Assessment Schedule – 2020
Mathematics and Statistics: Demonstrate understanding of chance and data (91037)

Evidence

Q ONE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Beginning of 2017 (January 2017). Indicated on diagram / lowest value.	Correct answer, with brief justification.		
(b)	**Long-term trend** There is an overall gradual decreasing trend in the population of tūturiwhatu, starting from approximately 1000 birds, falling to approximately 700 birds per season. (Allow other comparison values.) **Regular patterns** There seems to be a regular pattern every year where the population will increase rapidly to the peak towards the middle of the year and then also fall rapidly to create a trough towards the end of the year. **Unusual features** There seems to be an extra "shoulder" at the peak in the middle of 2020 which does not appear in the other peaks. There seems to be an extra fall in the trough at the beginning of 2017.	ONE feature clearly identified.	TWO different features clearly identified.	THREE different features clearly identified.
(c)(i)	$\frac{165}{1350} = \frac{11}{90} = 0.1222$	Correct answer.		
(ii)	$\frac{85}{250} = \frac{17}{50} = 0.34$		Correct answer.	
(iii)	Female = $\frac{690}{855} = \frac{45}{57} = 0.8070$ Male = $\frac{410}{495} = \frac{52}{99} = 0.8283$ So there is more chance of the male birds moving away as their probability is greater.	Correct probability evaluated for either male OR female.	Correct decision, with both probabilities calculated and clearly compared to justify the decision.	

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1 of u	2 of u	3 of u Or 1 of u and 1 of r	4 of u Or 2 of u and 1 of r	2 of r	3 of r	Minor omission in part (b).	Part (b) fully satisfied.

Q TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a) (i)	The greater width of the box indicates that there is greater variation / spread in the weights of the middle 50% of the female humpback whales.	Correct interpretation.		
(ii)	**Symmetry / Skew** Neither distribution is symmetrical, with female whale distributions slightly skewed to the left and male whale distribution slightly skewed to the right. **Shift** No noticeable shift evident. **Spread** The middle 50% box of the female whales is wider (IQR = 29 766.5 – 29 371.5 = 395 kg) than the middle 50% box of the male whales (IQR = 29 600 – 29 399 = 201 kg), so a greater variation in the female whales' weights. The overall variation of the male whales (29 999 – 29 001 = 998 kg) is slightly greater than the overall variation of female whales' weights (29 999 – 29 131 = 868), when comparing the overall range. **Centre** The mean / median of male whales' weights (29 481 / 29 446 kg) is less than the mean / median weight (29 620 / 29 371.5 kg) of female whales. **Shape** The distribution of female whales has a slight cluster between 29 350 – 29 400 kg; whereas, male whales don't seem to have any noticeable clusters. The upper 25% of male whales is more spread out than the upper 25% of the female whales. **Unusual** 4 male whales with weights between 29 900 and 30 000.	ONE valid statement about ONE significant feature.	TWO valid statements about TWO significant features.	
(iii)	This claim is likely to be correct. • The female median (29 673 kg) is greater than the male median (29 446 kg), and this implies that female whales tend to be heavier than the male whales in NZ. However, this is not a big difference when considering such large weights OR by comparing female mean (29 620 kg) with the male mean (29 481 kg). • This sample indicates that female whales tend to be heavier because the female median (29 673 kg) is greater than the male UQ (29 600 kg) so lies higher than the male middle 50% box (or equivalent). • $\frac{\text{DBM}}{\text{OVS}} = \frac{227}{395} = 0.574$ which is greater than $\frac{1}{3}$	Decision that claim is correct, with reason based on comparison of the medians or means.	Decision that claim is correct, with reason based on comparison of the medians AND with reference to the IQR boxes OR DBM / OVS.	
(b)(i)	$\frac{70}{820} = \frac{7}{82} = 0.0854$	Correct answer.		
(ii)	$\frac{230}{410} = \frac{23}{41} = 0.5610$		Correct answer.	

