1. (a)	$P(C') = \frac{103}{120}$ oe	**awrt 0.858**	B1 (1)
(b)	$P(A \cap B \cap C') = 0$		B1 (1)
(c)	$P(A \cup B \cup C') = \frac{9+3+2+5+1+93}{120}$ or $P(A \cup B \cup C') = 1 - \frac{7}{120}$		M1
	$= \frac{113}{120}$ oe	**awrt 0.942**	A1 (2)
(d)	$P(\text{At most } 1) = P(0 \text{ or } 1) = \frac{93+9+7+1}{120}$ or $\frac{120-2-5-3}{120}$		M1
	$= \frac{110}{120}$ oe	**awrt 0.917**	A1 (2)
(e)	$P(A \mid \text{At most } 1) = \frac{9/120}{\text{"}110/120\text{"}}$		M1
	$= \frac{9}{110}$ oe	**awrt 0.0818**	A1 (2)
(f)	$\left[P(X=0) = \frac{93}{120}\right]$ $P(X=1) = \frac{17}{120}$ $P(X=2) = \frac{8}{120}$ $P(X=3) = \frac{2}{120}$		M1
	$E(X) = \left[\frac{93}{120} \times 0\right] + \frac{17}{120} \times 1 + \frac{8}{120} \times 2 + \frac{2}{120} \times 3$		M1
	$= \frac{13}{40}$ or 0.325 oe		A1 (3)
	Notes		**[11]**

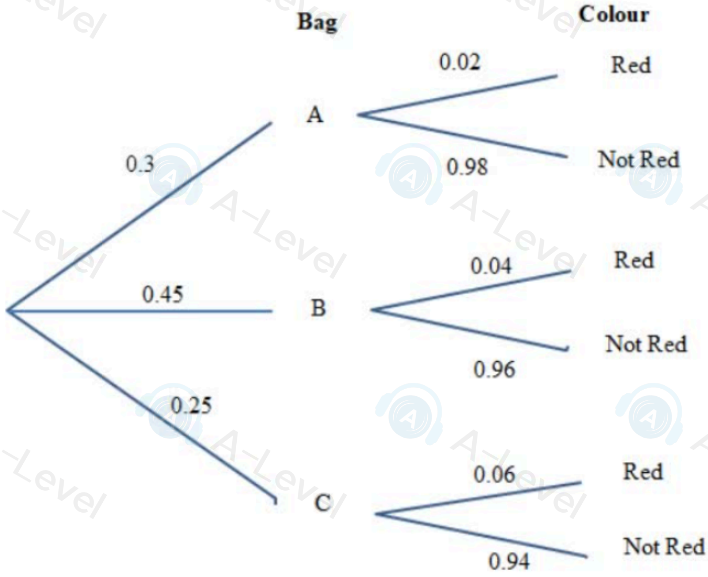
Question Number	Scheme	Marks
4.(a)	0.13	B1 (1)
(b)	$P(A) \times P(C) = P(A \cap C)$	
	$0.2 \times (0.08 + p) = 0.05$ **or** $P(C) = \frac{0.05}{0.10+0.05+0.01+0.04}$ or $\frac{0.05}{0.2}$ or 0.25	M1
	$p = 0.17$	A1
	P(no faults) $= 1 - (0.1 + 0.05 + 0.01 + 0.04 + 0.08 + 0.03 + \text{"}0.17\text{"})$	M1
	or $1 - [\text{"}P(C)\text{"} + 0.10 + 0.05 + 0.08]$	
	q = **0.52**	A1
Ans only	They can get q without finding p so a correct answer to q scores 4/4	(4)
(c)	P(Fault B but not fault C | Has fault A) $= \frac{0.05}{0.2}$	M1
	$= 0.25$	A1 (2)
(d)	P(exactly 2 defects) = 0.12 or $\frac{3}{25}$	B1
	P(both have 2 defects) = 0.12^2	M1
	= **0.0144** or $\frac{9}{625}$	A1 (3)
		Total 10

