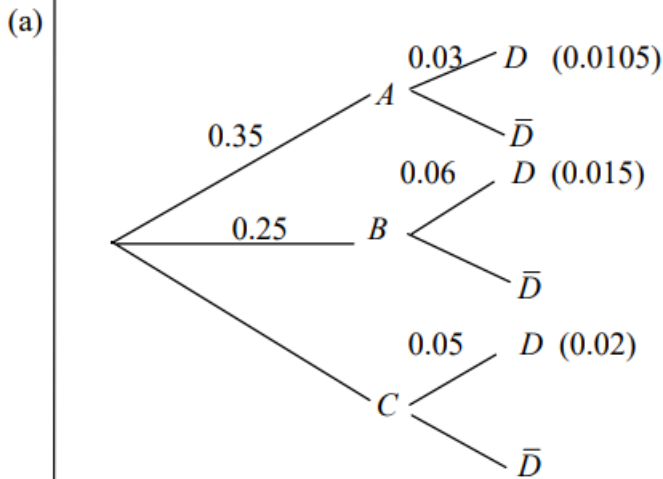


Conditional Probability with Tree Diagrams and Two-Way Tables (From Edexcel 6683)

Q1, (Jun 2005, Q7)

	Glasses	No Glasses	Totals		
Science	18	12	30		
Arts	27	23	50	50 may be seen in (a)	
Humanities	44	24	68	23 may be seen in (b)	B1
Totals	89	59	148		B1
(a)	$P(\text{Arts}) = \frac{50}{148} = \frac{25}{74} = 0.338$			a number/148	M1 A1 (4)
(b)	$P(\text{No glasses / Arts}) = \frac{23/148}{50/148} = \frac{23}{50} = 0.46$			$\frac{\text{prob}}{\text{their(a)prob}}$ or $\frac{\text{number}}{\text{their } 50}$	M1 A1 (2)
(c)	$P(\text{Right Handed}) = \left(\frac{30}{148} \times 0.8\right) + \left(\frac{50}{148} \times 0.7\right) + \left(\frac{68}{148} \times 0.75\right)$			attempt add three prob	M1 A1 ✓
	$= \frac{55}{74} = 0.743$			A1 ✓ on their (a) awrt 0.743	A1 (3)
(d)	$P(\text{ Science /Right handed}) = \frac{\frac{30}{148} \times 0.8}{(c)} = \frac{12}{55} = 0.218$			✓ on their (c)	M1 A1 ✓ A1 (3)

Q2, (Jan 2007, Q2)



Correct tree shape M1
 A, B and C and 0.35 and 0.25 A1
 D (x3) and 0.03, 0.06, 0.05 A1 (3)
 (May be implied by seeing
 $P(A \cap D)$ etc at the ends)

(b)(i) $P(A \cap D) = 0.35 \times 0.03, = \underline{0.0105}$ or $\frac{21}{2000}$

M1, A1

$P(C) = 0.4$ (anywhere) B1

(ii) $P(D) = (i) + 0.25 \times 0.06 + (0.4 \times 0.05)$
 $= \underline{0.0455}$ or $\frac{91}{2000}$

M1

A1 (5)

(c) $P(C|D) = \frac{P(C \cap D)}{P(D)}, = \frac{0.4 \times 0.05}{(ii)}$
 $= 0.43956... \text{ or } \frac{40}{91}$

M1, A1ft

0.44 or awrt 0.440 A1 (3)

[Correct answers only score full marks in each part]

11 marks

Q3, (Jun 2008, Q1)

(a)

Tree without probabilities or labels
0.02(Disease), 0.95(Positive) on correct branches
0.03(Positive) on correct branch.

(b) $P(\text{Positive Test}) = 0.02 \times 0.95 + 0.98 \times 0.03 = 0.0484$

(c) $P(\text{Do not have disease} | \text{Positive test}) = \frac{0.98 \times 0.03}{0.0484} = 0.607438\dots$ awrt 0.607

(d) Test not very useful OR
High probability of not having the disease for a person with a positive test

M1
A1
A1
[3]
M1A1ft
A1
[3]
M1
A1
awrt 0.607
[2]
B1
[1]
Total 9

Q4, (Jan 2009, Q2)

