that there is a difference in heights of competitors from this sample.
Reasoning:
1. The location of the medians / means OR the difference between is large enough to conclude that Athletic competitors are (on average) taller than Swimming competitors.
2. Overlap – although the median for Swimming is the same as the LQ for Athletics, the median for Athletics is larger than the LQ for Swimming.
3. The overall visible spread = 20.
20 / 5 = 4, due to sample being 100.
Difference between medians = 5.5.
Since 5.5 > 4, we can conclude that it is likely that there is a difference.
4. Sampling variation may mean that the next time a sample is taken, the median may lie inside the IQR of the other sport.
5. The median of Swimming is the same as the LQ for Athletics, and there is not a significant difference between the median for Athletics and UQ for Swimming.</td>
<td>Either first conclusion supported by 1 .
OR
Second conclusion supported by 5.</td>
<td>First conclusion supported by 2.</td>
<td>Second conclusion supported by 4
OR
By 3, using the 1/3 rule.
OR
First conclusion supported by 3 using the 1/5 rule.</td>
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<tr>
<td>(b)(i)</td>
<td>Athletes are more likely to weigh more than 100 kg. This is because more plots are above the 100 kg value for athletes than for swimmers (which only has about 4 above 100 kg).</td>
<td>Correct statement with some justification involving numbers of data values above 100kg.</td>
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(ii)	Lines of best fit drawn. The linear model is appropriate for swimming, as their weights tend to increase as their height does in a linear fashion. OR The line is a **good fit** for the pattern of the data on the graph. The linear model is okay for Athletics, as weight does tend to increase as height does, but the fit of the line to the data gets worse as height increases – it does not fit the pattern of the data on the graph well. Another model may be better. OR The linear model is okay for Athletics, as weight does tend to increase as height does. However, due to the increased variation as height increases with Athletics, a non-linear model may better represent the relationship between height and weight. *A curved line drawn on the graph is evidence of considering a non-linear model*	Positive lines of best fit drawn for Swimming and Athletics. *Accept appropriate curved lines.*	Comments on the appropriateness of the model drawn, for EITHER Swimming OR Athletics.	Comments on the appropriateness of the model drawn, for both Swimming AND Athletics AND refers to the model becoming less appropriate as height increases, so maybe a non-linear model may be more appropriate for Athletics.
(iii)	Swimming has the stronger relationship. This is because the dots are clustered together and closely follow the (linear) trend (or pattern of data on the graph). OR because **there is very little scatter of the data away from the trend/pattern on the graph** Athletics has a weaker relationship due to the dots being **more scattered away from the general trend / pattern on the graph**. The variation in weight increases as the athlete's height increases.	Swimming stated as the one with the strongest relationship.	One valid **justification** given for their statement.	Two valid **justifications** given for the statements about the strength of both Swimming AND Athletics. AND the weakening nature of that relationship as height increases.

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No response; insufficient relevant evidence.	1 of u	2of u	3 of u	4 of u	2 of r	3 of r	1 of t	2 of t

Three	Expected coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	$\frac{320}{3026}=\frac{160}{1513}=0.106$ Accept 0.11 and 0.10.	CAO acceptable (decimal answer must be at least 2 dp).		
(ii)	$\frac{818}{1020}=\frac{409}{510}=0.802$ Accept 0.8.	CAO acceptable (decimal answer must be at least 1 dp).		
(iii)	$\frac{715}{3026}+\frac{31}{3026}=\frac{746}{3026}=\frac{373}{1513}=0.247$	CAO as a decimal answer (must be at least 2 dp). Either $\frac{715}{3026}$ (0.23, 0.24) or $\frac{31}{3026}$ (o.o1) or decimal stated.	Decimal answers accepted with working. Accept $\frac{746}{3026}$ or equivalent fraction.	
(iv)	$\frac{2119}{3026}\times\frac{907}{3025}=\frac{1\,921\,933}{9\,153\,650}=0.2099$ OR $\frac{2119}{3026}\times\frac{907}{3026}=\frac{1\,921\,933}{9\,156\,676}=0.210$ Accept 0.21 Accept working with / without replacement being used.	CAO At least one correct probability.	At least one correct probability multiplied with another.	Correct answer shown supported with working. Decimal must be at least 2 dp.
(b)(i)	26% × 489 = 127.14 127 or 128 cyclists.	CAO Finds 127.14.	Correctly rounds to a whole number.	Includes an assumption that the numbers in Rio be similar to those from the 2012 Olympics.
(ii)	1. The graph is about age so it is of no use for predicting. (Accommodation, Transport and heats / finals) as age has no effect on these things. 2. the numbers of competitors would be needed to make these any of these predictions. 3. Gender is also needed to predict accommodation needs. 4. Entries are needed to predict numbers of heats, etc.	1 valid comment.	2 valid comments.	3 valid comments.

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Cut Scores

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