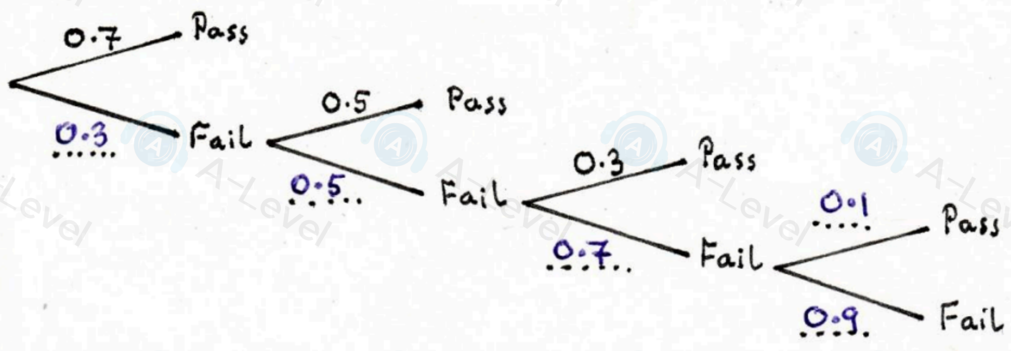
Question Number	Scheme	Marks
5. (a)	$\text{E}(X) = -2p - p + 0 + \frac{1}{2} + 3p$; $= \frac{1}{2}$	M1 ; A1
		(2)
(b)	$\text{E}(X^2) = 4p + p + 0 + 1 + 9p$ =[$14p + 1$]	M1A1
	[Var(X) =] $\text{E}(X^2) - [\text{E}(X)]^2 = 14p + 1 - ("\tfrac{1}{2}")^2$	dM1
	So $14p + 0.75 = 2.5$	M1
	$p = \underline{\frac{1}{8}}$	A1
		(5)
(c)	Sum of probabilities = 1 implies $q = \underline{\frac{3}{8}}$	B1ft
		(1)
(d)	P(Amar wins) = e.g. $\text{P}(X_1 > 0) + \text{P}(X_1 < 0) \times \text{P}([X_1 + X_2] > 0\{\mid X_1 < 0\})$ <u>or</u> $\text{P}(X_1 = 2 \text{ or } 3) + \text{P}(X_1 = -2) \times \text{P}(X_2 = 3) + \text{P}(X_1 = -1) \times \text{P}(X_2 = 2 \text{ or } 3)$	M1
	<u>**Cases**</u> $X_1 = -2$ and $X_2 = 3$ so probability = p^2 $X_1 = -1$ and $X_2 \geqslant 2$ so probability = $p\left(p + \tfrac{1}{4}\right)$	M1
	Total probability = $p + 0.25 + p^2 + p(p + 0.25) = \frac{1}{8} + \frac{1}{4} + \frac{1}{64} + \frac{1}{64} + \frac{1}{32}$	A1ft
	$= \underline{\frac{7}{16}}$	A1
		(4)
(e)	[Although E(X) > 0 since] P(win) < 0.5	M1
	Amar should not play the game <u>or</u> "disagree"	A1
		(2)
		[14]

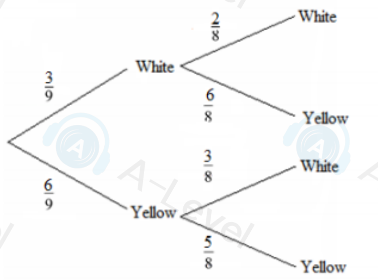
Question Number	Scheme	Marks
6. (a)	[P(S = 1) =] <u>**0**</u>	**B1**
		(1)
(b)	$\text{P}(S > 2) = 1 - \text{P}(S = 2)$ <u>or</u> $1 - \text{P}(S \leqslant 2)$ <u>or</u> $\text{P}(S = 3) + \text{P}(S = 4) + \text{P}(S = 5)$	**M1**
	$= 1 - \left(\frac{2}{5} \times \frac{1}{4}\right), = \frac{9}{10}$ <u>or</u> e.g. $\frac{2}{5} \times \frac{3}{4} + \frac{3}{5}$, = <u>**0.9**</u>	**M1 A1**
		(3)
(c)	$\text{P}(S = 3) = \left(\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} + \frac{2}{5} \times \frac{3}{4} \times \frac{1}{3}\right), = \frac{1}{5}$	**M1, A1**
		(2)
(d)	$\text{P}(S = 3 \mid \text{2nd is blue}) = \frac{\text{P}(S = 3 \cap \text{2nd is blue})}{\text{P(2nd is blue)}} = \frac{\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3}}{\frac{3}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{1}{4}} = \frac{1}{4}$	**M1 A1**
		(2)
(e)	$\text{P}(S = 5) = 4 \times \left(\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} \times \frac{2}{2} \times \frac{1}{1}\right) = \frac{2}{5}$	**B1** **M1 A1**
		(3)
		[11 marks]

Question Number	Scheme	Marks
1 (a)	[$0.15 + 0.13 + 0.12 =$] **0.4**	B1 (1)
(b)	$0.15 + 0.20 + 0.23 + 0.12$ or $1 - (0.17 + 0.13)$ or $0.35 + 0.35$	M1
	$=$ **0.7**	A1 (2)
(c)	$[P(A \mid B') =] \frac{P(A \cap B')}{P(B')}$ and $\frac{p}{"0.4"}$ or $\frac{0.15}{"0.4"}$	M1
	$= \frac{3}{8}$	A1 (2) [5 marks]
	Notes	

