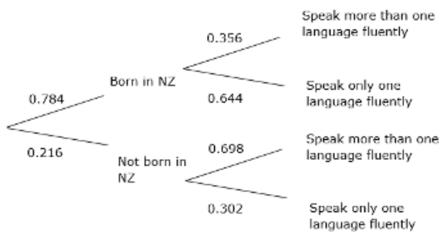
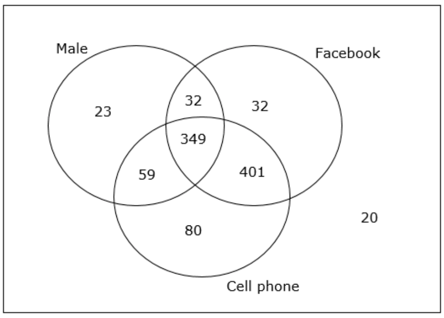
Assessment Schedule – 2017

Mathematics and Statistics (Statistics): Apply probability concepts in solving problems (91585)

Evidence Statement

One	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	 P(only one language) $= 0.784 \times 0.644 + 0.216 \times 0.302$ $= 0.570$ (3 d.p.)	Correct probability calculated.		
(a)(ii)	Test: $P(A).P(B) \neq P(A \cap B)$ $P(NZ \cap >1L) = 0.784 \times 0.356 = 0.279$ $P(NZ) . P(>1L) = 0.784 \times 0.430$ $= 0.337 \neq 0.279$ Therefore the events are not independent. *Accept equivalent explanation, eg:* P(speak more than one language fluently given born in NZ) = 0.356 P(speak more than one language fluently given not born in NZ) = 0.698 The events are not independent, since the probability of speaking more than one language is different depending on whether a student was born in NZ or not.	Relevant probability calculation.	Full explanation that links the decision that the two events are not independent to the calculations.	
(b)(i)	P(female ∩ does not own cell phone) $= \frac{52}{996} = 0.052$ (3 d.p.)	Correct probability calculated.		
(b)(ii)	Test: $P(A \cap B) = 0$. P(Facebook account ∩ cell phone) $= \frac{750}{996} \neq 0$ ($0.753 \neq 0$) Therefore the events are not mutually exclusive.	Correct probability calculated.	Full explanation that links the decision that the two events are not mutually exclusive to the calculations.	

(b)(iii)	 P(female ∩ no Facebook account ∩ no cell phone) = $\frac{20}{996}$ = 0.020 (3 d.p.)	Two correct values in a relevant Venn diagram.	Diagram completed and value of 20 found.	Correct probability calculated.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Reasonable start / attempt at one part of the question.	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t (with minor omission or error)	1 of t

<table>
<tr><th>Two</th><th>Expected Coverage</th><th>Achievement (u)</th><th>Merit (r)</th><th>Excellence (t)</th></tr>
<tr><td>(a)(i)</td><td>
<table>
<tr><th></th><th>Air NZ</th><th>Not Air NZ</th><th>Total</th></tr>
<tr><td>Delayed</td><td>24</td><td>7</td><td>31</td></tr>
<tr><td>Not delayed</td><td>40</td><td>12</td><td>52</td></tr>
<tr><td>Total</td><td>64</td><td>19</td><td>83</td></tr>
</table>
P(Delayed | Not Air NZ) = $\frac{7}{19}$
= 0.368 (3 d.p.)</td><td rowspan="2">Correct probability calculated for (a)(i).</td><td rowspan="2">Correct probability calculated for (a)(i).
AND
Two reasons given for (a)(ii).</td><td rowspan="2"></td></tr>
<tr><td>(a)(ii)</td><td>Two reasons of any type:
• Amount of data.
• Nature of data:
- the next day is likely to have different weather conditions
- the next day could be a different day of the week.</td></tr>
<tr><td>(a)(iii)</td><td>If $P(A \cup B) = 0.54$, then $P(A' \cap B') = 0.46$
If $P(A' \cup B) = 0.86$, then $P(A \cap B') = 0.14$
Therefore, $P(B') = 0.46 + 0.14 = 0.6$
and $P(B) = 1 - 0.6 = 0.4$
Accept other valid chains of reasoning or use of diagrams (e.g. a two way table) to determine probability.</td><td></td><td>One example of correct use of probability theory / method to deduce a relevant probability that was not provided (eg. 0.46 or 0.14 on a Venn diagram).</td><td>The probability is correctly calculated using a logical chain of reasoning.</td></tr>
<tr><td>(b)(i)</td><td>Percentage of predictions correct
$= \frac{172+94}{400} = 0.665 = 66.5\%$</td><td>Correct proportion calculated.</td><td></td><td></td></tr>
<tr><td>(ii)</td><td>P(predict female | actually female)
$= \frac{172}{172+26} = 0.869$
P(predict male | actually male)
$= \frac{94}{108+94} = 0.465$
So model predicts less than half of males as being male.
Accept other valid reasoning e.g. 198 females used website, but 280 females were predicted, so model predicting nearly 50% more females than used the website.</td><td>At least one correct additional proportion calculated as part of reasoning.</td><td>At least one correct additional proportion calculated and used appropriately to support reasoning about a potential issue with the model.</td><td></td></tr>
</table>

