



**General Certificate of Education (A-level)
January 2011**

Mathematics

MS/SS1A/W

(Specification 6360)

Statistics 1A/W

Mark Scheme

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Key to mark scheme abbreviations

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
✓ or ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
-x EE	deduct x marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

MS/SS1A/W

Q	Solution	Marks	Total	Comments
1(a)	$r = 0.757$ $r = 0.75$ to 0.77 $r = 0.65$ to 0.85	B3 (B2) (B1)	3	AWRT (0.75708) AWFW AWFW
	or Attempt at $\sum x$ $\sum x^2$ $\sum y$ $\sum y^2$ and $\sum xy$ or Attempt at S_{xx} S_{yy} and S_{xy} Attempt at substitution into correct corresponding formula for r $r = 0.757$	(M1) (m1) (A1)		271.5 6142.97 1911.9 304650.01 and 43259.17 (all 5 attempted) 0.2825 36.5425 and 2.4325 (all 3 attempted) AWRT
(b)	Strong/fairly strong/moderate positive (linear) correlation/relationship/association/link (but not 'trend') between Circumference/size and weight of (cricket) balls	Bdep1 B1	2	Dependent on $0.65 < r < 0.85$ Or equivalent; must qualify strength and indicate positive Bdep0 for very strong/high/average/medium/some etc. Context; providing $0 < r < 1$
Total			5	

MS/SS1A/W (cont)

Q	Solution	Marks	Total	Comments
2(a)(i)	$P(M \cap C) = \frac{175}{645} = \frac{35}{129} = 0.271$	B1	1	AWRT; accept either correct fraction
(ii)	$P(M) = \frac{519}{645} = \frac{173}{215} = 0.804$ to 0.805	B1	1	AWFW; accept either correct fraction
(iii)	$P(LD) = \frac{63}{645} = \frac{21}{215} = 0.097$ to 0.098	B1	1	AWFW; accept either correct fraction
(iv)	$P(L F) = \frac{94}{126} = \frac{47}{63}$ = 0.746	M1		Accept $\frac{94}{645} \div \frac{126}{645}$
		A1	2	AWRT
(b)	$P(L \cap L F) = \left(\frac{94}{126} \times \frac{93}{125}\right)$ or $\frac{8742}{15750}$ = 0.555	B1		Or $\left(\frac{47}{63} \times \frac{93}{125}\right)$ or $\frac{4371}{7875}$ or $\frac{1457}{2625}$
		B1	2	AWRT
(c)	$P(L \cap C \cap (LD + O))$ $= \frac{349}{645} \times \frac{193}{644} \times \frac{63+40}{643}$ SC The three correct fractions identified but not multiplied \Rightarrow M1 M0 M0 A0 $\times 6$ or 3 = 0.155 to 0.157 NB: 0.026 with no working \Rightarrow M1 only 0.026 \times 6 = 0.156 with no working \Rightarrow 4 marks	M1		Correct numerator
		M1		Correct denominator
		M1		Note that a denominator of $\binom{645}{3}$
		A1	4	\Rightarrow M2 (second and third M1 marks) AWFW
Total			11	

MS/SS1A/W (cont)

Q	Solution	Marks	Total	Comments
3(a)	Weight, $W \sim N(1018, 10^2)$			
(i)	$P(W < 1025) = P\left(Z < \frac{1025 - 1018}{10}\right)$	M1		Standardising (1024.5, 1025 or 1025.5) with 1018 and $(\sqrt{10}, 10 \text{ or } 10^2)$ and/or $(1018 - x)$
	$P(Z < 0.7) = 0.758$	A1	2	May be gained in (a)(i) or (a)(ii) AWRT (0.75804)
(ii)	$P(1015 < W < 1030)$			
	$= P(W < 1030) - P(W < 1015)$	M1		Difference of two probabilities May be implied
	$= P(Z < 1.2) - P(Z < -0.3)$			
	$= 0.88493 - (1 - 0.61791)$	M1		Area change
	$= 0.502 \text{ to } 0.504$	A1	3	May be implied by answer AWFW (0.50284)
(b)	$\bar{W} \sim \text{Normal with } \mu = 1018 \text{ and}$			
	$\sigma^2 = \frac{100}{24} = 4.1 \text{ to } 4.2$			CAO/AWFW (4.16666)
	or	B1		
	$\sigma = \frac{\sqrt{100}}{\sqrt{24}} = 2.02 \text{ to } 2.05$			CAO/AWFW (2.04124)
	$P(\bar{W} > 1015) = P\left(Z > \frac{1015 - 1018}{\frac{10}{\sqrt{24}}}\right)$	M1		Standardising 1015 with 1018 and c's $\frac{\sigma}{\sqrt{n}}$; not σ
	$= P(Z > -1.47) = 1 - P(Z < 1.47)$	m1		Area change
	$= 0.927 \text{ to } 0.932$	A1	4	May be implied by answer > 0.5 AWFW (0.92918)
	Total		9	

MS/SS1A/W (cont)

