Probability 1 MS

Q1.

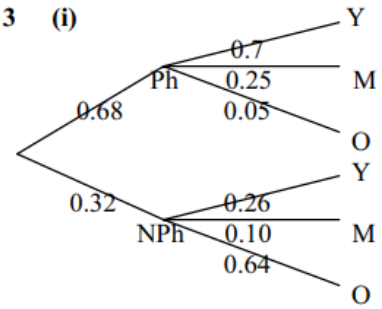
3	**(i)** $P(>5) = {}^7C_6(0.6)^6(0.4) + (0.6)^7$ $= 0.1306 + 0.02799$ $= 0.159$	M1 A1 [2]	Summing 2 or 3 binomial probs of the form ${}^7C_r(0.6)^r(0.4)^{7-r}$ Correct answer
	(ii) P(bark) = P(park, bark) + P(not park, bark) $= 0.6 \times 0.35 + 0.4 \times 0.75$ $= 0.51$	M1 A1 [2]	Summing two appropriate 2-factor probabilities Correct answer
	(iii) Variance (number of times) = 7.2	B1 [1]	Correct final answer

Q2.

5	**(i)** *A* *B* *C* *D* Rick 1/3 2/9 2/9 2/9 Brenda 1/4 1/4 1/4 1/4 Ali 2/35 2/35 2/7 3/5 P(Rick *B*, Brenda *B*, Ali not *B*) + P(Rick *B*, Brenda not *B*, Ali *B*) + P(Rick not *B*, Brenda *B*, Ali *B*) = 11/210 + 2/210 + 1/90 = 23/315 P(Rick *B*, Brenda *B*, Ali *B*) = 1/315 Prob(at least 2 at entrance *B*) = 24/315 (8/105) (0.0762)	M1 M1 M1 A1 [4]	Obtaining probs of each person for each entrance (can be implied or awarded in part **(i)** or part **(ii)**) Considering options 2 meet 1 doesn't, must have at least two 3-factor terms Adding option all three meet, must be added to a prob Correct answer
	(ii) P(entrance *A*) = 1/210 (0.00476) P(entrance *B*) = 1/315 (0.00317) P(entrance *C*) = 1/63 (0.0159) P(entrance *D*) = 1/30 (0.0333) P(same entrance) = 2/35 (0.0571)	M1 M1 A1 A1 [4]	Obtaining a three-factor prob for any entrance Adding four three-factor probabilities for the 4 entrances Two or more correct entrance probabilities Correct answer

Probability 1 MS

Q3.

3 (i) 	M1 A1 [2]	Y = young, M = middle-aged, O = old Correct shape with Ph, NPh first All probabilities and correct
(ii) $P(Ph \mid M) = \dfrac{0.68 \times 0.25}{0.68 \times 0.25 + 0.32 \times 0.1}$ $= 0.842$ (170/202)	B1 M1 A1 [3]	For correct numerator using cond prob formula with numerator < denominator For attempt at P(35 – 60 years old), involving the sum of two 2-factor probs, seen anywhere Correct answer

Q4.

2 P(pencil case | find) =	M1	Attempt to use cond prob formula, must be quotient
$\dfrac{P(\text{pencilcase and find})}{P(\text{find})} = \dfrac{0.7 \times 1}{0.7 + 0.3 \times 0.2}$	A1 A1	Correct num of a fraction Correct denominator
$= 0.921$	A1 **[4]**	Correct answer

Q5.

7 (a) (i) P(at least one 3) = 1 – P(no 3s) $= 1 - (5/6)^9$ $= 0.806$	 M1 A1 **[2]**	 Using 1 – none Correct answer
(ii) P(at least 1 three) = $1 - (5/6)^n$ $1 - (5/6)^n > 0.9$ $n > 12.6$ $n = 13$	B1 M1 M1 A1 **[4]**	 Equation or inequality involving n and 0.9 Solving attempt of sensible equation, can be trial Correct answer
(b) P(R wins his 1st ball) = P(GY) = 15/56 (0.268) P(R wins 2nd ball) = P(GGGY) = 3/28 P(R wins 3rd ball) = P(GGGGGY) $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} \times \frac{2}{5} \times \frac{1}{4} \times \frac{3}{3} = 1/56$ P(R wins) = 11/28 (0.393)	M1 M1 M1 A1 **[4]**	Using P(GY) Attempt to find P(GGGY) or P(GGGGGY) Adding three options Correct answer

Probability 1 MS

Q6.

7	(i)	P(2, N2, 2) = 1/4 × 1 × 1/7 = 1/28	M1		Considering at least two options of 2s and 8s
		P(8, 8, N8) = 1/4 × 2/5 × 3/7 = 3/70	M1		Considering three options for the 8s
		P(8, N8, 8) = 1/4 × 3/5 × 4/7 = 3/35	M1		Summing their options if more than 3 in total
		P(N8, 8, 8) = 3/4 × 2/5 × 4/7 = 6/35	B1		One option correct
		Σ = 47/140 (0.336)	A1	[5]	Correct answer
	(ii)	P(2, 2 given same) = $\frac{1/28}{47/140}$	M1		1/28 in numerator of a fraction
		= 5/47 (0.106)	A1	[2]	Correct answer
	(iii)	P(X) = 47/140	M1		Attempt to compare P(A and B) with P(A) × P(B) or using conditional probabilities
		P(Y) = 1/4			
		P(X and Y) = 1/28 ≠ 47/140 × 1/4	A1		Legitimate correct answer
		Not independent		[2]	

Q7.

