Assessment Schedule – 2019

Mathematics and Statistics: Apply probability methods in solving problems (91267)

Evidence

ONE	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	$\frac{30}{971} = 0.0309$ or equivalent.	Correct probability.		
(a)(ii)	$\frac{143}{971} = 0.1473$ or equivalent.	Correct probability.		
(b)	The relative risk that a female in this sample has a bag which is heavy = $\frac{141}{558}$ over $\frac{98}{413}$ = 1.0649 Accept as MEI: $\frac{208}{558}$ over $\frac{144}{413}$ = 1.0691 Explanation: This **means** that females are (6%) more likely to have a heavy bag. Qualification: This RR is only very slightly over 1 so it means that the difference may not actually be statistically significant (in essence). NB: Reciprocal RR for male/female is 0.94.	One risk correctly calculated.	**Correct** relative risk OR valid qualification on the claim is made.	T1: Correct or reciprocal relative risk and explanation T2: Correct or reciprocal relative risk and explanation AND a clear comment made which qualifies the claim's validity.
(c)(i)	The distributions in figure 1 are not symmetrical whereas a normal distribution is symmetrical and **bell-shaped**.	Describes the lack of symmetry.	Describes the lack of symmetry and clearly describes the **shape** of a normal distribution.	
(c)(ii)	You would not expect the bag weights to be symmetrically distributed as a normal distribution because: (1) as the mean is around 4 kg, you would need some negative weights to make a symmetrical distribution, which is impossible (2) while most people have average bag weights, some individuals carry a lot more gear than others [e.g. Sports people, those with lots of books …] so this will cause a tail to the right (3) most bags will be lighter than 4kg as [any valid reason], which will cause the peak to be at the low end of the axis (4) other valid reasoning.		Clear consideration of symmetry with ONE reason given to support the statement OR TWO reasons given clearly.	Clear consideration of symmetry with TWO reasons given to support the statement.

N1	N2	A3	A4	M5	M6	E7	E8
A valid attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	T1 OR T	T2 OR (T1 and T)

N∅ = No response; no relevant evidence.

TWO	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	$P(415 < x < 520)$ $= P(-1 < z < 2)$ $= 0.8186$	Correct probability.		
(a) (ii)	$P(x < 400)$ $= P(z < -1.4286)$ $= 0.0766$	Correct probability.		
(b)	$P(x < k) = 0.15$, $k = 413.7$ g $P(x > m) = 0.10$, $m = 494.9$ g Acceptable range is 413.7 to 494.9 g	One of the end points of the range correct or CAO.	Correct range given.	
(c)(i)	She is less consistent (the weights of her plates have more variety) than the company as a whole.	Unclear or contradictory comments with some validity.	Correct interpretation.	
(c)(ii)	$P(z > k) > 0.75$ so $k < -0.6745$ Hence, sd $< \dfrac{-50}{-0.6745} = 74.12\text{ g}$ (4sf) Her sd > 35, So the range of possible values is $35 < \text{sd} < 74.12$ Trial and improvement methods also acceptable with a record of consecutive trials.	Correct z-value found (± 0.6745) Or CAO	Correct sd found but not expressed as a correct inequality OR record of estimations leading to sd accurate to 2sf.	Correct range obtained OR record of estimations leading to range accurate to 2sf.
(d)(i)	$P(x > 520) = 0.02275$ P(2 plates over 520 g) $= 0.02275^2$ $= 0.0005176 \sim 0.05\%$	$P(x > 520)$ correct or CAO.	Correct probability.	
(d)(ii)	The probability from d(i) is very small, suggesting that Eddy's plates might have: (1) a higher mean than usual, since if the mean was the same the chance of 2 over 520 g is very low (2) a significantly increased variation in the weights of plates that he makes but the same mean (3) both a higher mean and increased variation (4) a distribution that may not even be normal, in which case it will be difficult to find probabilities (5) other valid reasoning.		One of the reasons is clearly stated.	Student cites low value of P(2 plates > 520 g) AND one of the reasons is clearly stated.

N1	N2	A3	A4	M5	M6	E7	E8
A valid attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

N0 = No response; no relevant evidence.

THREE	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	36%	Correct probability.		
(ii)	48%	Correct probability.		
(iii)	(1) If you play 100 times, you would expect to win \$2 ~ 36 times, win \$1 ~ 48 times, giving you total winnings of \$120 (or consistent with 24% in (ii), i.e. \$96). (2) But it would have cost you \$50 to play 100 games, **so** you would profit by about \$60 (using the \$110). (3) Ju-Eun cannot say that Kim will profit by exactly any amount as there is always random variation in games of chance so if you repeated the 100 games many times you would get a variety of profit figures. (4) The experimental probability would usually differ from the theoretical probability in any game of chance, so if Ju-Eun makes a claim like this based on calculations she may not be correct in practice. (5) Other valid reasoning.	ONE of points (1) to (4).	TWO of points (1) to (4).	
(b)	Probability tree implies that P(win a prize) = p(WW) + p(WLW) + p(WLLW) + p(LWW) + p(LWLW) + p(LLWW) $= 0.6^2 + 0.6^2 \times 0.4 + 0.6^2 \times 0.4^2 + 0.6^2 \times 0.4 + 0.6^2 \times 0.4^2 + 0.6^2 \times 0.4^2$ = 0.36 + 0.144 + 0.0576 + 0.144 + 0.0576 + 0.0576 = 0.8208	One correct, identifiable probability calculated for at least 3 games or CAO.	At least 4 out of the 6 probabilities correctly calculated and summed.	all 6 probabilities correctly calculated and summed.
(c)	Let x = p(wins first game) Since p(wins 2 games) = 1 – 0.75 = 0.25, $2x^2 = 0.25$ $x = 0.3536$ So p(loses both games) $= (1 - 0.3536)(1 - \frac{0.3536}{2})$ = 0.5321	Probability tree set up correctly with x, $2x$ and $\frac{x}{2}$ or CAO.	Obtains p(win first game) = 0.3536.	Correct probability obtained and clearly stated.

N1	N2	A3	A4	M5	M6	E7	E8
A valid attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

N0 = No response; no relevant evidence.

Cut scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 19	20 – 24