

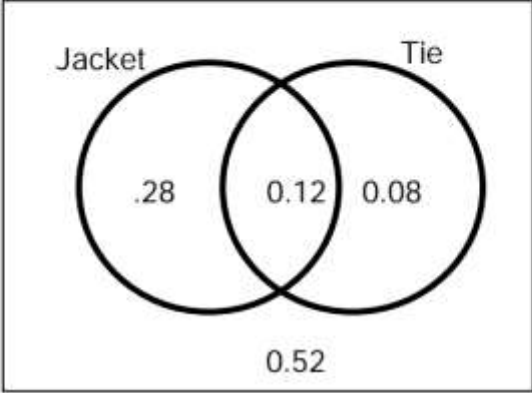
Intro to Probability (From OCR 4766)

<p>Let $P(B) = x$</p> <p>Using $P(A \cup B) = P(A) + P(B) - P(A \cap B)$</p> $0.9 = 2x + x - 0.3$ $x = 0.4$ $P(B) = 0.4$	<p>M1</p> <p>M1</p> <p>A1</p>	<p>Correct set of equations</p> <p>Correct solution</p>
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Q1, (Jan 2005, Q3)

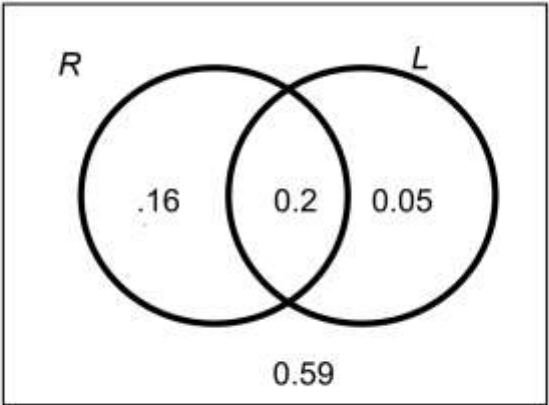
(i)	<p>P(all jam)</p> $= \frac{5}{12} \times \frac{4}{11} \times \frac{3}{10}$ $= \frac{1}{22} = 0.04545$	<p>M1 $5 \times 4 \times 3$ or $\binom{5}{3}$ in numerator</p> <p>M1 $12 \times 11 \times 10$ or $\binom{12}{3}$ in denominator</p> <p>A1 CAO</p>	3
(ii)	<p>P(all same)</p> $= \frac{5}{12} \times \frac{4}{11} \times \frac{3}{10} + \frac{4}{12} \times \frac{3}{11} \times \frac{2}{10} + \frac{3}{12} \times \frac{2}{11} \times \frac{1}{10}$ $= \frac{1}{22} + \frac{1}{55} + \frac{1}{220} = \frac{3}{44} = 0.06818$	<p>M1 Sum of 3 reasonable triples or combinations</p> <p>M1 Triples or combinations correct</p> <p>A1 CAO</p>	3
(iii)	<p>P(all different)</p> $= 6 \times \frac{5}{12} \times \frac{4}{11} \times \frac{3}{10}$ $= \frac{3}{11} = 0.2727$	<p>M1 5,4,3</p> <p>M1 $6 \times$ three fractions or $\binom{12}{3}$ denom.</p> <p>A1 CAO</p>	3

Q2, (Jan 2006, Q8i-iii)

(i)	$P(\text{jacket and tie}) = 0.4 \times 0.3 = 0.12$	M1 for multiplying A1 CAO	2
(ii)		G1 for two intersecting circles labelled G1 for 0.12 and either 0.28 or 0.08 G1 for remaining probabilities <u>Note</u> FT their 0.12 provided < 0.2	3
(iii)	<p>(A) $P(\text{jacket or tie}) = P(J) + P(T) - P(J \cap T)$ $= 0.4 + 0.2 - 0.12 = 0.48$</p> <p>OR $= 0.28 + 0.12 + 0.08 = 0.48$</p> <p>(B) $P(\text{no jacket or no tie}) = 0.52 + 0.28 + 0.08 = 0.88$</p> <p>OR $0.6 + 0.8 - 0.52 = 0.88$</p> <p>OR $1 - 0.12 = 0.88$</p>	B1 FT B2 FT <u>Note</u> FT their 0.12 provided < 0.2	3
		TOTAL	8

(i)	$P(A \cap B) = 0.4$	B1 CAO	1
(ii)	$P(C \cup D) = 0.6$	B1 CAO	1
(iii)	Events B and C are mutually exclusive.	B1 CAO	1
(iv)	$P(B) = 0.6$, $P(D) = 0.4$ and $P(B \cap D) = 0.2$	B1 for $P(B \cap D) = 0.2$ soi	
	$0.6 \times 0.4 \neq 0.2$ (so B and D not independent)	E1	2
		TOTAL	5

Q4, (Jan 2006, Q5)

