OCR
RECOGNISING ACHIEVEMENT

Friday 24 May 2013 – Morning

AS GCE MEI STATISTICS

G241/01 Statistics 1 (Z1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book G241/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book**. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets **[ ]** at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

Section A (36 marks)

1 The weights, x grams, of 100 potatoes are summarised as follows.

$$n = 100 \qquad \Sigma x = 24\,940 \qquad \Sigma x^2 = 6\,240\,780$$

(i) Calculate the mean and standard deviation of x. **[3]**

(ii) The weights, y grams, of the potatoes after they have been peeled are given by the formula $y = 0.9x - 15$. Deduce the mean and standard deviation of the weights of the potatoes after they have been peeled. **[3]**

2 Every evening, 5 men and 5 women are chosen to take part in a phone-in competition. Of these 10 people, exactly 3 will win a prize. These 3 prize-winners are chosen at random.

(i) Find the probability that, on a particular evening, 2 of the prize-winners are women and the other is a man. Give your answer as a fraction in its simplest form. **[4]**

(ii) Four evenings are selected at random. Find the probability that, on at least three of the four evenings, 2 of the prize-winners are women and the other is a man. **[4]**

3 The weights of bags of a particular brand of flour are quoted as 1.5 kg. In fact, on average 10% of bags are underweight.

(i) Find the probability that, in a random sample of 50 bags, there are exactly 5 bags which are underweight. **[3]**

(ii) Bags are randomly chosen and packed into boxes of 20. Find the probability that there is at least one underweight bag in a box. **[2]**

(iii) A crate contains 48 boxes. Find the expected number of boxes in the crate which contain at least one underweight bag. **[2]**

4 Martin has won a competition. For his prize he is given six sealed envelopes, of which he is allowed to open exactly three and keep their contents. Three of the envelopes each contain £5 and the other three each contain £1000. Since the envelopes are identical on the outside, he chooses three of them at random. Let £X be the total amount of money that he receives in prize money.

(i) Show that $\mathrm{P}(X = 15) = 0.05$. **[2]**

The probability distribution of X is given in the table below.

r	15	1010	2005	3000
$\mathrm{P}(X = r)$	0.05	0.45	0.45	0.05

(ii) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. **[5]**

5 A researcher is investigating whether people can identify whether a glass of water they are given is bottled water or tap water. She suspects that people do no better than they would by guessing. Twenty people are selected at random; thirteen make a correct identification. She carries out a hypothesis test.

(i) Explain why the null hypothesis should be $p = 0.5$, where p represents the probability that a randomly selected person makes a correct identification. **[2]**

(ii) Briefly explain why she uses an alternative hypothesis of $p > 0.5$. **[1]**

(iii) Complete the test at the 5% significance level. **[5]**

Section B (36 marks)

6 The birth weights in kilograms of 25 female babies are shown below, in ascending order.

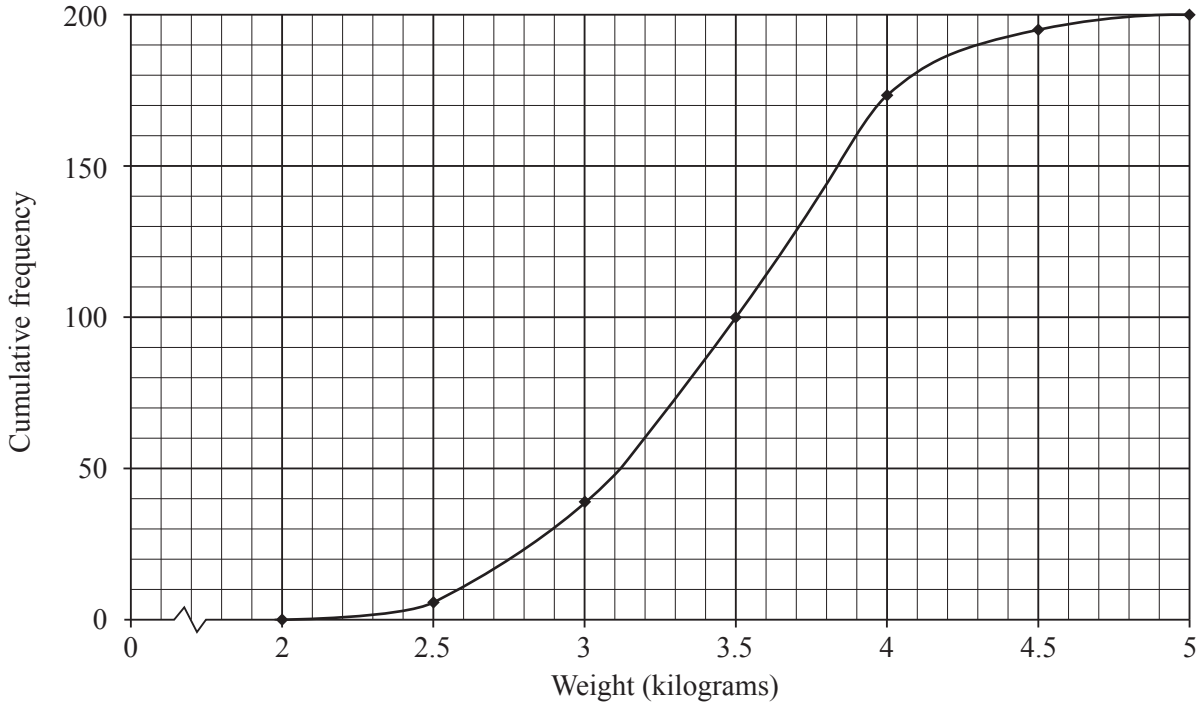
1.39	2.50	2.68	2.76	2.82	2.82	2.84	3.03	3.06	3.16	3.16	3.24	3.32
3.36	3.40	3.54	3.56	3.56	3.70	3.72	3.72	3.84	4.02	4.24	4.34	

