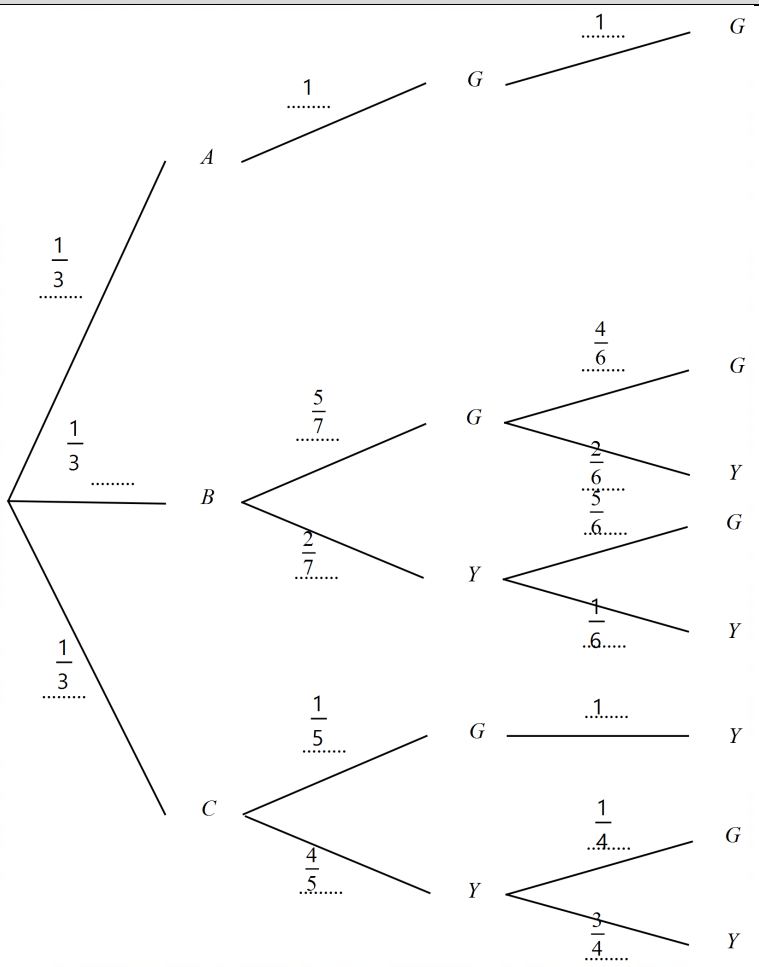
Pearson Edexcel

Mark Scheme

Probability and Statistical distributions

Pearson Edexcel GCE
In Mathematics (9MA0)
Paper 31 Statistics

Question	Scheme	Marks
1a		
	For $\frac{1}{3}$ in all 3 places on the 1st branches and 1 in the correct place on branch 2 and branch 3	B1
	For $\frac{5}{7}$, $\frac{2}{7}$, $\frac{1}{5}$ and $\frac{4}{5}$ in the correct place on 2nd branches	B1
	For $\frac{4}{6}$, $\frac{2}{6}$, $\frac{5}{6}$, $\frac{1}{6}$, $\frac{1}{4}$ and $\frac{3}{4}$ in the correct place on 3rd branches	B1
		(3)
1b	$\frac{1}{3}[\times 1\times 1]+\frac{1}{3}\times\frac{5}{7}\times\frac{4}{6}$	M1
	$=\frac{31}{63}$	A1
		(2)
1c	$\frac{\frac{1}{3}\times\frac{5}{7}\times\frac{4}{6}}{\frac{31}{63}}$	M1
	$=\frac{10}{31}$	A1
		(2)
		(7 marks)

