Basic Probability Ans

0 min
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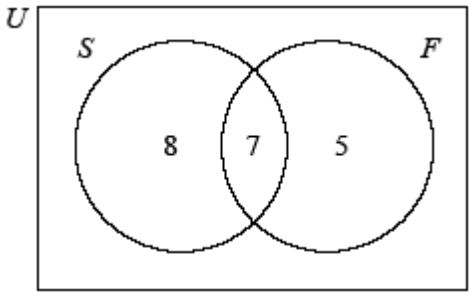
1. (a)



(A1)(A1)(A1) (C3)

Note: *Award (A1) for a labeled Venn diagram with appropriate sets.*
(A1) for 7, (A1) for 8 and 5.

(b) P (Spanish / one language only) = $\dfrac{\frac{8}{20}}{\frac{8}{20}+\frac{5}{20}}$ (M1)(A1)(ft)

Note: *Award (M1) for substituted conditional probability formula, (A1) for correct substitution. Follow through from their Venn diagram.*

= $\frac{8}{13}$ (0.615, 61.5%) (A1)(ft)

OR

P (Spanish / one language only) = $\frac{8}{8+5}$ (A1)(ft)(M1)

Note: *Award (A1) for their correct numerator, (M1) for correct recognition of regions.*
Follow through from their Venn diagram.

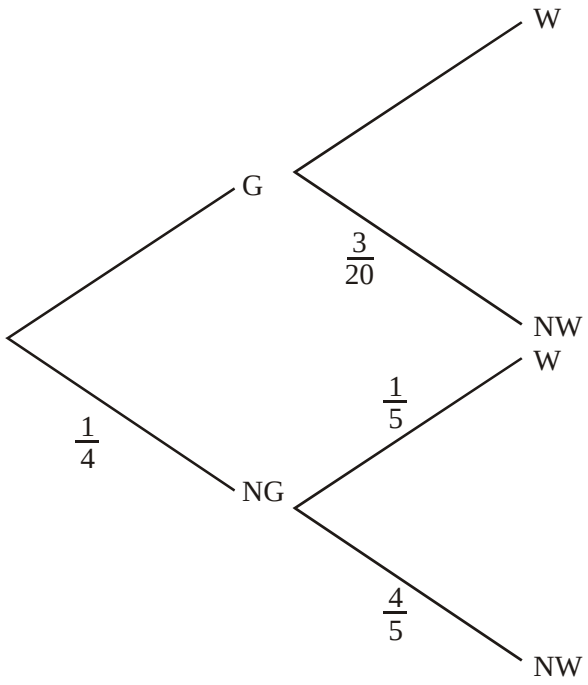
= $\frac{8}{13}$ (0.615, 61.5%) (A1)(ft) (C3)

[6]

2.

Note: *In the Spanish papers B is used instead of G and P is used instead of W.*

(a)



(A4) (C4)

(b) P ($G \cap W$) = $\frac{3}{4} \times \frac{17}{20}$ (A1)

P($NG \cap W$) = $\frac{1}{4} \times \frac{1}{5}$ (A1)

P(W) = $\frac{3}{4} \times \frac{17}{20} + \frac{1}{4} \times \frac{1}{5}$ (M1)

= $\frac{11}{16}$ (0.6875, 68.75% or 0.688 to 3 s.f.) (A1) (C4)

[8]

3. (a) (i) P(chocolate, chocolate) = $\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$ = (0.09) (M1)(A1) 2

(ii) P(one is plain) = P(chocolate, plain) + P (plain, chocolate) (M1)

$= \left(\frac{3}{10} \times \frac{7}{10}\right) + \left(\frac{7}{10} \times \frac{3}{10}\right) = \frac{42}{100}$ = (0.42) (M1)(A1) 3

(b) (i) a = 8, b = 9 (A1)(A1) 2

(ii) P(chocolate, chocolate) = 0 (A1) 1

(iii) P(at least one chocolate) = P(one is chocolate) (M1)

$= \left(\frac{9 \times 1}{10 \times 9}\right) + \left(\frac{1 \times 9}{10 \times 9}\right) = \frac{18}{90}$ = 0.2 (M1)(A1) 3

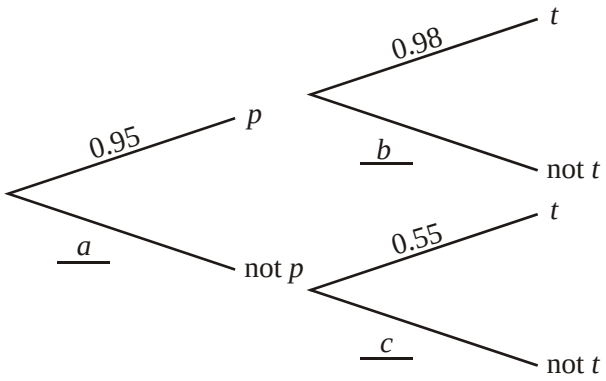
(c) P(tin, chocolate)

