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Question number	Mark scheme	Marks
1. (*a*)	$P(A \mid FR) = \dfrac{P(A)P(FR \mid A)}{P(A)P(FR \mid A)+P(B)P(FR \mid B)+P(C)P(FR \mid C)}$ use of Bayes	M1
	$= \dfrac{0.32}{(0.4\times0.8)+(0.1\times0.6)+(0.5\times0.9)}$ numerator denominator	A1 A1
	$= 0.386$	A1
	(FR = full recovery)	**(4 marks)**
2. (*a*) (i)	$\binom{7}{1}(0.12)^2(0.88)^6 = 0.0468$	M1 A1 (2)
(ii)	$\dfrac{3}{0.12} = 25$	B1 (1)
(*b*)	Probability constant; games independent of each other	B1; B1 (2)
(*c*)	$\dfrac{r}{p} = 18$; $\dfrac{r(1-p)}{p^2} = 36$	B1; B1
	$18(1-p) = 36p$ Substitute $\dfrac{r}{p}$	M1
	$18 = 54p$	A1
	$p = \frac{1}{3}$; Mary	A1; A1 ft (5)
		(10 marks)

(ft = follow through mark)

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Question number	Mark scheme	Marks
3. (*a*) (i)	$\left(\frac{5}{6}\right)^2\left(\frac{1}{6}\right) = \frac{25}{216} = 0.116$ $(p)^2(1-p)$	M1 A1
(ii)	$1 - \{P(1) + P(2) + P(3)\} = 1 - \left\{\frac{1}{6} + \left(\frac{5}{6}\right)\left(\frac{1}{6}\right) + \frac{25}{216}\right\}$	M1 A1
	$= \frac{125}{216}$	
	$= 0.579$	A1 (5)
	$G_R(t) = \frac{1}{6}t + \left(\frac{5}{6}\right)\left(\frac{1}{6}\right)t^2 + \left(\frac{5}{6}\right)^2\left(\frac{1}{6}\right)t^3 + \ldots\ldots\ldots\ldots$ $\Sigma \text{prob} \times t^n$	M1 A1
	$= \frac{\frac{1}{6}t}{1-\frac{5}{6}t}$	M1
	$= \frac{t}{6-5t}$ (*)	A1 (4)
(*c*)	$G_S(t) = \left(\frac{t}{6-5t}\right)^3$	B1 (1)
		(10 marks)
4. (*a*)	$E(P) = \frac{1}{2}$	B1 (1)
(*b*)	$E(P^2) = \frac{1}{2}$	B1
	$\text{Var}(P) = \frac{1}{2} - \left(\frac{1}{2}\right)^2$	M1
	$= \frac{1}{4}$	A1 (3)
(*c*)	$M_P^{(3)}(t) = \frac{3}{4}t + \ldots$	M1
	$E(P^3) = \frac{3}{4}$	A1 (2)
(*d*)	$M_Y(t) = e^{-t}\left(1 + \frac{4t}{2} + \frac{(4t)^2}{4} + \ldots\right)$	M1 M1
	$= e^{-t}(1 + 2t + 4t^2 + \ldots\ldots)$	A1
	$= (1 - t + \frac{1}{2}t^2 - \frac{1}{6}t^3 + \ldots)(1 + 2t + 4t^2 + \ldots)$	M1
	$= 1 + t + \frac{5}{2}t^2 + \ldots$	A1 (5)
		(11 marks)

(ft = follow through mark; (*) indicates final line is given on the paper)

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Question number		Mark scheme		Marks
5.	(*a*)	$f(x)=\begin{cases}\lambda e^{-\lambda x}, & x\geq 0\\ 0, & \text{otherwise}\end{cases}$		B1 B1 (2)
	(*b*)	$\lambda = \dfrac{1}{1500}$		B1 (1)
	(*c*)	$\displaystyle\int_0^{200} \frac{1}{1500} e^{-\frac{1}{1500}x}\,dx = \left[-e^{-\frac{1}{1500}x}\right]_0^{200}$	Limits needed	M1 A1
		$= 0.125$		A1 (3)
	(*d*)	$\displaystyle\int_0^{200} \lambda e^{-\lambda x}\,dx < \frac{1}{20}$		M1
		$1 - e^{-200\lambda} < \frac{1}{20}$		A1
		$\lambda < 0.000\,256$		A1
		Mean $\geq \lambda = 3899.14 \approx 3900$		M1 A1 (5)
				(11 marks)

