A-LEVEL
STATISTICS

Statistics 2 – SS02
Mark scheme

6380
June 2014

Version/Stage: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

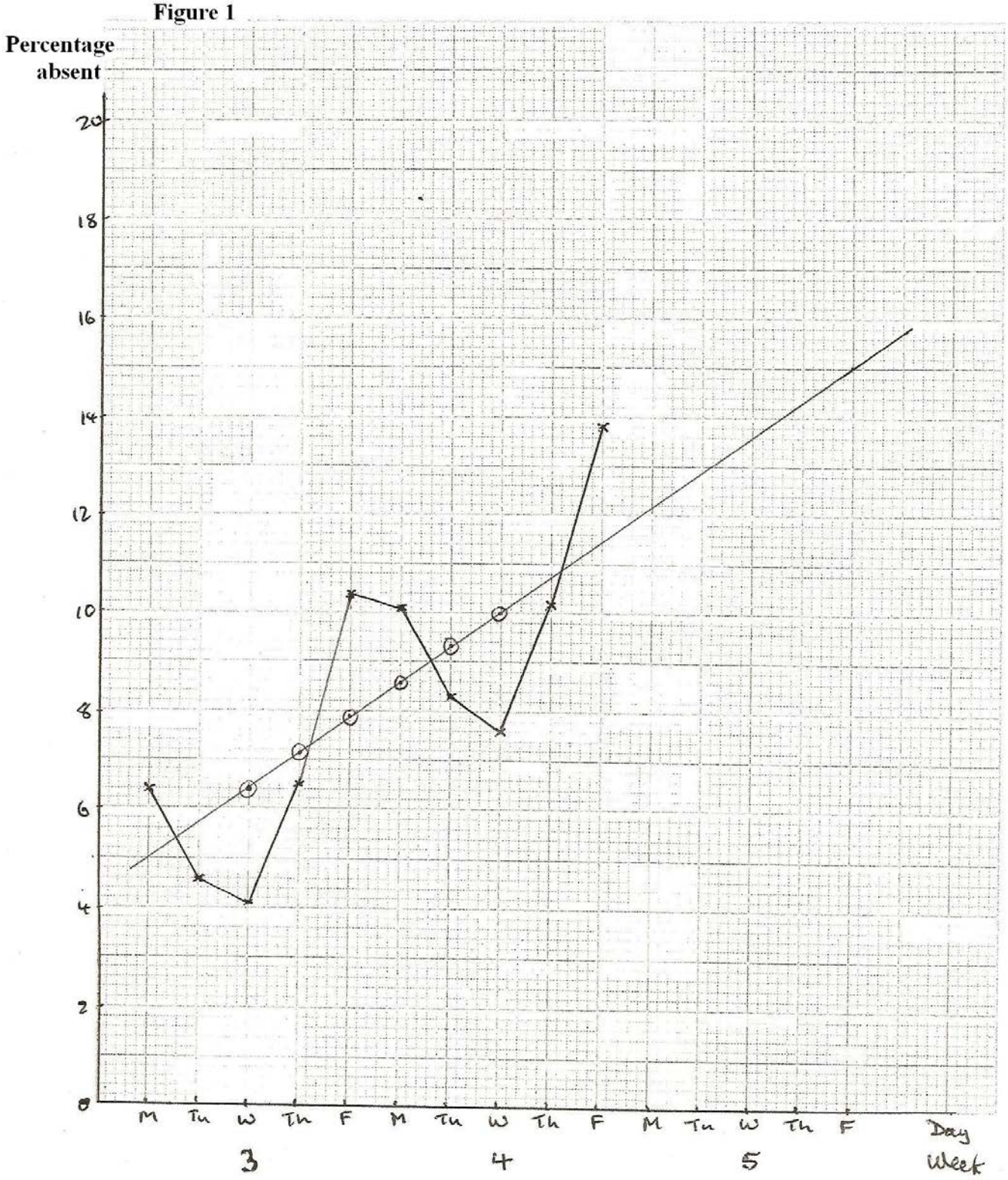
Further copies of this Mark Scheme are available from aqa.org.uk

Q	Solution	Marks	Total	Comments
1(a) (i)	0.57	B1	**1**	CAO
(ii)	360 × 0.57, 0.32 and 0.11	M1		At least one
	= 205.2º, 115.2º, 39.6º	A1	**2**	Any two. CAO
(b)	Mean = 20 × 0.57 + 50 × 0.32 + 210 × 0.11	M1		
	= 50.5	A1		AG
	$20^2 \times 0.57 + 50^2 \times 0.32 + 210^2 \times 0.11 - 50.50^2$	M1		3328.75 seen unsupported earns M1
	= 3328.75 s.d = £57.70	A1	**4**	AWFW £57.60 to £57.70
(c)(i)	Mean = 10 × 0.57 + 50 × 0.32 + 210 × 0.11			Or £50.50 – £5.70
	= £44.80	B1		
(ii)	1.2 × 90 × 44.80 – (50.5 × 90)	M1		
	= £293.40	A1	**3**	Accept £293

