Stats 2 Poisson Distribution Answers

1(a)(i)	$P(X=2)=\dfrac{e^{-1.5}\times(1.5)^2}{2!}=0.251$	M1A1	2	
(ii)	$p=(0.251)^3=0.0158$	M1A1√	2	on their p from (i)
(b)(i)	$Y\sim P_o(9.0)$	B1	1	
(ii)	$P(Y\geq 12)=1-P(Y\leq 11)$			
	$=1-0.8030$	M1		
	$=0.197$	A1	2	
(c)	attacks patients:			
	randomly (p constant)	B1		mean of 1.5 $\Rightarrow p$ small (B1) (unless very few patients)
	independently	B1	2	
	Total		**9**	

1(a)	For a 1-year period			
	The number of A grades ~ Po(3)			
	For a 5-year period			
	Number of A grades ~ Po(15)	B1		
	P(Total A-grades > 18)			
	= 1 − (Total ≤ 18)	M1		
	= 1 − 0.8195			
	= 0.1805			
	= 0.181	A1	3	AWFW 0.180 to 0.181
(b)(i)	$X+Y\sim$ Po(10)	B1		
	$P(X+Y\leq 14)=0.917$	M1A1	3	AWFW 0.916 to 0.917 incl
(ii)	X and Y are independent variables.	E1	1	
	Total		**7**	

2(a)(i)	$\mathrm{P}(A=4)=\dfrac{\mathrm{e}^{-3.5}\times(3.5)^4}{4!}=0.189$	M1A1	2	
(ii)	$\mathrm{P}(B\le 6)=0.762$	B1	1	
(iii)	$T=A+B\sim \mathrm{Po}(8.5)$			
	$\mathrm{P}(T \text{ fewer than } 10)=\mathrm{P}(T<10)$	M1		Use of Po (8.5)
	$=\mathrm{P}(T\le 9)$	M1		$T\le 9$ attempted
	$=0.653$	A1	3	CAO
(b)	$X\sim \mathrm{B}(5,0.653)$	B1		$X\sim \mathrm{B}(5,\text{ their } p)$
	$\mathrm{P}(X\ge 4)=\binom{5}{4}(0.653)^4(0.347)$			
	$+(0.653)^5$	M1		
	$=0.31547+0.11873$			
	$=0.434$	A1√	3	On their p from (a)(iii)
(c)(i)	$\bar{x}=9.2$	B1		
	$s^2=9.29$	B1	2	$\sigma^2=8.36$
(ii)	Mean and variance have similar values	B1√		
	which suggests that Poisson distribution	B1√	2	
	may be appropriate			
	Total		**13**	

2(a)(i)	$\mathrm{P}(X=3)=\dfrac{\mathrm{e}^{-3.5}\times(3.5)^3}{3!}=0.216$	M1		
		A1	2	
(ii)	$\mathrm{P}(Y\ge 5)=1-\mathrm{P}(Y\le 4)$	M1		used
	$=1-0.2851$			
	$=0.715$	A1	2	
(b)(i)	$T\sim \mathrm{Po}(9.5)$	B1	1	
(ii)	$\mathrm{P}(7\le T\le 10)=\mathrm{P}(T\le 10)-\mathrm{P}(T\le 6)$	M1		
	$=0.6453-0.1649$	A1		
	$=0.480$	A1	3	Accept 0.48
(iii)	$p=(0.4804)^3=0.111$	M1		
		A1√	2	
	Total		**10**	
