Assessment Schedule – 2014

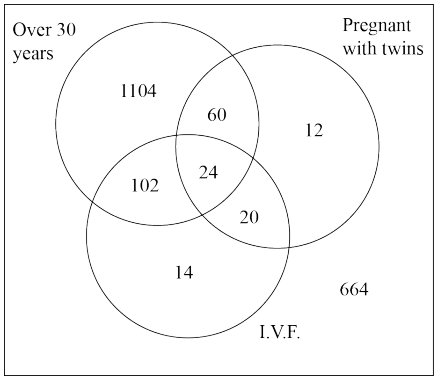
Mathematics and Statistics (Statistics): Apply probability concepts in solving problems (91585)

Evidence Statement

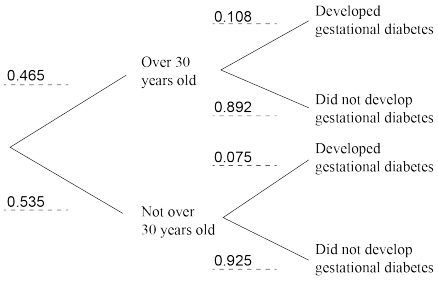
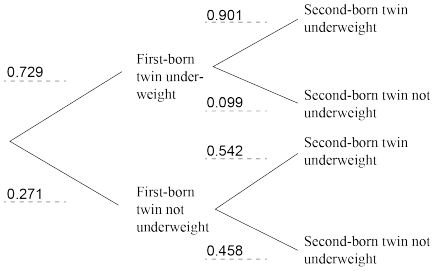
<table>
<tr><th>One</th><th>Expected Coverage</th><th>Achievement (u)</th><th>Merit (r)</th><th>Excellence (t)</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th></th><th>Over 30 years old</th><th>Not over 30 years old</th><th>Total</th></tr>
<tr><td>Pregnant with twins</td><td>84</td><td>32</td><td>116</td></tr>
<tr><td>Not pregnant with twins</td><td>1206</td><td>678</td><td>1884</td></tr>
<tr><td>Total</td><td>1290</td><td>794</td><td>2000</td></tr>
</table>
P(not pregnant with twins and over 30)
$= \frac{1206}{2000} = 0.603$</td><td rowspan="2">Proportion correctly calculated for part (a).

OR

Conditional probability for one woman correctly calculated for part (b).</td><td rowspan="2">Conditional probability for both women correctly calculated for part (b).</td><td rowspan="2"></td></tr>
<tr><td>(b)</td><td>P(one women over 30 if pregnant with twins) = $\frac{84}{116}$ (0.724)
P(both women over 30 if both pregnant with twins) $= \frac{84}{116} \times \frac{83}{115} = 0.523$</td></tr>
<tr><td>(c)</td><td>P(is with twins) $= \frac{116}{2000}$
P(is over 30) $= \frac{1290}{2000}$
P(is pregnant with twins and over 30)
$= \frac{84}{2000} = 0.042$
P(is with twins) × P(is over 30)
$= \frac{116}{2000} \times \frac{1290}{2000} = 0.037$
Therefore the events are not independent as $P(A) \times P(B) \neq P(A \cap B)$
OR
P(is with twins $\mid$ over 30)
$= \frac{84}{1290} = 0.065$
P(is with twins) $= \frac{116}{2000} = 0.058$
Therefore the events are not independent as $P(B / A) \neq P(B)$
Accept other valid chains of reasoning.</td><td>Correct probabilities calculated as part of a reasonable attempt to use an independence rule.</td><td>Independence rule used with correct probabilities to determine events are not independent.</td><td></td></tr>
</table>

(d)	A Venn diagram or other suitable diagram or method is used.  P(not over 30 and not pregnant with twins and did not use I.V.F.) $= \frac{664}{2000} = 0.332$ *Accept other valid chains of reasoning.*		A reasonable attempt is made to organise information (eg. calculates at least four values correctly) and arrives at a consistent incorrect probability.	Probability correctly calculated.

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

Two	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	P(gestational diabetes OR over 30) = 0.505 $400 \times 0.505 = 202$ 202 women in this study developed gestational diabetes or were over 30 years old.	The number of women is correctly determined in part (i). OR The correct probabilities are calculated for the first set of branches in part (ii).	The correct probabilities are calculated for all branches in part (ii).	
(ii)	Tree is completed with probabilities rounded to 3 decimal places where needed.  			
(iii)	P(gestational diabetes / over 30) = 0.108 P(gestational diabetes / not over 30) = 0.075 Relative risk = $\frac{0.108}{0.075} = 1.44$ The risk for a woman over 30 years of age developing gestational diabetes is 1.44 [times] greater than the risk for a woman no more than 30 years old.	The correct conditional probabilities are identified for the comparison, eg through the use of probability statements.	A statement is made that compares the risk using numerical values.	
(b)	Probability statements, a tree diagram or another method (two-way table) is used to find required probabilities of combined events.  P(first-born twin underweight and second-born twin not underweight) $= 0.729 \times 0.099 = 0.0722$ P(second-born twin normal weight or overweight) $= 0.124 + 0.729 \times 0.099 = 0.1962$ P(first-born twin underweight / second-born twin not underweight) $= \frac{0.0722}{0.1962} = 0.368$	At least one correct probability relevant to the problem is calculated.	A reasonable attempt to model the situation using appropriate methods and / or diagrams is demonstrated, including at least one correct probability relevant to the problem being calculated.	The correct conditional probability is calculated, supported by a clear communication of strategy used to obtain this probability, including use of correct probability statements.

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No response; no relevant evidence.	Reasonable start / attempt at one part of the question.	Almost complete correct answer	1 of u	2 of u	1 of r	2 of r	1 of t (with minor error)	1 of t

Three	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)	The proportion of days where the sum of the ages of the three children was 8 is $\frac{12}{30}$ (or $\frac{12}{33}$). This is different to the theoretical probability of 0.3. However, we would expect a difference between the observed proportion and the theoretical probability, [due to chance variation.] [So the parent is incorrect to reason that just because the two probabilities are different, this is evidence the selection process was not random.]	A vague explanation about how the observed proportion is unlikely to be the same as the theoretical probability for part (a). OR Some discussion how a simulation would allow the parent to see that there is variability present in part (b).	A clear explanation about how the observed proportion is unlikely to be the same as the theoretical probability for part (a). OR Discusses how a simulation would allow the parent to see that there is variability present in part (b).	A clear explanation about how the observed proportion is unlikely to be the same as the theoretical probability for part (a). AND Discusses how a simulation would allow the parent to see that there is variability present in part (b).
(b)	A simulation would allow the parent to see that there is variation for the experimental probability for sets of 30 days. [They could then determine the likelihood of obtaining a result at least as large as 40% if the children were randomly selected.]			
(c)	Table is completed with correct probabilities: P(sum of the ages of the three children is 6) $= \frac{6}{10} \times \frac{5}{9} \times \frac{4}{8} = \frac{1}{6}$ P(sum of the ages of the three children is 7) $= 1 - \frac{1}{6} - \frac{1}{30} - \frac{3}{10} = \frac{1}{2}$ P(sum of the ages of the three children is 9) $= \frac{4}{10} \times \frac{3}{9} \times \frac{2}{8} = \frac{1}{30}$	One probability not given in the table is correctly calculated.	All missing probabilities are correctly calculated.	

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No response; no relevant evidence.	Reasonable start / attempt at one part of the question.	Almost complete correct answer	1 of u	2 of u	1 of r	2 of r	1 of t (with minor error)	1 of t

Cut Scores

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 6	7 – 12	13 – 19	20 – 24