Assessment Schedule – 2016

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

Evidence Statement

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
ONE (a)(i)	$p = 0.3 \times 0.65 = 0.195$	Probability found.		
(ii)	$p = (0.7 \times 0.6) + (0.3 \times 0.35 \times 0.6)$ $= 0.42 + 0.063$ $= 0.483$	Either 0.42 or 0.063 calculated.	Probability found.	
(iii)	$P(\text{1st and Local}) = 0.7 \times 0.31 = 0.217$ $P(\text{2nd and Local}) = 0.3 \times 0.35 \times 0.31 = 0.03255$ $P(\text{Local}) = 0.217 + 0.03255 = 0.24955$ $p = \dfrac{0.217}{0.24955} = 0.87$	Either 0.217 or 0.03255 found.	P(Local) found.	Solution found.
(iv)	$P(\text{Export}) = (0.7 \times 0.09) + (0.3 \times 0.35 \times 0.09)$ $\qquad\qquad = 0.07245$ Total crop $= \dfrac{120 \times 172}{0.07245} = 284\,887$	0.07245 found.		Crop found.
(b)(i)	$p = \dfrac{2}{3} \times 0.85 \times 0.3 = 0.17$	Probability found.		
(ii)	$P(\text{Jazz export}) = \dfrac{2}{3} \times 0.85 \times 0.12 = 0.068$ $P(\text{Beauty export}) = \dfrac{1}{3} \times 0.95 \times 0.15 = 0.0475$ $P(\text{Beauty}) = \dfrac{0.0475}{0.068 + 0.0475} = 0.4113$ No. cartons $= 294 \times 0.4113 = 120.9$ Hence the minimum condition is met.		0.411 found.	Correct answer found and conclusion given.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	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

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
TWO (a)(i)	$p = \dfrac{180}{1200} = 0.15$	Proportion found.		
(ii)	$p = \dfrac{122}{180} = 0.68$	Proportion found.		
(iii)	$p = \dfrac{122}{1200} = 0.102$ Expected No. $= 0.102 \times \dfrac{1200}{560} \times 171000$ $= 37254$	Proportion found.	Expected number found.	
(iv)	Risk of Conventional $= \dfrac{122}{640} = 0.1906$ Risk of Organic $= \dfrac{58}{560} = 0.1036$ Relative risk $= \dfrac{0.1906}{0.1036} = 1.84$ As this does not exceed 2, then the claim is not justified.	One risk found.	Relative risk found.	Comparison with 2 and correct conclusion.
(b)(i)	<table><tr><td></td><td>Jazz</td><td>Beauty</td><td>Total</td></tr><tr><td>Diseased</td><td>52</td><td>128</td><td>180</td></tr><tr><td>Not diseased</td><td>838</td><td>182</td><td>1020</td></tr><tr><td>Total</td><td>890</td><td>310</td><td>1200</td></tr></table> $\dfrac{52}{1200} = 0.043$		Proportion found.	
(ii)	Risk of Jazz $= \dfrac{52}{890} = 0.0584$ Risk of Beauty $= \dfrac{128}{310} = 0.4129$ Relative risk $= \dfrac{0.4129}{0.0584} = 7.066$ Hence $7.066 > 1.84$ and it is more likely that variety determines whether an apple is diseased.	Both risks found.	Relative risk found.	Correct interpretation and comparison of risks and a correct conclusion.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	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

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
THREE (a)(i)	$P(0 < Z < 1.33) = 0.4088$	Probability found.		
(ii)	$P(Z < -2.22)$ $= 0.01313$ Hence about 1.3%	Percentage found.		
(iii)	$P(Z < z) = 0.95 \Rightarrow z = 1.645$ $\dfrac{x - 310}{4.5} = 1.645$ $x = 310 + 1.645 \times 4.5 = 317.4$ g	$z = 1.645$ found.	Correct answer.	
(iv)	$P(\text{Under or Over}) = 0.01313 + 0.05 = 0.06313$ $1 - 0.06313 = 0.9369$ Machine needs checking if 3 bottles are outside the accepted range $= 0.06313^3$. OR if 2 bottles are outside the accepted range $3 \times 0.06313^2 \times 0.9369$ $p = (0.06313)^3 + 3 \times (0.06313^2 \times 0.9369)$ $= 0.011$		Finds 0.9369.	Probability found.
(b)(i)	$p = \dfrac{20}{150} = 0.13$	Proportion found.		
(ii)	Possible valid comments could include: **Shape:** Graph 1: Symmetrical; bell-shape. Graph 2: Not symmetrical; skewed to the right. **Centre:** Graph 1: Unimodal – mode at 310; median = mode = mean. Graph 2: Unimodal – mode at 302 – 304; median (302 – 304) and mean both to the left of centre. **Spread:** Graph 1: Range of about 28. Graph 2: Range of 14. **Proportions:** Proportions vary, e.g. between 298 and 300 for figures 1 and 2.	One valid comment about each of two aspects of shape, centre and spread.	Three valid comments, at least one comparative, covering two aspects of shape, centre and spread. There must be numerical support for at least one comment.	As for Merit except at least two comparative comments and all three aspects of shape, centre and spread covered. There could also be some comparisons of class proportions.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	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

Cut Scores

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