



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 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 $r = 0.757$	B3 (B2) (B1) (M1) (m1) (A1)	3	AWRT (0.75708) AWFW AWFW 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)	$P(M) = \frac{519}{645} = \frac{173}{215} = 0.804 \text{ to } 0.805$	B1	1	AWFW; accept either correct fraction
(iii)	$P(LD) = \frac{63}{645} = \frac{21}{215} = 0.097 \text{ to } 0.098$	B1	1	AWFW; accept either correct fraction
(iv)	$P(L F) = \frac{94}{126} = \frac{47}{63}$ $= 0.746$	M1 A1	2	Accept $\frac{94}{645} \div \frac{126}{645}$ AWRT
(b)	$P(L \cap L F) = \left(\frac{94}{126} \times \frac{93}{125} \right) \text{ or } \frac{8742}{15750}$ $= 0.555$	B1 B1	2	Or $\left(\frac{47}{63} \times \frac{93}{125} \right) \text{ or } \frac{4371}{7875} \text{ or } \frac{1457}{2625}$ 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 $\times 6 \text{ or } 3$ $= 0.155 \text{ to } 0.157$ NB: 0.026 with no working $\Rightarrow$ M1 only 0.026 $\times$ 6 = 0.156 with no working $\Rightarrow$ 4 marks	M1 M1 M1 A1	4	Correct numerator Correct denominator Note that a denominator of $\binom{645}{3}$ $\Rightarrow$ 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)	$P(W < 1025) = P\left(Z < \frac{1025 - 1018}{10}\right)$ $P(Z < 0.7) = 0.758$	M1 A1	2	Standardising (1024.5, 1025 or 1025.5) with 1018 and $(\sqrt{10}, 10 \text{ or } 10^2)$ and/or $(1018 - x)$ May be gained in (a)(i) or (a)(ii) AWR (0.75804)
(ii)	$P(1015 < W < 1030)$ $= P(W < 1030) - P(W < 1015)$ $= P(Z < 1.2) - P(Z < -0.3)$ $= 0.88493 - (1 - 0.61791)$ $= 0.502 \text{ to } 0.504$	M1 M1 A1	3	Difference of two probabilities May be implied Area change May be implied by answer AFW (0.50284)
(b)	$\bar{W} \sim \text{Normal with } \mu = 1018 \text{ and } \sigma^2 = \frac{100}{24} = 4.1 \text{ to } 4.2$ or $\sigma = \frac{\sqrt{100}}{\sqrt{24}} = 2.02 \text{ to } 2.05$ $P(\bar{W} > 1015) = P\left(Z > \frac{1015 - 1018}{\frac{10}{\sqrt{24}}}\right)$ $= P(Z > -1.47) = 1 - P(Z < 1.47)$ $= 0.927 \text{ to } 0.932$	B1 M1 m1 A1	4	CAO/AFW (4.16666) CAO/AFW (2.04124) Standardising 1015 with 1018 and c's $\frac{\sigma}{\sqrt{n}}$; not σ Area change May be implied by answer > 0.5 AFW (0.92918)
	Total		9	

MS/SS1A/W (cont)

Q	Solution	Marks	Total	Comments
4(a)	$R \sim B(15, 0.45)$			
(i)	$P(R \leq 5) = 0.26(0) \text{ to } 0.261$	B1	1	AWFW (0.2608)
(ii)	$P(R > 10) = 1 - P(R \leq 10)$ $= 1 - (0.9745 \text{ or } 0.9231)$ $= 0.025 \text{ to } 0.026$	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 $\binom{15}{6}(0.45)^6(0.55)^9$ $= 0.191 \text{ to } 0.192$	M1 A1	2	Can be implied by a correct answer AWFW (0.1914)
(iv)	$P(5 \leq R \leq 10) = 0.9745 \text{ or } 0.9231 \quad (p_1)$ Minus $0.1204 \text{ or } 0.2608 \quad (p_2)$ $= 0.853 \text{ to } 0.855$ Or B (15, 0.45) terms stated for at least 3 values within $4 \leq R \leq 11$ gives probability $= 0.853 \text{ to } 0.855$	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)	$P(S) = 0.85 \text{ plus } 1 \text{ minus}$ $(0.15 \times 0.80) \quad (0.15 \times 0.20)$ $= 0.97$ 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)	$P(S \geq 48) = 0.81 \text{ to } 0.82 \text{ or } 0.5553$ or 0.9372 $= 0.81(0) \text{ to } 0.811$ 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 a (intercept) = 29.95 to 30 (or 659/22) a (intercept) = 29 to 31 Thus $y = 30 + 1.28x$	B2 (B1) B2 (B1) B1F	5	AWRD; (CAO or equivalent) (1.28182) AFWW Treat rounding of correct answers as ISW AFWW; (CAO or equivalent) (29.95455) AFWW F on a and b
	or Attempt at $\sum x$ $\sum x^2$ $\sum y$ and $\sum xy$ ($\sum y^2$) or Attempt at S_{xx} and S_{xy} (S_{yy}) Attempt at correct formula for b gradient b (gradient) = 1.28 (or 141/110) a (intercept) = 29.95 to 30 (or 659/22) Thus $y = 30 + 1.28x$ Accept a and b interchanged only if identified correctly by a clearly shown equation	(M1) (m1) (A1) (A1) (B1F)		275 9625 682 and 20575 (47494) (All four attempted) 2750 and 3525 (5210) (Both attempted) AWRD; (CAO or equivalent) AFWW; (CAO or equivalent) F on a and b 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)	$7.45 \text{ am} \Rightarrow x = 15$ $\Rightarrow y_{15} = 30 + 1.28 \times 15$ $= 47$ to 52	B1 M1 A1	5	CAO; stated, used or implied Use of $10 < x < 20$ AFWW (49.2)
	Time before 9.00 am = $9.00 - (7.45 + c's y_{15})$ $= 23$ to 28	M1 A1		May be implied AFWW (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	M1 A1	2	Expression must be seen ($\sqrt{6.25375}$) AWRT (2.50075)
	NB: $s = \frac{400.24}{64 \text{ or } 65}$ (6.15754 or 6.25375)	(B1)		No $\sqrt{\quad}$ and/or use of divisor n
	or $s = \sqrt{\frac{400.24}{65}}$ (2.48144)	(B1)		Use of divisor n
(b)(i)	96%(0.96) $\Rightarrow z = 2.05$ to 2.06	B1		AWFW (2.0537)
	CI for μ is $\bar{x} \pm z \times \frac{s}{\sqrt{n}}$	M1		Used Must have $\sqrt{n}$ with $n > 1$
	Thus $20.4 \pm 2.0537 \times \frac{2.50}{\sqrt{65 \text{ or } 64}}$	A1F		F on $\bar{x}$ and z
	Hence 20.4 ± 0.6 or (19.8, 21(.0))	A1	4	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	B1F		Or equivalent Dependent on CI in (b)(i)
	no (significant) evidence to support claim	Bdep1	2	Or equivalent Dependent on B1F
	Total		10	
	TOTAL		60	