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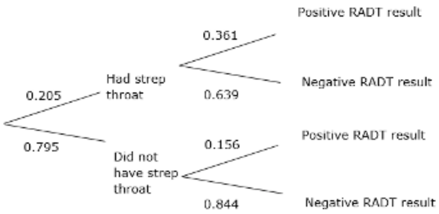
<table>
<tr><th>Three</th><th>Expected Coverage</th><th>Achievement (u)</th><th>Merit (r)</th><th>Excellence (t)</th></tr>
<tr><td>(a)(i)</td><td>P(Not strep throat)
= 0.124 + 0.671
= 0.795

As this proportion is over 50%, the data supports the statement.</td><td>Correct proportion calculated.</td><td>Correct proportion calculated
AND
justification of support for the statement.</td><td></td></tr>
<tr><td>(a)(ii)</td><td>P(positive RADT result | strep) = $\frac{0.074}{0.074+0.131} = 0.361$
P(positive RADT result | not strep) = $\frac{0.124}{0.124+0.671} = 0.156$

</td><td>Correct probabilities calculated for the first set of branches.</td><td>Correct probabilities calculated for all branches (don't penalise a lack of rounding to 3 dp).</td><td></td></tr>
<tr><td>(b)(i)</td><td>Estimated P(S = 1) = $\frac{7}{50}$ = 0.14</td><td>Correct estimated probability calculated.</td><td></td><td></td></tr>
<tr><td>(b)(ii)</td><td>A score of 1 requires at least two of the spinners to show a 1.
In total, there are $4 \times 4 \times 4 = 64$ possible outcomes.
Of these, 10 would have at least two of the spinners showing one:
111,112,113,114,121,131,141,211,311,411
Theoretical P(S = 1) = $\frac{10}{64}$ = 0.156 (3 d.p.)
Accept use of probability tree or similar diagram to determine theoretical probability.</td><td>Probability of one outcome found, ie
$\left(\frac{1}{4}\right)^3 = \frac{1}{64}$</td><td>Correct theoretical probability calculated.</td><td></td></tr>
<tr><td>(b)(iii)</td><td><table><tr><td>s</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>P($S = s$)</td><td>0.156</td><td>0.344</td><td>0.344</td><td>0.156</td></tr><tr><td>P(S=s)</td><td>5/32</td><td>11/32</td><td>11/32</td><td>5/32</td></tr></table>Requires knowledge that distribution is symmetric, so P(X = 2) = 0.5 – P(X = 1) = 0.344. Could use systematic approach like (b)(ii).</td><td>P(S = 4) = P(S = 1)</td><td>P(S = 2) or P(S = 3) correct.</td><td>Probability distribution table completed.</td></tr>
</table>

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Cut Scores

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