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Question number	Mark scheme	Marks
6. (*a*)	$G_x(1) = 1$ Use of $G_x(I) = 1$	M1
	$k = (1 + 1 + 3)^2 = 1$,	
	$k = \frac{1}{25}$ (*) Fully correct	A1 (2)
(*b*)	$\frac{1}{25}(1 + t + 3t^2)(1 + t + 3t^2) = \frac{1}{25}(1 + 2t + 7t^2 + \ldots)$ Attempt to find coefficient of x^2	M1
	Coefficient of $x^2 = \frac{7}{25}$	A1 (2)
(*c*)	$G'_X(t) = \frac{2}{25}(1 + 6t)(1 + t + 3t^2)$	M1 A1
	$G'_X(1) = 2\frac{4}{5}$ $E(X) = 2\frac{4}{5}$ Must say $E(x) = G'_X(1)$	A1
	$G''_X(t) = \frac{2}{25}(1 + 6t)(1 + 6t) + \frac{12}{25}(1 + t + 3t^2)$	M1 A1
	$G''_X(1) = 6\frac{8}{25}$	A1
	$\text{Var}(X) = 6\frac{8}{25} + 2\frac{4}{5} - (2\frac{4}{5})^2$	M1
	$= 1\frac{7}{25}$	A1 (8)
(*d*)	$\frac{t}{25}$; $(1 + t^2 + 3t^4)^2$	B1; B1 (2)
		(14 marks)

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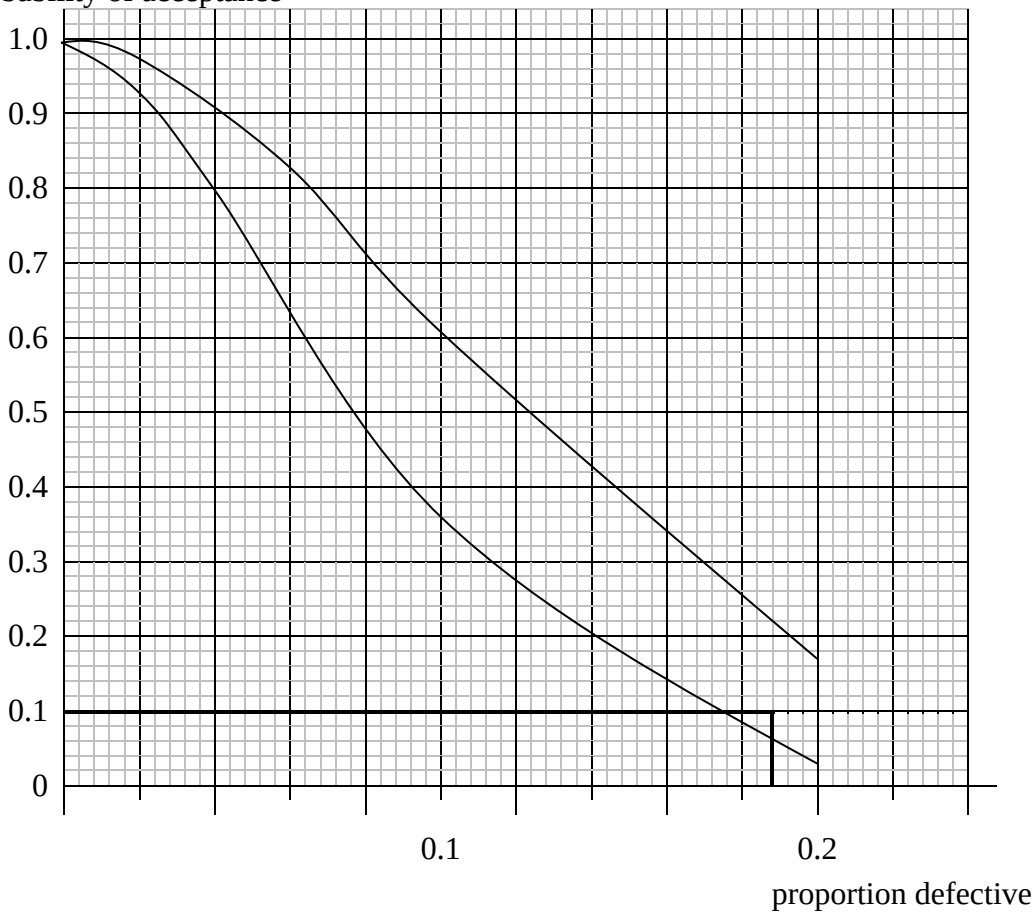
Question number		Mark scheme	Marks
7.	(*a*)	$x = P(0) + P(1)$	M1
		$= (0.94)^{20} + 20 \times (0.06)\,(0.94)^{19}$	A1
		$= 0.66$ (2dp)	A1
		$y = P(0) + P(1)\,\{P(0) + P(1)\}$	M1
		$= 0.96^{10}$; $+ 10 \times (0.96)^9 \times (0.04) \times \{(0.96)^{10} + 10(0.96)^9\,(0.04)\}$	A1; A1
		$= 0.93$	A1 (7)
	(*b*)	probability of acceptance  	
		Scales and labels; operating characteristics	B1; M1
		Plan A; Plan B	A1 ft; A1 ft
	(*c*)	0.18 or 0.19	M1 A1 ft (2)
	(*d*)	Plan B; because it has a lower probability of rejection	B1; B1 (2)
			(15 marks)

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