Q	Solution	Marks	Total	Comments
4(a)	$R \sim B(15, 0.45)$			
(i)	$P(R \leq 5) = 0.26(0)$ to 0.261	B1	1	AWFW (0.2608)
(ii)	$P(R > 10) = 1 - P(R \leq 10)$ $= 1 - (0.9745 \text{ or } 0.9231)$ $= 0.025$ to 0.026	M1 A1	2	Requires '1 -' Accept 3dp rounding or truncation Can be implied by 0.025 to 0.026 but not by 0.0769 to 0.077 AWFW (0.0255)
(iii)	$P(R = 6) = 0.4522 - (a)(i)$ or $\binom{15}{6}(0.45)^6(0.55)^9$ $= 0.191$ to 0.192	M1 A1	2	Can be implied by a correct answer AWFW (0.1914)
(iv)	$P(5 \leq R \leq 10) = 0.9745$ or 0.9231 (p_1) Minus 0.1204 or 0.2608 (p_2) $= 0.853$ to 0.855 Or B (15, 0.45) terms stated for at least 3 values within $4 \leq R \leq 11$ gives probability $= 0.853$ to 0.855	M1 A1 (M1) (A2)	3	Accept 3dp rounding or truncation $p_2 - p_1 \Rightarrow$ M0 M0 A0 $(1 - p_2) - p_1 \Rightarrow$ M0 M0 A0 $p_1 - (1 - p_2) \Rightarrow$ M1 M0 A0 only providing result > 0 Accept 3dp rounding or truncation AWFW (0.8541) Can be implied by a correct answer AWFW (0.8541)
(b)(i)	$P(S) = 0.85$ plus 1 minus (0.15×0.80) (0.15×0.20) $= 0.97$ NB: $(0.85 \times 0.20) + 0.80 \Rightarrow$ B0 B0 $(0.85 \times 0.20) + (0.85 \times 0.80)$ $+ (0.15 \times 0.80) \Rightarrow$ B0 B1	B1 B1	2	CAO; requires 'plus' or 'minus' CAO; not simply 0.12 or 0.03 AG
(ii)	$P(S \geq 48) = 0.81$ to 0.82 or 0.5553 or 0.9372 $= 0.81(0)$ to 0.811 NB: Answer = 0.4447 or 0.1892 or $0.0628 \Rightarrow$ M1 only	M2 A1	3	Accept 3dp rounding or truncation M2 for the three correctly expressed terms for B (50, 0.03) or B (50, 0.97) added AWFW (0.8108)
(iii)	$p = 1 - 0.85 = 0.15$ Mean, $\mu = 80 \times 0.15 = 12$ SC Mean = $9.6 \Rightarrow$ B1 only	B1 B1	2	CAO; may be implied by correct answer or correct expression for mean CAO
Total			15	

MS/SS1A/W (cont)

Q	Solution	Marks	Total	Comments
5(a)	b (gradient) = 1.28 (or 141/110) b (gradient) = 1.25 to 1.35	B2 (B1)	5	AWRT; (CAO or equivalent) (1.28182) AWFW Treat rounding of correct answers as ISW
	a (intercept) = 29.95 to 30 (or 659/22) a (intercept) = 29 to 31	B2 (B1)		AWFW; (CAO or equivalent) (29.95455) AWFW
	Thus $y = 30 + 1.28x$	B1F		F on a and b
	or Attempt at $\sum x$ $\sum x^2$ $\sum y$ and $\sum xy$ ($\sum y^2$)	(M1)		275 9625 682 and 20575 (47494) (All four attempted)
	or Attempt at S_{xx} and S_{xy} (S_{yy})	(m1)		2750 and 3525 (5210) (Both attempted)
	Attempt at correct formula for b gradient b (gradient) = 1.28 (or 141/110) a (intercept) = 29.95 to 30 (or 659/22) Thus $y = 30 + 1.28x$	(A1) (A1) (B1F)		AWRT; (CAO or equivalent) AWFW; (CAO or equivalent) F on a and b
	Accept a and b interchanged only if identified correctly by a clearly shown equation			If a and b are not identified anywhere in the question, then: 1.25 to 1.35 \Rightarrow B1 29 to 30 \Rightarrow B1
(b)	7.45 am $\Rightarrow x = 15$ $\Rightarrow y_{15} = 30 + 1.28 \times 15$ $= 47$ to 52	B1 M1 A1	5	CAO; stated, used or implied Use of $10 < x < 20$ AWFW (49.2)
	Time before 9.00 am = $9.00 - (7.45 + c's y_{15})$ $= 23$ to 28	M1 A1		May be implied AWFW (25.8)
	SC Answer of 17 CAO (use of c's $y_{15} = 58$) gains 2 marks			NB: An answer of 8.32 to 8.37 gains B1 M1 A1 M0 A0
	Total		10	

MS/SS1A/W (cont)

Q	Solution	Marks	Total	Comments
6(a)(i)	Mean, $\bar{x} = 20.4$	B1	1	CAO
(ii)	Standard deviation $s = \sqrt{\frac{400.24}{64}}$ = 2.50 NB: $s = \frac{400.24}{64 \text{ or } 65}$ (6.15754 or 6.25375) or $s = \sqrt{\frac{400.24}{65}}$ (2.48144)	M1 A1 (B1) (B1)	 2	Expression must be seen ($\sqrt{6.25375}$) AWRT (2.50075) No $\sqrt{\quad}$ and/or use of divisor n Use of divisor n
(b)(i)	96%(0.96) $\Rightarrow z = 2.05$ to 2.06 CI for μ is $\bar{x} \pm z \times \frac{s}{\sqrt{n}}$ Thus $20.4 \pm 2.0537 \times \frac{2.50}{\sqrt{65 \text{ or } 64}}$ Hence 20.4 ± 0.6 or (19.8, 21(.0))	B1 M1 A1F A1	 4	AWFW (2.0537) Used Must have \sqrt{n} with $n > 1$ F on \bar{x} and z AWRT
(ii)	Times/ X are not (known to be) normally distributed	B1	1	Or equivalent Not data, values, sample, n large
(c)	CI in (b)(i) contains/includes 20 thus no (significant) evidence to support claim	B1F Bdep1	 2	Or equivalent Dependent on CI in (b)(i) Or equivalent Dependent on B1F
	Total		10	
	TOTAL		60	