$\left(\frac{1}{2} \times \frac{3}{10}\right) + \left(\frac{1}{2} \times \frac{1}{10}\right)$ (M1)(M1)(M1)

= $\frac{4}{20}$ = (0.2) (A1) 4

[15]

4. (a)



$a = 0.05$ (A1)
$b = 0.02$ (A1)
$c = 0.45$ (A1) (C3)

(b) $0.95 \times 0.98 = 0.931$ (M1)(A1) (C2)

(c) $0.95 \times 0.02 + 0.05 \times 0.45$ (M1)(M1)
$= 0.0415$ (A1) (C3)

[8]

5. (a) (i) $a = 0 \left(\frac{0}{4}\right)$ (A1)

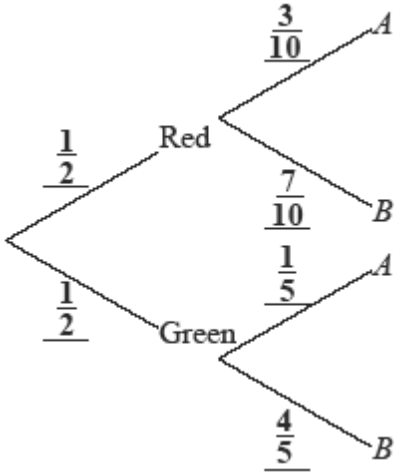
(ii) $b = \frac{3}{4}$ (0.75, 75%) (A2)(G2)

(iii) $\frac{4}{5} \times \frac{3}{4}$ (M1)(A1)

$\frac{12}{20}\left(\frac{3}{5}, 0.6, 60\%\right)$ (A1)(ft)(G2)

Note: *Award (M1) for multiplying two probabilities, (A1) for using their probabilities, (A1) for answer.*

(b)



(A1)(A1)(A1)

Note: *Award (A1) for each pair.*

(c) (i) $\frac{1}{2}\times\frac{3}{10}+\frac{1}{2}\times\frac{1}{5}$ (M1)(M1)

$= \frac{5}{20}\left(\frac{1}{4}, 0.25, 25\%\right)$ (A1)(ft)(G2)

Note: *Award (M1) for two products seen with numbers from the problem, (M1) for adding two products. Follow through from their tree diagram.*

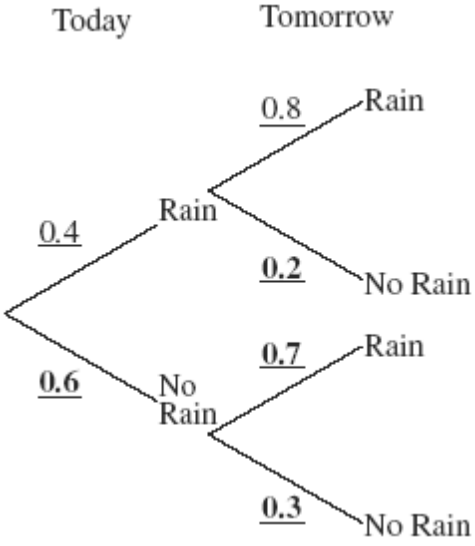
(ii) $\frac{\frac{1}{2}\times\frac{3}{10}}{\frac{1}{4}}$ (M1)(A1)

$= \frac{3}{5}$ (0.6, 60%) (A1)(ft)(G2)

Note: *Award (M1) for substituted conditional probability formula, (A1) for correct substitution. Follow through from their part (b) and part (c) (i).*

[15]

6. (a)



(A1)(A1)(A1) (C3)

Note: *Award (A1) for each correct pair.*

(b) $0.4 \times 0.8 + 0.6 \times 0.7$ (A1)(ft)(M1)

Notes: *Award (A1)(ft) for two consistent products from tree diagram, (M1) for addition of their products. Follow through from their tree diagram provided all probabilities are between 0 and 1.*

$= 0.74$ (A1)(ft) (C3)

[6]

7. (a) 12 (A2) (C2)

(b) $\frac{3}{12} = \frac{1}{4}$ or 25% (A2) (C2)

(c) $\frac{2}{12} = \frac{1}{6}$ or 16.7% (3 s.f.) (A2) (C2)

(d) $\frac{4}{12} = \frac{1}{3}$ or 33.3% (3 s.f.) (A2) (C2)

[8]

8. (a) $\frac{4}{9}$ (A2)

(b) $\frac{2}{9}$ (A2)

[4]

9. Accept all answers given as percentages. If a correct fraction is seen as answer, ignore subsequent cancellations or decimal reductions (including AP's) if incorrect.

