GCE MARKING SCHEME

SUMMER 2017

MATHEMATICS - S1
0983-01

INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

S1– June 2017 – Markscheme

Ques	Solution	Mark	Notes
1(a)	(If A,B are independent,)P($A\cap B$)= 0.2 × 0.3 = 0.06	B1	
	(Using P($A\cap B$) = P(A) + P(B) – P($A\cup B$))		
	EITHER P($A\cap B$) = 0.2 + 0.3 – 0.4 = 0.1		
	OR P($A\cup B$) = 0.2 + 0.3 – 0.06 = 0.44	B1	
	(A and B are not independent because)		
	EITHER 0.1≠ 0.06 OR 0.4 ≠ 0.44	B1	
(b)(i)	$P(A\mid B)=\frac{P(A\cap B)}{P(B)}$	M1	FT from (a) M0 if independence assumed
	$=\frac{1}{3}$	A1	
	So $P(A'\mid B)=\frac{2}{3}$	A1	
(ii)	$P(A\cup B')=P(A)+P(B')-P(A\cap B')$	M1	M0 if independence assumed
	$=P(A)+1-P(B)-\left(P(A)-P(A\cap B)\right)$	m1	
	$=\frac{4}{5}$	A1	
2(a)	$E(X^2)=\text{Var}(X)+\left(E(X)\right)^2$	M1	
	= 104	A1	
(b)	E(Y) = 2E(X) + 3	M1	
	= 23	A1	
	Var(Y) = 4Var(X)	M1	
	= 16	A1	Award M0 for 2×, M1 for 4×
3(a)	P(1 each col) = $\frac{4}{9}\times\frac{3}{8}\times\frac{2}{7}\times 6$ or $\frac{\binom{4}{1}\binom{3}{1}\binom{2}{1}}{\binom{9}{3}}$	M1A1	M1A0 if 6 omitted
	$=\frac{2}{7}$ (0.286)	A1	
(b)	P(3 same col) =		
	$\frac{4}{9}\times\frac{3}{8}\times\frac{2}{7}+\frac{3}{9}\times\frac{2}{8}\times\frac{1}{7}$ or $\frac{\binom{4}{3}+\binom{3}{3}}{\binom{9}{3}}$	M1A1	
	$=\frac{5}{84}$ (0.0595)	A1	

Ques	Solution	Mark	Notes
4(a)(i)	P(at least 1 error) = $1-e^{-0.8}$ = 0.551	M1 A1	M0 exactly 1, M1 more than 1 Accept the use of tables
(ii)	P(3rd page 1st error) = $(1-0.551)^2 \times 0.551$ = 0.111	M1 A1	FT $0.449^2 \times$ answer to (a)
(b)(i)	$p_n = (e^{-0.8})^n$ $= e^{-0.8n}$	M1 A1	Accept 0.449 for $e^{-0.8}$ A1 can be earned later
(ii)	Consider $e^{-0.8n} < 0.001$ $-0.8n\log e < \log 0.001$ giving $n > 8.63...$ Therefore take $n = 9$	M1 A1 A1 A1	Allow the use of = Accept solutions using tables or evaluating powers of $e^{-0.8}$
5(a)(i)	X is B(10,0.7)	B1	
(ii)	$E(X) = 7$ $SD(X) = \sqrt{10\times0.7\times0.3}$ = 1.45	B1 M1 A1	Accept $\sqrt{2.1}, \frac{\sqrt{210}}{10}$
(iii)	Let Y = Number of games won by Brian so that Y is B(10,0.3) $P(X \ge 6) = P(Y \le 4)$ = 0.8497	M1 m1 A1	M0 no working Accept summing individual probabilities
(b)	Let G = number of games lasting more than 1 hour G is B(44,0.06) which is approx Po(2.64) $P(G > 2) = 1-e^{-2.64}\left(1+2.64+\frac{2.64^2}{2}\right)$=0.492	B1 M1A1	si M0 no working
6(a)	$E(X) = \frac{1}{54}\left(2\times2^2+3\times3^2+4\times4^2+5\times5^2\right)$ = 4.15 (112/27) $E(X^2) = \frac{1}{54}\left(2^2\times2^2+3^2\times3^2+4^2\times4^2+5^2\times5^2\right)$ (18.11.) Var(X) = $18.11.. - 4.1481...^2 = 0.904$ (659/729)	M1 A1 M1A1 A1	Allow MR for wrong range .
(b)	The possible values are 4,5,5 P(Sum = 14) = $\frac{4^2\times5^2\times5^2}{54^3}\times3$ = 0.191	B1 M1A1 A1	si Accept 0.19

Ques	Solution	Mark	Notes
7(a)(i)	$P(+) = 0.05\times0.96+0.95\times0.02$ $= 0.067$	M1A1 A1	
(ii)	$P(\text{disease}\|+) = \dfrac{0.05\times0.96}{0.067}$ $= 0.716$ cao	B1B1 B1	FT denominator from (i)
(b)(i)	$P(2^{nd}+) = 0.716\times0.96+(1-0.716)\times0.02$ $= 0.693$	M1 A1	FT from (a)
(ii)	$P(\text{disease}\|2^{nd}+) = \dfrac{0.716\times0.96}{0.693}$ $= 0.992$ cao (2304/2323)	M1 A1	Accept $\dfrac{0.05\times0.96^2}{0.05\times0.96^2+0.95\times0.02^2}$
8(a)(i)	$F(2) = 1$ so $12k = 1$ giving $k = \dfrac{1}{12}$	M1 A1	Convincing
(ii)	Use of $F(x) = 0.95$ $x^4 - x^2 - 11.4 = 0$ $x^2 = 3.913...$ $x = 1.98$	M1 A1 A1 A1	
(iii)	$P(X < 1.25\|X < 1.75) = \dfrac{F(1.25)}{F(1.75)}$ $= \dfrac{1.25^4 - 1.25^2}{1.75^4 - 1.75^2}$ $= 0.14$	M1 A1 A1	
(b)(i)	$f(x) = F'(x)$ $= \dfrac{1}{6}(2x^3 - x)$	M1 A1	M1 for knowing you have to differentiate
(ii)	Use of $E(\sqrt{X}) = \int \sqrt{x} f(x)\mathrm{d}x$ $= \dfrac{1}{6}\int \sqrt{x}(2x^3 - x)\mathrm{d}x$ $= \dfrac{1}{6}\left[\dfrac{4x^{9/2}}{9} - \dfrac{2x^{5/2}}{5}\right]_1^2$ $= 1.29$	M1 A1 A1 A1	FT from (b)(i) if answer between 1 and 2