$E = \text{take regular exercise}$ $B = \text{always eat breakfast}$

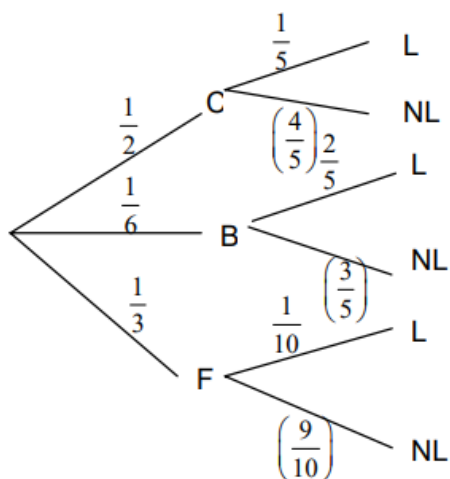
(a) $P(E \cap B) = P(E | B) \times P(B)$
 $= \frac{9}{25} \times \frac{2}{3} = 0.24$ or $\frac{6}{25}$ or $\frac{18}{75}$

(b) $P(E \cup B) = \frac{2}{3} + \frac{2}{5} - \frac{6}{25}$ | or $P(E' | B')$ | or $P(B' \cap E)$ | or $P(B \cap E')$
 $= \frac{62}{75}$ | $= \frac{13}{25}$ | $= \frac{12}{75}$ | $= \frac{32}{75}$
 $P(E' \cap B') = 1 - P(E \cup B) = \frac{13}{75}$ or 0.173

(c) $P(E | B) = 0.36 \neq 0.40 = P(E)$ or $P(E \cap B) = \frac{6}{25} \neq \frac{2}{5} \times \frac{2}{3} = P(E) \times P(B)$
 So E and B are not statistically independent

M1
A1 (2)
M1
A1
M1 A1 (4)
M1
A1 (2)
[8]

(a)



Correct tree
 All labels
 Probabilities
 on correct
 branches

B1
 B1
 B1

(3)

(b)(i)

$$\frac{1}{3} \times \frac{1}{10} = \frac{1}{30} \text{ or equivalent}$$

M1 A1

(2)

(ii)

$$\begin{aligned} \text{CNL} + \text{BNL} + \text{FNL} &= \frac{1}{2} \times \frac{4}{5} + \frac{1}{6} \times \frac{3}{5} + \frac{1}{3} \times \frac{9}{10} \\ &= \frac{4}{5} \text{ or equivalent} \end{aligned}$$

M1

A1

(2)

(c)

$$P(F' / L) = \frac{P(F' \cap L)}{P(L)} \quad \text{Attempt correct conditional probability **but see notes**}$$

M1

$$= \frac{\frac{1}{6} \times \frac{2}{5} + \frac{1}{2} \times \frac{1}{5}}{1 - (ii)}$$

$\frac{\text{numerator}}{\text{denominator}}$

$\frac{A1}{A1ft}$

$$= \frac{\frac{5}{30}}{\frac{1}{5}} = \frac{5}{6} \text{ or equivalent}$$

cao

A1

(4)
[11]

Q6, (Jun 2012, Q7)

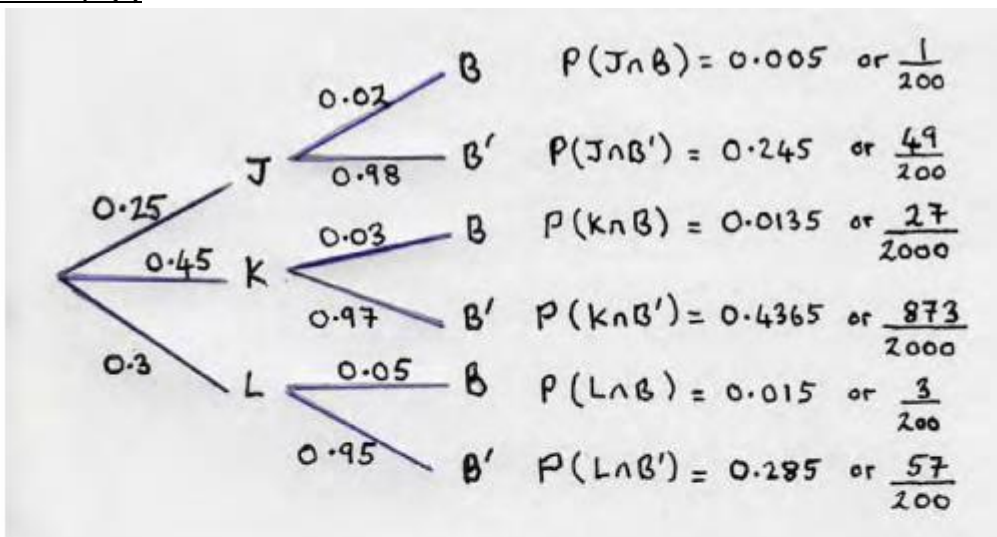
(a)		<p>Shape B1</p> <p>Labels & 0.03 B1</p> <p>Labels & 0.7,0.02 B1</p>	(3)
(b)	$P(\text{Exactly one defect}) = 0.03 \times 0.3 + 0.97 \times 0.02 \text{ or } P(PS \cup Split) - 2P(PS \cap Split)$ $= [0.009 + 0.0194 =] \quad \text{awrt } \underline{\underline{0.0284}}$	<p>M1A1ft</p> <p>A1 cao (3)</p>	
(c)	$P(\text{No defects}) = (1 - 0.03) \times (1 - 0.02) \times (1 - 0.05) \text{ (or better)}$ $= 0.90307 \quad \text{awrt } \underline{\underline{0.903}}$	<p>M1</p> <p>A1 cao (2)</p>	
(d)	$P(\text{Exactly one defect}) = (b) \times (1 - 0.05) + (1 - 0.03) \times (1 - 0.02) \times 0.05$ $= "0.0284" \times 0.95 + 0.97 \times 0.98 \times 0.05$ $= [0.02698 + 0.04753] = 0.07451 \quad \text{awrt } \underline{\underline{0.0745}}$	<p>M1 M1</p> <p>A1ft</p> <p>A1 cao (4)</p>	[12]