(i) Find the median and interquartile range of these data. **[3]**

(ii) Draw a box and whisker plot to illustrate the data. **[3]**

(iii) Show that there is exactly one outlier. Discuss whether this outlier should be removed from the data. **[4]**

The cumulative frequency curve below illustrates the birth weights of 200 male babies.



(iv) Find the median and interquartile range of the birth weights of the male babies. **[3]**

(v) Compare the weights of the female and male babies. **[2]**

(vi) Two of these male babies are chosen at random. Calculate an estimate of the probability that both of these babies weigh more than any of the female babies. **[3]**

7 Jenny has six darts. She throws darts, one at a time, aiming each at the bull's-eye. The probability that she hits the bull's-eye with her first dart is 0.1. For any subsequent throw, the probability of hitting the bull's-eye is 0.2 if the previous dart hit the bull's-eye and 0.05 otherwise.

(i) Illustrate the possible outcomes for her first, second and third darts on a probability tree diagram. **[4]**

(ii) Find the probability that

(*A*) she hits the bull's-eye with at least one of her first three darts, **[3]**

(*B*) she hits the bull's-eye with exactly one of her first three darts. **[4]**

(iii) Given that she hits the bull's-eye with at least one of her first three darts, find the probability that she hits the bull's-eye with exactly one of them. **[3]**

Jenny decides that, if she hits the bull's-eye with any of her first three darts, she will stop after throwing three darts. Otherwise she will throw all six darts.

(iv) Find the probability that she hits the bull's-eye three times in total. **[4]**

OCR
RECOGNISING ACHIEVEMENT

Friday 24 May 2013 – Morning

AS GCE MEI STATISTICS

G241/01 Statistics 1 (Z1)

PRINTED ANSWER BOOK

G215980613

Candidates answer on this Printed Answer Book.

OCR supplied materials:
- Question Paper G241/01 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

G 2 4 1 0 1

Candidate forename		Candidate surname	

Centre number						Candidate number				

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Section A (36 marks)

1 (i)	
1 (ii)	

2 (i)

2 (ii)

3 (i)	
3 (ii)	
3 (iii)	

4 (i)

4 (ii)

5 (i)	
5 (ii)	
5 (iii)	
	(answer space continued on next page)

5 (iii)	**(continued)**

Section B (36 marks)

6 (i)	
6 (ii)	
6 (iii)	

6 (iv)	
6 (v)	
6 (vi)	

7 (i)	

7 (ii) (*A*)

7 (ii) (*B*)

7 (iii)

7 (iv)	

OCR
RECOGNISING ACHIEVEMENT

GCE

Statistics (MEI)

Advanced Subsidiary GCE **AS H132**

OCR Report to Centres

June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

CONTENTS

Advanced Subsidiary GCE Statistics (H132)

OCR REPORT TO CENTRES

G241 Statistics 1

General Comments

On the whole candidates coped well with this paper. A good number of candidates scored 60 marks or more out of 72. A considerable number of candidates scored the majority of their marks on topics which overlap with Higher Tier GCSE; however, Question 3 on the binomial distribution was well answered. Most candidates supported their numerical answers with appropriate working. However, when written explanations were required, the poor handwriting and use of English of some candidates made it difficult to determine what they were trying to say.