Question	Scheme	Marks
5. (a)	$-2a + (0) + 2a + 4c = 0.8$ or $4c = 0.8$	M1
	$c = 0.2$	A1 (2)
(b)	$4a + (0) + 4a + 16c = 5$ or $8a + 16c = 5$	M1
	$8a + 3.2 = 5$ so **$a = 0.225$ or $\frac{9}{40}$**	A1
	$2a + b + c = 1$ so $b = 1 - "0.2" - 2 \times "0.225"$	M1
	$b = 0.35$ or $\frac{7}{20}$	A1ft (4)
(c)	$\text{Var}(X) = 5 - 0.8^2$, $=$ **4.36**	M1A1 (2)
(d)	[$5 - 3\text{E}(X) = 5 - 3 \times 0.8$] $=$ **2.6**	B1 (1)
(e)	$3^2 \text{Var}(X) = 9 \times 4.36$, or $[\text{E}(Y^2) - (\text{E}(Y))^2] = 46 - 2.6^2$ $=$ **39.24** awrt **39.2**	M1, A1 (2)
(f)	$Y \geq 0 \Rightarrow 5 - 3X \geq 0 \Rightarrow 5 \geq 3X$	M1
	$X \leq 1\frac{2}{3}$	A1
	$[P(Y \geq 0) = P(X \leq 0) =]$ $P(X = -2) + P(X = 0)$ or $a + b$	M1
	$=$ **0.575 or $\frac{23}{40}$**	A1ft (4) [15]

Qu	Scheme	Marks
4(a)		B1B1
		(2)
(b)	$0.3\times"0.98"$	M1
	$=0.294$	A1
		(2)
(c)	$(0.3\times0.02)+("0.45"\times"0.04")+("0.25"\times"0.06")$	M1
	$=0.039$	A1
		(2)
(d)	$\text{P}(\text{C}\mid\text{Red})=\dfrac{"0.25"\times"0.06"}{"0.039"}\left[=\dfrac{0.015}{"0.039"}\right]$	M1,M1
	$=0.3846\ldots$ or $\dfrac{5}{13}$	A1
		(3)
	Notes	**Total 9**

Question Number	Scheme	Marks
4.(a)		B1 B1 (2)
(b)	$1-0.3\times0.5\times0.7\times0.9$ <u>or</u> $0.7+(0.3\times0.5)+(0.3\times0.5\times0.3)+(0.3\times0.5\times0.7\times0.1)$ $= \mathbf{\underline{0.9055}}$	M1 A1 (2)
(c)	$[\mathrm{P}(P_1\cup P_2\mid \text{Pass})=]\ \dfrac{0.7+"0.3"\times0.5}{(b)},\ =\dfrac{0.85}{"0.9055"}$ $=0.938707\ldots$ = awrt $\mathbf{\underline{0.939}}$	M1, A1ft A1 (3)
(d)	$p+(1-p)(p-0.2)$ <u>or</u> $1-(1-p)(1.2-p)$ (o.e.) e.g. $p+p-p^2+0.2p-0.2=0.95 \rightarrow p^2-2.2p+1.15=0$ **(*)**	M1 dM1A1cso (3)
(e)	$p=\dfrac{2.2\pm\sqrt{2.2^2-4\times1.15}}{2}$ <u>or</u> Complete the sq: $(p-1.1)^2-1.1^2+1.15=0$ $=\dfrac{2.2\pm0.4898\ldots}{2}$ <u>or</u> $\dfrac{2.2\pm\sqrt{0.24}}{2}$ <u>or</u> $1.1\pm\sqrt{0.06}$ <u>or</u> $(1.34\ldots),\ 0.855\ldots$ $p=0.85505102\ldots$ $p=\mathbf{\underline{0.855}}$	M1 A1 A1 (3)

Question Number	Scheme	
7(a)		B1 M1A1 (3)
(b)	$"\frac{3}{9}"\times"\frac{6}{8}"+"\frac{6}{9}"\times"\frac{3}{8}"$, $\quad =\frac{1}{2}$ oe	M1, A1
		(2)
(c)	$1-"\frac{6}{9}"\times"\frac{5}{8}"$ or $"\frac{3}{9}"+"\frac{6}{9}"\times"\frac{3}{8}"$, $\quad =\frac{7}{12}$ oe	M1, A1
		(2)
(d)	$\dfrac{"\frac{3}{9}"\times"\frac{2}{8}"}{"\frac{7}{12}"}$, $\quad =\frac{1}{7}$ oe	M1, A1
		(2)
(e)	$\frac{\frac{1}{2}n}{n}\times\frac{\frac{1}{2}n-1}{n-1}\times\frac{\frac{3}{8}n}{n-2}\times\frac{\frac{1}{8}n}{n-3}=\frac{3}{235}$ | $\frac{4x}{8x}\times\frac{4x-1}{8x-1}\times\frac{3x}{8x-2}\times\frac{x}{8x-3}=\frac{3}{235}$	M1M1
	$\frac{3}{128}n^3(\frac{1}{2}n-1)=\frac{3}{235}n(n-1)(n-2)(n-3)\left[\rightarrow 63n^3-3198n^2+8448n-4608=0\right]$	dM1
	$\left[235n^2=256(n-1)(n-3)\Rightarrow\right]21n^2-1024n+768=0$ **or** $\left[(3n-6)(21n^2-1024n+768)\right]$ $\left[\Rightarrow(n\neq 2\therefore)\right]21n^2-1024n+768=0$	A1
		(4)