

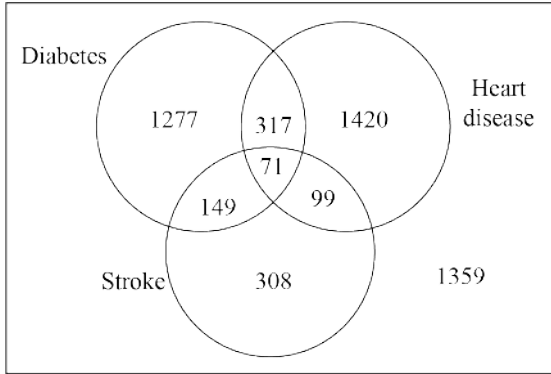
Assessment Schedule – 2020**Mathematics and Statistics (Statistics): Apply probability concepts in solving problems (91585)****Evidence Statement**

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)																
ONE (a)(i)	<table border="1"> <thead> <tr> <th></th> <th>Dehydrated</th> <th>Not Dehydrated</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>LBS</td> <td>20</td> <td>12</td> <td>32</td> </tr> <tr> <td>Normal</td> <td>7</td> <td>41</td> <td>48</td> </tr> <tr> <td>Total</td> <td>27</td> <td>53</td> <td>80</td> </tr> </tbody> </table> <p>$P(\text{dehydrated}) = \frac{27}{80} = 0.3375$</p>		Dehydrated	Not Dehydrated	Total	LBS	20	12	32	Normal	7	41	48	Total	27	53	80	P(dehydrated) correctly calculated.		
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(ii)	<p>$P(\text{dehydrated} \cap \text{LBS}) = \frac{20}{80} = 0.25 \neq 0$</p> <p>As this probability is not equal to zero, the events [‘student is dehydrated’ and ‘student has low blood sugar’] <u>are not</u> mutually exclusive.</p>	P(dehydrated \cap LBS) correctly calculated.	P(dehydrated \cap LBS) correctly calculated, shown not equal to zero and statement of events not being mutually exclusive.																	
(iii)	<p>Reasons may include:</p> <ul style="list-style-type: none"> Students are selected from only one school – the proportion of low blood sugar after exercise may be different in another school. Amount of data – a small number of students (80) have been studied, the estimate of the probability of low blood sugar after exercise may be less accurate for this small group of students. <p><i>Accept other valid reasons with clear links to the difference in probability of decreased blood sugar levels.</i></p>		ONE reason identified and explained, with clear link to context. OR TWO reasons identified without clear link to context.	TWO reasons identified and explained, with clear links to context.																

(b)(i)	<p>$P(\text{decreased cognitive ability} \cap \text{dehydrated and low blood sugar})$ $= 0.15 \times 0.45 = 0.0675$</p> <p>$P(\text{decreased cognitive ability} \cap \text{not dehydrated and normal blood sugar})$ $= 0.57 \times 0.05 = 0.0285$</p> <p>$P(\text{decreased cognitive ability} \cap \text{dehydrated or low blood sugar, but not both})$ $= 0.28 \times 0.32 = 0.0896$</p> <p>$P(\text{decreased cognitive ability})$ $= 0.0675 + 0.0285 + 0.0896$ $= 0.1856$</p>	At least ONE combined probability correctly calculated.	Probability of decreased cognitive ability correctly calculated.	
(ii)	<p>$P(\text{not dehydrated and normal blood sugar} \mid \text{decreased cognitive ability})$ $= \frac{0.0285}{0.1856} = 0.1536$</p> <p>The proportion of students with decreased cognitive ability that are neither dehydrated nor have low blood sugar is approximately 15%.</p>		Correct (or consistent) probability with clear working.	Correct (or consistent) probability with clear working. AND Interpretation in context.

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	2 of t

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
<p>TWO (a)(i)</p> <p>(ii)</p> <p>(iii)</p>	<p>$P(\text{cholesterol level greater than } 200 \text{ mg / dL}) = (0.05 \times 0.73) + (0.95 \times 0.24)$ $= 0.0365 + 0.228$ $= 0.2645$ Number expected = $0.2645 \times 100 = 26.45$. Accept 26 or 27 people.</p> <p>$P(\text{heart disease} \mid \text{positive test result})$ $= \frac{P(\text{heart disease} \cap \text{positive})}{P(\text{positive})}$ $= \frac{0.0365}{0.2645} = 0.138$</p> <p>The patient should not be overly concerned that they actually have heart disease if they receive a positive test result as the chance of actually having heart disease is small.</p> <p>When the threshold value increases, the $P(\text{positive test})$ <u>decreases</u>.</p> <p>The $P(\text{no heart disease when cholesterol is above the new threshold})$ decreases significantly compared to $P(\text{heart disease when cholesterol is above the new threshold})$. This means that $P(\text{heart disease} \mid \text{cholesterol is above the higher threshold})$ will increase.</p>	<p>Number correctly calculated.</p> <p>Conditional probability correctly calculated.</p>	<p>Conditional probability correctly calculated. AND Comment that the patient should not be concerned.</p> <p>Statement that $P(\text{positive test})$ decreases.</p>	<p>Statement that $P(\text{positive test})$ decreases. AND Correct reasoning that $P(\text{heart disease} \mid \text{positive test})$ increases.</p>