There was no evidence of candidates being unable to complete the paper in the allocated time. As last year only a small minority of candidates attempted parts of questions in answer sections intended for a different question/part and most candidates had adequate space in the answer booklet without having to use additional sheets. Those candidates who overwrote pencil working in ink, even if they made an attempt to rub out the pencil, made the work very difficult to read. Candidates should be advised to refrain from doing this.

Unfortunately, as in recent series, most candidates lost marks due to over specification of some of their answers, despite recent examiners' reports warning against this. The worst cases of this were in both parts of Question 1 and in Question 4(ii), where the vast majority of candidates gave the variance to 8 significant figures. It is possible that they thought that as it was a sum of money it should be exact, but of course the units of the variance would be pounds^2.

Comments on Individual Questions

1)(i) The vast majority of candidates answered this part correctly, though many lost marks for over-specification of the standard deviation (often given as 14.475). A small minority managed to over-specify the mean, giving it as 249.40. Only a few candidates found the root mean standard deviation instead of the standard deviation.

1)(ii) The mean was usually tackled correctly, but then the mark sometimes lost was for over-specification. Calculating the standard deviation seemed to cause more problems, with attempts made to 'start again' or comments such as 'it remains the same'. Candidates were not penalised a second time if they over-specified again – many in fact gave 6 or 7 significant figures in their (correct) answer.

2)(i) Candidates using the ${}^nC_r$ method tended to be more successful, as when using the product of 3 fractions method many did not realise that they needed to multiply the final product by 3. A small minority of candidates did not follow instructions and either left a fraction in unsimplified form (usually 15/36) or gave the answer as a decimal.

2)(ii) Most candidates made a reasonable start in this part, using their answer from part (i). However, many only calculated one probability, or missed the coefficient of 4 when calculating the probability of 3 evenings, not realising this was a binomial situation. Some candidates calculated the probability of 3, rather than *at least* 3, and thus only gained 1 mark. A small minority of candidates used statistical functions on graphical calculators to just write down an answer – this was a risky strategy, as a slip in copying the answer was heavily penalised, since no method was shown.

3)(i) This question was very well answered, with most candidates scoring all 3 marks. However, a few candidates seemed to have no idea about the binomial distribution.

3)(ii) Again another well answered question, although occasionally candidates did not read the question carefully and continued to use $n = 50$ in their calculation.

3)(iii) Full marks were available here for a correct follow through from part (ii), so many candidates managed to recover from an incorrect answer. However a large proportion of candidates rounded their answer to the nearest whole number, thus losing a mark. Others over-specified their final answer, again losing a mark. Other common errors were to use $p = 0.1$, rather than their answer to part (ii), or to use $n = 48 \times 20$.

4)(i) This was well answered by the majority of candidates with most of them using the product of 3 fractions method. A few successfully used $1/({}^{20}C_3)$. There were a few candidates who used the probabilities in the table to give 1-(0.45+0.45+0.05), for which of course no credit was available.

4)(ii) This was very well answered, with nearly all candidates picking up 4 marks out of 5. Very few candidates gained the final mark, due to over-specification of the variance, usually giving an answer of 445511.25. A minority of candidates made the usual errors in this type of question such as: squaring the probabilities when finding $E(X^2)$, subtracting $E(X)$ rather than $[E(X)]^2$ or introducing spurious multipliers or dividers. Candidates should be advised to check carefully the figures which they enter into their calculator, as although the written down calculation was usually correct, sometimes the answer written was not.

5) The wording of the researcher's theory appeared to cause confusion for some of the candidates throughout the question. This was translated into some poorly worded explanations and conclusions in all three parts of the question. Good comprehension skills are required in this type of question and, unfortunately, these skills were not always in evidence.

5)(i) Many candidates scored both marks. Unfortunately a good proportion lost either the first or the second mark by not mentioning 'guess' or only including it when they quoted the question or not mentioning, in any form, the idea of the two possible outcomes. Some candidates simply just re-stated the null hypothesis in words.