(i)	$P(R) \times P(L) = 0.36 \times 0.25 = 0.09 \neq P(R \cap L)$ Not equal so not independent. (Allow $0.36 \times 0.25 \neq 0.2$ or $0.09 \neq 0.2$ or $\neq p(R \cap L)$ so not independent)	M1 for 0.36×0.25 or 0.09 seen A1 (numerical justification needed)	2
(ii)		G1 for two overlapping circles labelled G1 for 0.2 and either 0.16 or 0.05 in the correct places G1 for all 4 correct probs in the correct places (including the 0.59)	3

Q5, (Jan 2009, Q5i,ii)

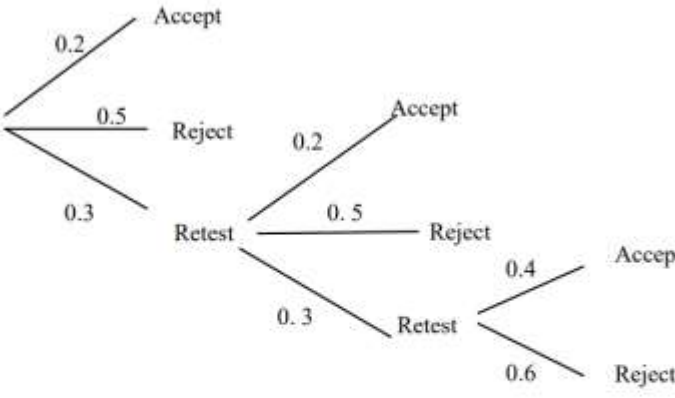
(i)		<p>G1 first set of branches</p> <p>G1 <i>indep</i> second set of branches</p> <p>G1 <i>indep</i> third set of branches</p> <p>G1 labels</p>	4
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Q6, (Jun 2010, Q7)

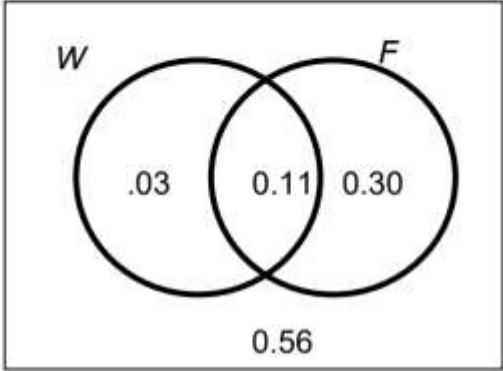
(ii)	<p>(A) $P(\text{all on time}) = 0.95^3 = 0.8574$</p>	<p>M1 for 0.95^3 A1 CAO</p>	2
	<p>(B) $P(\text{just one on time}) =$ $0.95 \times 0.05 \times 0.4 + 0.05 \times 0.6 \times 0.05 + 0.05 \times 0.4 \times 0.6$ $= 0.019 + 0.0015 + 0.012 = 0.0325$</p>	<p>M1 first term M1 second term M1 third term A1 CAO</p>	4
	<p>(C) $P(1200 \text{ is on time}) =$ $0.95 \times 0.95 \times 0.95 + 0.95 \times 0.05 \times 0.6 + 0.05 \times 0.6 \times 0.95 +$ $0.05 \times 0.4 \times 0.6 = 0.857375 + 0.0285 + 0.0285 + 0.012 = 0.926375$</p>	<p>M1 any two terms M1 third term M1 fourth term A1 CAO</p>	4

Q7, (Jan 2011, Q5i,ii)

(i)	$P(\text{Wet and bus}) = 0.4 \times 0.7$ $= 0.28$	M1 for multiplying probabilities A1 CAO	2	Fractional answer = $7/25$ (Allow $28/100$)
(ii)	$P(\text{Walk or bike}) =$ $0.6 \times 0.5 + 0.6 \times 0.4 + 0.4 \times 0.2 + 0.4 \times 0.1 \text{ or}$ $0.3+0.24+0.08+0.04$ $= 0.66$	M1 for any two correct pairs M1 for sum of all four correct terms With no extra terms for second M1 A1 CAO	3	$\text{Or } = 0.6 \times 0.9 + 0.4 \times 0.3 \text{ gets M1 for either term}$ $= 0.54 + 0.12 \text{ gets M1 for sum of both}$ A1 CAO $\text{Or } = 1 - 0.6 \times 0.1 - 0.4 \times 0.7 = 0.66. \text{ M1 for } 1 - \text{one correct term, M1 for complete correct expression and A1 for correct evaluation.}$

<p>(i)</p>		<p>G1 G1 G1 [3]</p>	<p>Do a vertical scan and give:</p> <p>First column Second column Final column</p> <p>Do not award if first two branches missing Branches two and three should come out of 'retest'</p>	<p>Allow labels such as A, R, F(Fail) etc All probabilities correct All probabilities correct</p> <p>All probabilities correct</p> <p>If any labels missing or incorrect allow max 2/3 Do not allow misreads here as all FT (eg 0.3 and 0.5 reversed)</p>
<p>(ii)</p>	<p>$P(\text{Accepted}) = 0.2 + (0.3 \times 0.2) + (0.3 \times 0.3 \times 0.4)$</p> <p>$= 0.2 + 0.06 + 0.036 = 0.296$</p>	<p>M1 A1 [2]</p>	<p>For second or third product CAO</p>	<p>FT their tree provided correct numbers of terms and correct structure of 3, 3, 2 branches. Allow 37/125 oe</p>