Q	Solution	Marks	Total	Comments
2(a)(i)	P(< 4) = P(≤ 3) = 0.558(4)	B1	**1**	AWFW 0.558 to 0.559
(ii)	Using Po(13)	B1		Stated or use of any of 0.1658, 0.2517,0.9573, 0.9750
	Use of P(≤ 19) = 0.9573 for top value	M1		
	subtract P(≤ 10) = 0.2517 for bottom value	M1		Indep of previous M1
	giving 0.7056	A1		AWFW 0.705 to 0.706
	SC Stating that P(≤ 19) – P(≤ 10) is required but using wrong value of λ earns a single M1		**4**	
(b)(i)	P(at least 1) = 1 – P(0)	M1		Attempt to apply in this case
	= 1 – 0.0183 = 0.9817 (or 0.982)	A1	**2**	CAO
(ii)	$0.9817^2 \times 0.0183$	M1		Use of their (b)(i)
	× 3	m1		
	= 0.0529	A1	**3**	AWFW0.052 to 0.053
(c)	Mean = 100	B1		CAO
	Standard deviation = √100 = 10	B1	**2**	CAO
(d)	Because we can no longer assume independence.	E1	**1**	OE

Q	Solution	Marks	Total	Comments
3(a)	Division by 5	B1		
	Addition of correct 5 values	M1		
	(4.6 + 4.1 + 6.5 + 10.4 + 10.1) ÷ 5 = 7.14	A1		CAO
			3	
(b)(i)	Correct plot	B1		
	Reasonable trend line	B1		
			2	
(ii)	Seasonal variation	B1		
	about an upward linear trend	B1		
			2	
(c)	Friday effect = [(10.4–7.9) + (13.8–11.5)] ÷ 2	M1		Complete method
	= 2.4	A1		2.3 to 2.7
	Trend line predicts 15.0	B1		± 0.5
	Friday effect + trend line prediction	M1		Dep on M1
	= 17.4%	A1		AWFW 17 to 18 Dep on all previous marks having been gained
			5	
(d)	Less than forecast so some success.	E1		
	Still more than week 4 so limited success.	E1		
	Any changes may have had nothing to do			OE
	with incentives (trend must change some time)	E1		Max of 2 marks.
			2	

Figure 1


Percentage absent
20
18
16
14
12
10
8
6
4
2
0
M Tu W Th F M Tu W Th F M Tu W Th F
Day
3
4
5
Week

Q	Solution	Marks	Total	Comments
4(a)	The sample must be a **random** sample.	E1	**1**	
(b)	H_0: $\mu = 9.0$	B1		
	H_1: $\mu \neq 9.0$	B1		
	$z_{crit} = \pm 1.9600$	B1		
	$z_{test} = (9.2 - 9.0) \div (1.3 \div \sqrt{120})$	M1,m1		M1 for $\div \sqrt{120}$, m1 for rest
	$= 1.6853$	A1		AWFW +1.68 to +1.69
	$z_{test} < z_{crit}$ so accept H_0	A1		
	Insufficient evidence that the mean power of the batch is different from 9.0 watts.	E1	**8**	
(c)(i)	H_1 becomes $\mu > 9.0$	B1		
(ii)	z_{crit} becomes 1.6449	B1		AWFW 1.64 to 1.65
(iii)	Now we reject H_0 and say that	B1		PI by context statement.
	there is sufficient evidence that the mean power of the batch is more than 9.0 watts.	E1	**4**	Dep on both B1s in (i) and (ii)

Q	Solution	Marks	Total	Comments
5(a)	Total for school = 750	B1		
	Bronwyn needs $^{50}/_{750} = {}^{1}/_{15}$ of population	M1		Possibly implied
	Attempt to divide each cell by 15	m1		
	Integer answers			
	Boys 4 5 5 6 6	A1		At least two $\neq 5$ seen
	Girls 4 5 5 5 5		**4**	
(b)(i)	All the boys followed by all the girls	B1		Or vice versa
(ii)	Choose a number between 1 and 15 at random	B1		
	using random numbers, calculator, etc	B1		Any valid method suggested, dep on previous B1
	Select every fifteenth pupil after that	B1	**4**	
(c)	Advantage – does not need to find particular pupils, quicker or easier.	E1		Or similar, must be in context
	Disadvantage – groups arriving together are likely to have travelled together.	E1	**2**	Or similar, must be in context