(iii)	Male = $\frac{80+180+90+40}{820} = \frac{390}{820} = \frac{39}{52} = 0.4756$ Female = $\frac{100+230+70+30}{820} = \frac{430}{820} = \frac{43}{82} = 0.5244$ So, from this data, it does support the internet claim. However: • The probability values are quite close to each other, so there is not a great difference between the male / female chances of being taken home. • This data is from only one centre's open day, which may not be indicative of all NZ SPCA Centres, so a conclusion should not be made from this data alone. • This data is from only one year, which may not be indicative of all years, so a conclusion should not be made from this data alone. • The data provided is for only cats / dogs / rabbits / guinea pigs, so a statement for all animals would not be valid. • Sampling variability could alter these figures, so the conclusion may not be true with a greater or different sample.	Correct probability evaluated for either male OR female.	Correct decision, with both a probability calculated AND clearly compared to justify their decision.	Correct decision, with a probability calculated AND clearly compared to justify their decision AND the internet claim evaluated with at least two comments that doubt the claim.

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1 of u	2 of u	3 of u Or 1 of u and 1 of r	4 of u Or 2 of u and 1 of r	2 of r	3 of r	Minor omission in part (b) (iii).	Part (b) (iii) satisfied.

Q THREE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)(i)	The chances are small / unlikely because in this sample there are only 4 out of 55 elephants with that waist size. OR The chances are small / unlikely because there are not many dots above the horizontal line at 450 cm.	Correct answer, with brief justification.		
(ii)	Line of best fit drawn in approximately the correct position. • The strength is moderate /moderately strong because most of the points form a reasonably narrow band OR • The strength is moderate /moderately strong because visually most of the points lie reasonably close to the line of best fit.	Appropriate line of best fit drawn.	Justified comments about the strength of the relationship.	
(iii)	Comments selected from: • Most of the data has been collected from elephants with the larger feet sizes, so probably from the adult elephants. • There is one interesting / unusual value (117 feet size, 460 waist size), whose waist size is greater than the other elephants with similar foot sizes. (Could be indicated and identified on the graph.) • Reference to differing confidence levels in predictions depending on feet size, i.e. the smaller feet sizes have a stronger relationship, but the larger feet sizes have a weaker relationship. • It is a positive, linear relationship; so as feet size increases, then so does the waist size also increase.	ONE feature clearly identified and interpreted.	TWO features clearly identified AND interpreted.	
(iv)	Difyr should be wary of predicting for all elephants because: • This is only one sample, so sampling variability is likely to alter the results for further samples. • This sample is only for African elephants, but not all elephants are from Africa, so predictions cannot be made. • The question does not make it clear which elephants were selected from zoo or wild elephants, and the results are likely to be different between them. • This sample contains only 7 male elephants, which is not a sufficiently large sample to make predictions for male elephants. • The graph would not be very useful as the relationship is not that strong, particularly for the larger elephants, so predictions may not be very accurate. • Sample size of 55 is adequate but could be larger to reduce errors.	ONE valid statement.	TWO valid statements, explained and justified.	THREE valid statements, clearly explained and justified.

(b)(i)	p(Croc on Spinner X) = $\frac{2}{6} = \frac{1}{3}$ p(Croc on Spinner Y) = $\frac{1}{6}$ p(Croc on Spinner Z) = $\frac{1}{3}$ Disagree because Spinners X and Z have the same chance of success.	Correct probabilities evaluated and disagreement with reason.		
(ii)	• Disagree because decisions about bias cannot be made after just 5 spins. • In experimental prob, any result is possible, so elephants not appearing in the first five spins is not sufficient evidence of bias. • Spinner Z has p(elephant) = 1/3, but that does not mean it will appear with exactly that proportion.	Disagree, with ONE valid statement.	Disagree, with TWO valid statements, explained and justified.	
(iii)	$\frac{2}{6} \times \frac{3}{6} \times \frac{1}{3} = \frac{1}{18} = 0.0556$	Probability of spinning an elephant on any one spinner found.	Correct probability evaluated.	

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1 of u	2 of u	3 of u Or 1of u and 1 of r	4 of u Or 2 of u and 1 of r	2 of r	3 of r	Minor omission in part (a) (iv).	Part (a) (iv) satisfied.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24