Q9, (Jun 2011, Q5i,ii)

<p>(i)</p>		<p>G1 for two labelled intersecting circles</p> <p>G1 for at least 2 correct probabilities.</p> <p>G1 for remaining correct probabilities</p>	<p>3</p>	<p>Allow labels such as $P(W)$ and $P(F)$</p> <p>Allow other sensible shapes in place of circles</p>
<p>(ii)</p>	<p>$P(W) \times P(F) = 0.14 \times 0.41 = 0.0574 \neq P(W \cap F) = 0.11$</p> <p>So not independent.</p>	<p>M1 for 0.41×0.14</p> <p>A1 Condone dependent</p> <p>Must have full method www</p> <p>Must have either $P(W \cap F)$ or 0.11</p>	<p>2</p>	<p>Answer of 0.574 gets Max M1A0</p> <p>Omission of 0.0574 gets M1A0 Max</p> <p>Or:</p> <p>$P(W F) = 0.11/0.41 = 0.268 \neq P(W) (= 0.14)$ M1 for full working</p> <p>$P(F W) = 0.11/0.14 = 0.786 \neq P(F) (= 0.41)$ M1 for full working</p> <p>No marks without correct working</p>

<p>(i)</p>			<p>G1 G1 G1 G1</p> <p>[4]</p>	<p>For first set of branches For second set of branches (indep) For third set of branches (indep) For labels</p>	<p>All probabilities correct All probabilities correct All probabilities correct All correct labels for 'Hit' and 'Miss', 'H' and 'M' etc. Condone omission of First, Second, Third. Do not allow misreads here as all FT</p>
<p>(ii)</p>	<p>A</p>	<p>$P(\text{Hits with at least one}) = 1 - P(\text{misses with all})$ $= 1 - (0.9 \times 0.95 \times 0.95) = 1 - 0.81225 = 0.18775$</p> <p>ALTERNATIVE METHOD only if there is an attempt to add 7 probabilities At least three correct triple products Attempt to add 7 triple products</p> <p>FURTHER ALTERNATIVE METHOD $0.1 + 0.9 \times 0.05$ Above probability + $0.9 \times 0.95 \times 0.05$</p>	<p>M1* M1* dep A1</p> <p>M1 M1 A1</p> <p>M1 M1 A1</p> <p>[3]</p>	<p>For $0.9 \times 0.95 \times 0.95$ For 1 – ans CAO</p> <p>CAO</p> <p>CAO</p>	<p>FT their tree for both M marks, provided three terms</p> <p>0.188 or better. Condone 0.1877 Allow 751/4000</p> <p>(not necessarily correct triple products)</p>

Q11, (Jun 2016, Q2)

(i)	$P(\text{Does not lose any match}) = 0.8^3 = 0.512 = \frac{64}{125}$	B1 [1]		
(ii)	$P(\text{Wins all 3 or draws all 3 or loses all 3}) = 0.5^3 + 0.3^3 + 0.2^3$ $= 0.16 = \frac{4}{25}$	M1 A1 [2]	Including addition	
(iii)	$P(\text{all three outcomes occur}) = 3! \times 0.5 \times 0.3 \times 0.2$ $= 0.18$ Required probability = $1 - '0.18' = 0.16$ $= 0.66 = \frac{33}{50}$	M1* A1 *M1 dep A1 [4]	CAO	Allow M1 for $k \times 0.5 \times 0.3 \times 0.2$ even if $k = 1$ Even if cubed Not if cubed
	OR:			
	$P(\text{WWW}') + P(\text{DDD}') + P(\text{LLL}')$	M1	For any one product (no need for '3 ×')	Even if cubed
	$3 \times 0.5^2 \times 0.5 + 3 \times 0.3^2 \times 0.7 + 3 \times 0.2^2 \times 0.8$	M1	For '3 ×'	Dep on at least 1 correct term
	$0.375 + 0.189 + 0.096$	M1	For sum of three correct terms (no need for '3 ×') And no incorrect terms	NB common wrong answer of 0.22 from omitting '3 ×' or 0.44 from '2×' scores M1M0M1A0 Not if cubed
	0.66	A1	CAO	
	OR:			
	$P(\text{WWD}) + P(\text{WWL}) + P(\text{DDW}) + P(\text{DDL}) + P(\text{LLW}) + P(\text{LLD})$	M1	For any one product (no need for '3 ×')	Even if cubed
	$3 \times 0.5^2 \times 0.3 + 3 \times 0.5^2 \times 0.2 + 3 \times 0.3^2 \times 0.5 + 3 \times 0.3^2 \times 0.2 + 3 \times 0.2^2 \times 0.5 + 3 \times 0.2^2 \times 0.3$	M1	For '3 ×'	Dep on at least 1 correct term
	$0.225 + 0.15 + 0.135 + 0.054 + 0.06 + 0.036$	M1	For sum of six correct terms (no need for '3 ×') And no incorrect terms	Not if cubed
	0.66	A1	CAO	