Q	Solution	Marks	Total	Comments
6(a)	1964	B1	**1**	
(b)	The trend is downwards (decreasing or negative) from 1961 to 1977 and then upwards (increasing or positive) to 2010.	M1 A1	**2**	For the downwards then upwards For details of the years.
(c)	(86746 – 40591) = 46155 ÷ 86746 × 100 (completion of method) = 53.2%	M1 m1 A1	**3**	For both correct and subtraction Or 100 – (40591 × 100/86746) Accept 53% from correct working.
(d)(i)	Evidence of 40,591, 177,903, 377,136, 579,593, 695,434 and 723,165 being used. Accurately plotted	M1 A1 A1	**3**	At least 4 accurate (2 s.f.) Completely correct
(ii)	Attempt to read at ~360,000 25.5 to 26, 29.5 to 30 Median age in 2010 is 4 years higher.	M1 A1 A1	**3**	AWRT 4. Not simply "higher"
(e)	Omitting 88, 86, 95 Omitting second 81 or 00 Completely correct list 20, 80, (0)9, 13, 28, 49, 74, 81, (0)3	M1 M1 A1	**3**	Either of these. Indep of previous M1 SC If neither of M1 marks are earned but 2-digit numbers from the correct column are given then award B1

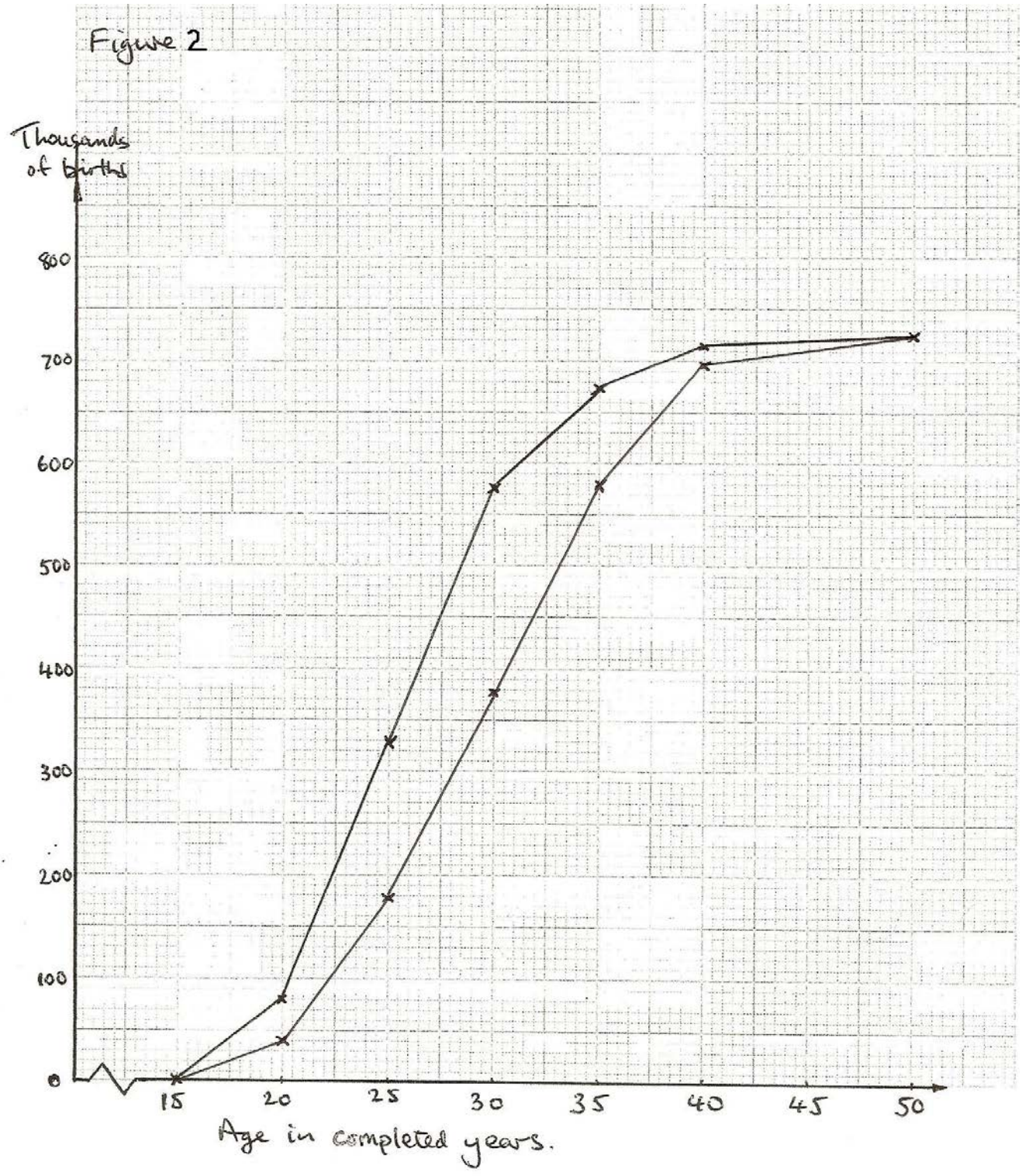


Figure 2
Thousands of births
800
700
600
500
400
300
200
100
0
15
20
25
30
35
40
45
50
Age in completed years.