<p>(b)(i)</p>	 <p>$\frac{1420}{5000} = 0.284$</p>	<p>Proportion correct.</p>		
<p>(ii)</p>	<p> $P(\text{diabetes} \text{heart disease}) = \frac{388}{1907} = 0.2035$ $P(\text{stroke} \text{heart disease}) = \frac{170}{1907} = 0.0891$ $\frac{P(\text{diabetes} \text{heart disease})}{P(\text{stroke} \text{heart disease})} = 2.282$ </p> <p>The claim is justified, as a [randomly chosen] patient is more than twice as likely to be diagnosed with diabetes compared to stroke (given that they have been diagnosed with heart disease).</p>	<p>At least one conditional probability correctly calculated.</p>	<p>Calculation of correct ratio using correct denominator. OR Correct ratio found with use of incorrect denominator and claim confirmed with justification.</p>	<p>Calculation of correct ratio. AND Claim confirmed with justification.</p>

N0	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	2 of t

<p>(b)(i)</p>	<p> $P(\text{female} \cap \text{ear piercing(s)}) = \frac{91}{250} = 0.364$ $P(\text{female}) \times P(\text{ear piercing(s)}) = \frac{138}{250} \times \frac{149}{250} = 0.329$ <p>As $P(\text{female}) \times P(\text{ear piercing(s)}) \neq P(\text{female} \cap \text{ear piercing(s)})$, the two events stated are <u>not independent</u>.</p> <p>OR using the conditional probability test, for example,</p> $P(\text{ear piercing(s)}) = \frac{149}{250} = 0.596$ $P(\text{ear piercing(s)} \text{female}) = \frac{91}{138} = 0.659$ <p>Different answers suggest <u>non</u>-independence of the two events stated.</p> </p>	<p>Relevant probabilities calculated for the test chosen.</p>	<p>Relevant probabilities calculated for the test chosen.</p> <p>AND</p> <p>Statement of non-independence of events.</p>	
<p>(ii)</p>	<p> $P(3 \text{ males have ear piercing(s)}) = \frac{58}{112} \times \frac{57}{111} \times \frac{56}{110} = 0.1354$ $P(2 \text{ males have ear piercing(s)}) = \left(\frac{58}{112} \times \frac{57}{111} \times \frac{54}{110} \right) + \left(\frac{58}{112} \times \frac{54}{111} \times \frac{57}{110} \right) + \left(\frac{54}{112} \times \frac{58}{111} \times \frac{57}{110} \right)$ $= 0.3916$ $P(2 \text{ or } 3 \text{ males have ear piercing(s)}) = 0.1354 + 0.3916 = 0.5270$ <p>Assumptions:</p> <ul style="list-style-type: none"> Assumption made that the presence of ear piecing(s) for each male is independent. Assumption made that sampling without replacement is necessary as you can't reselect a male. </p>	<p>Probability correctly calculated for either 2 or 3 males having ear piercing(s).</p> <p>OR</p> <p>Incorrect probability calculated for either of 2 or 3 males having ear piercing(s) using sampling with replacement. That is, $P(3 \text{ males have ear piercing(s)}) = 0.1389$ $P(2 \text{ males have ear piercing(s)}) = 0.3879$</p>	<p>Probability correctly calculated for sum of 2 or 3 males having ear piercing(s).</p> <p>OR</p> <p>Incorrect probability calculated for sum of 2 or 3 males having ear piercing(s) using sampling with replacement. That is, $P(2 \text{ or } 3 \text{ males have ear piercing(s)}) = 0.1389 + 0.3879 = 0.5268$</p>	<p>Probability correctly calculated for 2 or 3 males having ear piercing(s).</p> <p>AND</p> <p>One assumption stated clearly in context.</p>

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Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 14	15 – 19	20 – 24