Question	Scheme	Marks
2a	Discrete uniform [distribution]	B1
		(1)
2b	$\mathrm{P}(X=x)=\begin{cases}\frac{1}{4} & x=5,6,7,8\\ 0 & \text{otherwise}\end{cases}$	M1A1
		(2)
2c(i)	$\mathrm{P}(Y=X)=0.1\times0.25+0.2\times0.25+0.3\times0.25+0.4\times0.25$	M1
	$=0.25$	A1
(ii)	$Y=6$ then $X=5$ $Y=7$ then $X=5$ or 6 $Y=8$ then $X=5$, 6 or 7	M1
	$\mathrm{P}(Y>X)=0.2\times0.25+0.3\times0.5+0.4\times0.75$	M1
	$=0.5$	A1
		(5)
2d(i)	$X=8$ $Y=8$ so 0.25×0.4	M1
	$=\frac{1}{10}$	A1
		(2)
(ii)	$X=5$ $Y=7$ $X=6$ $Y=6$ $X=7$ $Y=5$	M1
	$0.25\times0.3+0.25\times0.2+0.25\times0.1$ or 0.25×0.6	M1
	$=\frac{3}{20}$	A1
		(3)
		(13 marks)

Question	Scheme	Marks
3a	A and C	B1
		(1)
3b	$\mathrm{P}(A)\times\mathrm{P}(B)=\mathrm{P}(A\cap B)\Rightarrow(p+1.2)\times0.3=0.12$	M1
	$p=0.28$	A1
		(2)
3c	$\mathrm{P}(B\mid C)=\frac{1}{4}\Rightarrow\frac{0.1}{0.1+q}=0.25$	M1
	$q=0.3$	A1
	$r=0.12$	A1
		(3)
3d	$\mathrm{P}(A\cup C\mid B)=\frac{0.22}{0.3}$	M1
	$=\frac{11}{15}=0.73\dot{3}$	A1
		(2)
		(8 marks)

Question	Scheme	Marks
4a(i)(ii)	$M \sim \mathrm{B}(20, 0.15)$	M1
	$\mathrm{P}(M = 3) = 0.242828...$ awrt 0.243	A1
	$\mathrm{P}(M > 5) = 0.067307...$ awrt 0.0673	A1
		(3)
4b	$X \sim \mathrm{B}(n, 0.15)$	
	$\left[{}^{n}C_{0}(0.15)^{0}\right]0.85^{n} < 0.01$	M1
	$n > \dfrac{\log(0.01)}{\log(0.85)}$ or $n > \log_{(0.85)}(0.01)$	M1
	$n > 28.336... \Rightarrow n = 29$	A1
		(3)
4c	$Y \sim \mathrm{N}(120, 102)$	B1
	$\mathrm{P}(Y > 110) \approx \mathrm{P}(Y > 110.5)$	M1
	$\left[\mathrm{P}\left(\dfrac{110.5 - "120"}{\sqrt{"102"}}\right)\right] = 0.826555...$ awrt 0.827	A1
		(3)
4d	$A \sim \mathrm{B}(20, 0.1)$ $\mathrm{P}(A = 3) = 0.190119...$	M1
	$\mathrm{P}(M = 3) \times \mathrm{P}(A = 3) = "0.242828..." \times "0.190119..."$	M1
	$= 0.0461665...$ awrt 0.0462	A1
		(3)
		(12 marks)

Question	Scheme	Marks
5a	$\mathrm{P}(X < a) = 0.01$ or $\mathrm{P}(X > a + 10) = 0.05$	
	$\dfrac{a - 252}{\sigma} = -2.3263$ or $\dfrac{a + 10 - 252}{\sigma} = 1.6449$	M1
	-2.3263 and 1.6449	B1
	$\dfrac{a - 252}{\sigma} = -2.3263$ and $\dfrac{a + 10 - 252}{\sigma} = 1.6449$	A1
	$(a - 252 = -2.3263\sigma) - (a - 242 = 1.6449\sigma)$	M1
	$10 = 3.9712\sigma \Rightarrow \sigma = 2.5$*	A1cso
		(5)
5b(i)	$\mathrm{P}(\mu - 2\sigma < X < \mu + \sigma) \Rightarrow \mathrm{P}(247 < X < 254.5)$	M1
	$= 0.81859\ldots$ awrt 0.819	A1
		(2)
(ii)	$\mathrm{P}(X^2 - 506X + 64000 < 0)$	M1
	$\mathrm{P}((X - 250)(X - 256) < 0) \Rightarrow \mathrm{P}(250 < X < 256)$	M1
	$= 0.73...$ awrt 0.730 - 0.733	A1
		(3)
		(10 marks)