Note *In each of (a)(i), (a)(iii), (b)(i) and (b)(ii) award (A1) for numerator and (A1) for denominator. Ft if the denominator is incorrect.*

(a) (i) P(shady) = $\frac{32}{60}\left(=\frac{8}{15}\text{ or }0.533\right)$ (A1)(A1)

Note: *Award (A1) for numerator, (A1) for denominator.*

(ii) P(dark and low growth rate) = $\frac{8}{60}\left(=\frac{2}{15}\text{ or }0.133\right)$ (A1)

(iii) P(not dark) = $\frac{60-11}{60}=\frac{49}{60}(=0.817)$ (A1)(A1) 5

(b) (i) P (high growth rate or dark environment)
= $\frac{11+25-6}{60}\left(\text{or}\frac{8+14+8}{60}\right)=\frac{30}{60}\left(=\frac{1}{2}\text{ or }0.5\right)$ (A1)(A1)

(ii) P (in light, given high growth rate) = $\frac{8}{25}$ (= 0.32) (A1)(A1) 4

(c) (i) P(CC) = $\frac{8}{60}\times\frac{7}{59}=\frac{56}{3540}\left(=\frac{14}{885}=0.0158\right)$ (M1)(A1)

or (G2)

Note: *Award (M1) for multiplication of two fractions, (A1) for the answer.*

(ii) Three alternative valid approaches might be seen:

$\frac{23}{60}\times\frac{22}{59}$

OR $\frac{15}{60}\times\frac{14}{59}+\frac{15}{60}\times\frac{8}{59}+\frac{8}{60}\times\frac{15}{59}+\frac{8}{60}\times\frac{7}{59}$

OR $1-\left(\frac{37}{60}\times\frac{36}{59}+\frac{37}{60}\times\frac{15}{59}+\frac{15}{60}\times\frac{37}{59}+\frac{37}{60}\times\frac{8}{59}+\frac{8}{60}\times\frac{37}{59}\right)$ (M1)(A1)

$= \frac{506}{3540}\left(\text{or }\frac{253}{1770}\text{ or }0.143\right)$ (A1)

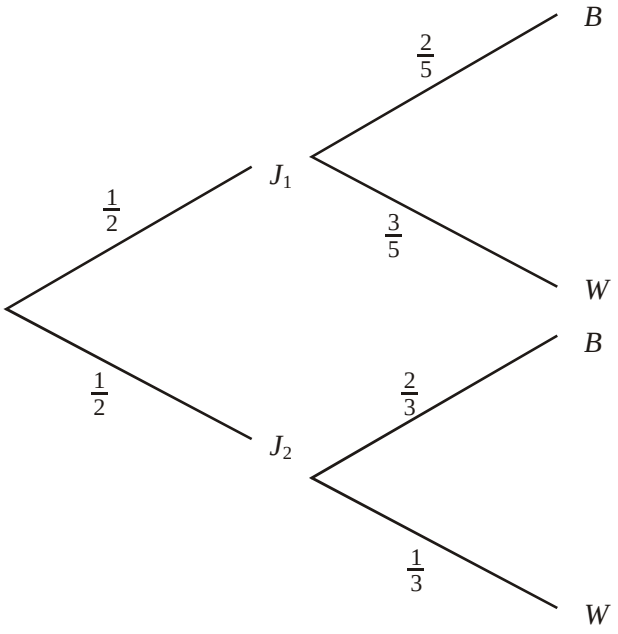
or (G3) 5

Note: *If* $= \frac{23}{60}\times\frac{22}{59}$ *is doubled, award (M1)(A0)(A0).*

If non-replacement is treated incorrectly in (i), ft to (ii) if consistent

[14]

10. (a)



(A1)

(A1) 2

(b) $P(J_1 \cap W) = \left(\frac{1}{2}\right)\left(\frac{3}{5}\right)$, $P(J_2 \cap W) = \left(\frac{1}{2}\right)\left(\frac{1}{3}\right)$ (M1)

Note: *Award (M1) for either correct.*

$P(W) = \frac{3}{10}+\frac{1}{6}$ (M1)

$= \frac{7}{15}$ ***or*** 0.467 (3 s.f.) ***or*** 46.7% (3 s.f.) (A1) 3

(c) $P(J_1 \cap W \cap W) = \left(\frac{1}{2}\right)\left(\frac{3}{5}\right)\left(\frac{2}{4}\right)$, $P(J_2 \cap W \cap W) = 0$ (M1)

$P(W \cap W) = \frac{3}{20} + 0$

$= \frac{3}{20}$ ***or*** 0.15 ***or*** 15% (A1) 2

[7]

11. (a) For solving for $P(A \cap B)$ from the formula in their tables (M1)
$P(A \cap B) = 0.2$ (A1) (C2)

(b) Because $0.4 \times 0.65 \neq 0.2$ need to see the numbers, not just a statement (R1)
Therefore no, not independent (A1) (C2)

Note: *Cannot award (A1) if (R1) not awarded.*

(c) Because $P(A \cap B) \neq 0$ (R1)
Not mutually exclusive (A1) (C2)

Note: *Cannot award (A1) if (R1) not awarded.*

[6]