6	(i)	P(0, 1, 2) $=(0.85)^6 + (0.15)(0.85)^5{}_6C_1 +$ $(0.15)^2(0.85)^4{}_6C_2$ = 0.953	B1 M1 A1	 [3]	0.15 and 0.85 seen Any binomial expression Σpowers = 6, Σ p = 1 Correct answer
	(ii)	P(D) = 0.6 × 0.1 + 0.4 × 0.55 = 0.28 P(B|D) = $\frac{P(B \cap D)}{P(D)}$ 0.06/0.28 = 0.2143 P(> 1) = 1 – P(0) = 1 – $(0.7857)^5$ = 1 – 0.7078 = 0.701	M1 A1 M1 √A1 M1 A1	 [6]	Attempt to find P(D) 0.28 seen Using cond prob formula to find P(B|D) Correct unsimplified answer Binomial expression 1 –P(0) or 1 –P(0, 1) Σ p = 1 Correct answer accept 0.700

Probability 1 MS

Q8.

2 **(i)**	$P(F) = \frac{12}{30}$ (0.4)	B1	$\frac{12}{30}$ or $\frac{16}{30}$ or $\frac{5}{30}$ seen
	or $P(W) = \frac{16}{30}$ (0.533)	M1	Valid attempt to find P(F or W)
	or $P(M \cap W') = \frac{5}{30}$ (0.167)		
	$(F \text{ or } W) = \frac{13}{30} + \frac{3}{30} + \frac{9}{30}$	A1	Correct unsimplified expression
	or $1 - \frac{5}{30}$ or $\frac{12}{30} + \frac{16}{30} - \frac{3}{30}$		
	$= \frac{5}{6}$ (0.833)	A1 [4]	Correct answer
(ii)	P(M) = 18/30 (0.6), P(W) = 16/30 (0.533), P(M) × P(W) = 8/25 (0.32)	M1	Valid attempt to find P(M), P(W) and P(M) × P(W)
	P(M and W) = 13/30 (0.433) ≠ 8/25 (0.32)	A1	P(M and W) = 13/30 ≠ 8/25 and correct conclusion
	not independent		
	OR		
	$P(M \mid W) = \frac{P(M \text{ and } W)}{P(W)} = \frac{13/30}{16/30} = \frac{13}{16}$ (0.813)	M1	Valid attempt to find P(M and W), P(W) and P(M and W) ÷ P(W)
	$\neq \frac{18}{30} = P(M)$,	A1	$\frac{13}{16} \neq \frac{18}{30} = P(M)$
	not independent		
	OR		
	$P(W \mid M) = \frac{P(M \text{ and } W)}{P(W)} = \frac{13/30}{18/30} = \frac{13}{18}$	M1	Valid attempt to find P(M and W), P(M) and P(M and W) ÷ P(M)
	$\neq \frac{16}{30} = P(W)$,	A1	$\frac{13}{16} \neq \frac{18}{30} = P(M)$
	not independent	[2]	

Probability 1 MS

Q9.

6 **(i)** $P(O \text{ given } +) = \frac{0.37}{0.83}(0.4458)$	B1 A1 M1		0.83 seen or implied Attempt to find P(O given +) using conditional probability fraction Binomial term ${}^9C_r p^r(1-p)^{9-r}$, $r \neq 0$ or 9
$P(0, 1, 2) = (0.4458)^0(0.5542)^9 + {}^9C_1(0.4458)^1(0.5542)^8 + {}^9C_2(0.4458)^2(0.5542)^7$	M1 A1		Binomial expression P(0, 1, 2) or P(0, 1, 2, 3) powers summing to 9 any $0 < p < 1$ Correct unsimplified expression
$= 0.156$	A1	[6]	Correct final answer
(ii) $\mu = 150 \times 0.35 = 52.5$,	B1		150×0.35 (52.5) and $150 \times 0.35 \times 0.65$ (34.125) seen
$\sigma^2 = 150 \times 0.35 \times 0.65 = 34.125$	M1 M1		Standardising, using sd not variance Using continuity correction, 59.5 or 60.5
$P(> 60.5) = P\left(z > \pm\frac{60.5 - 52.5}{\sqrt{34.125}}\right)$	M1		correct area (< 0.5, for mean < their 60)
$= 1 - \Phi(1.369)$			
$= 0.0854$ or 0.0855	A1	[5]	correct value

Q10.

6 **(i)**			
	wrapped	unwrapped	total
choc	7	10	17
not choc	5	8	13
total	12	18	30
	B1		One correct row or column numbers
	B1	[2]	All correct including labels
(ii) 12/30 (0.4)	B1ft	[1]	Ft their table
(iii) 10/18 (5/9) (0.556)	B1ft	[1]	Ft their table
(iv) 10/17 (0.588)	B1ft	[1]	Ft their table
(v) P(2 wrapped)			
$= 12/30 \times 11/29 \times 18/28 \times 17/27 \times {}_4C_2$	M1 M1 M1		Mult by ${}_4C_2$ $12 \times 11 \times 18 \times 17$ seen in num $30 \times 29 \times 28 \times 27$ seen in denom
$= 0.368$ (374/1015)	A1		Correct answer
OR			
${}_{12}C_2 \times {}_{18}C_2)/{}_{30}C_4$	M1 M1 M1		${}_{12}C_2$ seen mult or alone in num (not added) ${}_{18}C_2$ seen mult or alone in num (not added) ${}_{30}C_4$ seen in denom
$= 0.368$	A1	[4]	Correct answer