Q7, (Jan 2011, Q7)

<p>(a)</p>		<p>both $\frac{2}{3}, \frac{1}{3}$ B1</p> <p>$\frac{4}{9}$ B1</p> <p>both $\frac{3}{5}, \frac{2}{5}$ B1</p> <p>all three of $\frac{4}{9}, \frac{4}{9}, \frac{5}{9}$ B1</p>	<p>(4)</p>
<p>(b)</p>	$P(A) = P(RR) + P(YY) = \frac{1}{2} \times \frac{2}{5} + \frac{1}{2} \times \frac{2}{5} = \frac{2}{5}$	<p>B1 for $\frac{1}{2} \times \frac{2}{5}$ (oe) seen at least once</p>	<p>B1 M1 A1 (3)</p>
<p>(c)</p>	$P(B) = P(RRR) + P(RYR) + P(YRR) + P(YYR)$ $\left(\frac{1}{2} \times \frac{2}{5} \times \frac{2}{3}\right) + \left(\frac{1}{2} \times \frac{3}{5} \times \frac{5}{9}\right) + \left(\frac{1}{2} \times \frac{3}{5} \times \frac{5}{9}\right) + \left(\frac{1}{2} \times \frac{2}{5} \times \frac{4}{9}\right) = \frac{5}{9} \quad (*)$	<p>M1 for at least 1 case of 3 balls identified. (Implied by 2nd M1)</p>	<p>M1</p> <p>M1, A1cso (3)</p>
<p>(d)</p>	$P(A \cap B) = P(RRR) + P(YYR)$ $= \left(\frac{1}{2} \times \frac{2}{5} \times \frac{2}{3}\right) + \left(\frac{1}{2} \times \frac{2}{5} \times \frac{4}{9}\right) = \frac{2}{9} \quad (*)$	<p>M1 for identifying both cases and + probs. may be implied by correct expressions</p>	<p>M1</p> <p>A1cso (2)</p>
<p>(e)</p>	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= \frac{2}{5} + \frac{5}{9} - \frac{2}{9} = \frac{11}{9}$	<p>Must have some attempt to use</p>	<p>M1</p> <p>A1cao (2)</p>
<p>(f)</p>	$\frac{P(RRR)}{P(RRR) + P(YYY)} = \frac{\frac{1}{2} \times \frac{2}{5} \times \frac{2}{3}}{\left(\frac{1}{2} \times \frac{2}{5} \times \frac{2}{3}\right) + \left(\frac{1}{2} \times \frac{2}{5} \times \frac{5}{9}\right)} = \frac{6}{11}$	<p>Probabilities must come from the product of 3 probs. from their tree diagram.</p>	<p>M1</p> <p>A1ft</p> <p>A1 cao (3)</p> <p>[17]</p>

Q8, (Jun 2014, Q4)

(a)



M1

A1

(2)

(b) $0.25 \times 0.98,$ $= 0.245$ (or exact equiv. e.g. $\frac{49}{200}$)

M1A1

(2)

(c) $0.25 \times 0.02 + 0.45 \times 0.03 + 0.3 \times 0.05,$ $= 0.0335$ (or exact equiv. e.g. $\frac{67}{2000}$)

M1A1

(2)

(d) $[P(J \cup L | B)] = \frac{0.25 \times 0.02 + 0.3 \times 0.05}{0.0335}$ or $\frac{0.0335 - 0.45 \times 0.03}{0.0335}$
 $= 0.5970...$ awrt **0.597** (or $\frac{40}{67}$ or exact equiv.)

M1A1ft

A1

(3)

Total 9