5)(ii) This was not as well answered as part (i). There was a failure to distinguish between guessing and being able to identify between the two types of water. A lot of candidates lost the mark because they gave the reason for the alternative hypothesis as '13 people out of 20 in the researcher's sample identified correctly' which of course is not a valid reason.

5)(iii) The most successful way of approaching this hypothesis test was to compare P($X \geq 13$) with the significance level. Several of the candidates, who used this method failed to gain the final mark due to not putting the explanation in the context of the question. Other candidates used incorrect probabilities, usually P($X \geq 12$) or P($X \geq 14$). Candidates who used the critical region method normally gained the first two marks but then many of them failed to gain any more marks – usually because they had included 14 in the critical region. Unfortunately some candidates started looking at the two probabilities necessary for the critical region but made no mention of the critical region, or critical value, so did not gain any marks.
It is pleasing to report, on the other hand, that very few candidates tried to use point probabilities. However, although full marks could be obtained by comparing 0.8684 with 95%, many candidates either compared with 5% or made no explicit comparison at all - such candidates were unable to gain any credit.

6)(i) Most candidates successfully found the median, although instead of the 13th value some found average of the 12^{th} and 13^{th} values. However, candidates were less successful in finding the interquartile range. The lower quartile was usually found correctly, but the upper quartile was more frequently wrong, with an answer of 3.665 being the most common error. Occasionally candidates did not subtract to find the interquartile range, but instead some found the midpoint of their quartiles.

6)(ii) The response to this question was very disappointing. Perhaps because they were faced with a blank space rather than graph paper, most candidates thought that accuracy was not required. Very few had a scale and some of those that did failed to make it linear. Some candidates simply sketched a box and whisker plot and then labelled the diagram with the relevant values. This did not gain marks as the question clearly instructs candidates to 'Draw a box and whisker plot…'. It seems likely that many candidates either did not have, or did not think to use a ruler. Far too many freehand diagrams were seen, with the sizes of the box and whiskers and the position of the median not in proportion.

6)(iii) Many candidates correctly found the upper and lower limits for the outliers. The most common misconception was that outliers were calculated using median ± 1.5×IQR, although many other errors were also seen. A few candidates attempted to use the mean and standard deviation, and if they got both of these correct, full marks were available, but unfortunately one or other of the two statistics was usually incorrect.
It was necessary to check both limits to show that there was only one outlier, but some candidates ignored the upper limit. Many candidates failed to give an explanation in context regarding the outlier, though those that did often made a valid point about premature babies.

6)(iv) As in part (i), the median was usually found correctly, but some candidates lost a mark due to inaccurate reading of the scales in finding the quartiles.

6)(v) Only about one third of candidates scored both marks. Credit was given to those candidates who could only compare medians and interquartile ranges without an explanation of what they meant. Candidates who just said 'boys are heavier' failed to get credit without a comment such as 'generally' or 'on average' or 'tend to be'. Similarly 'more consistent' or 'vary less' or 'less spread' gained credit for interquartile range – 'smaller range' was not awarded credit.

6)(vi) This part discriminated very well between the higher-scoring candidates. Many candidates realised that approximately 10 male babies weighed more than 4.34 kg. Unfortunately many then did not know how to proceed, often squaring 0.05 (10/200) rather than multiplying by 9/199. Those candidates who misread the scale but knew how to proceed could gain a Special Case mark. A significant number of candidates missed out this part altogether.

7)(i) The majority of tree diagrams were well constructed with correct labelling. Weaker candidates sometimes became confused and made errors in the 2nd and/or 3rd branch.

7)(ii)*A* Many candidates employed the 1 – P(misses with all) method, usually successfully, but a significant number used the protracted method of listing all 7 triplets associated with at least one hit. Usually errors were made using such an approach.

7)(ii)*B* Most candidates found the correct three products and calculated them correctly. A small number failed to find all three. For those who got the tree diagram wrong, follow through marks were available.

7)(iii) Many of those who reached this part were successful. However, there was considerable confusion in finding the conditional probability, often with a correct denominator but a wrong numerator of P(at least one)×P(exactly one). Some candidates inverted the fraction.

7)(iv) Approximately one third of candidates were successful in this part. However many were confused. Many candidates successfully found the first product but then failed to find the second, or found additional products. Those who attempted the second product often made errors. The last three probabilities were often 0.1×0.2×0.2 rather than 0.05×0.2×0.2.

For a description of how UMS marks are calculated see:
www.ocr.org.uk/learners/ums_results.html

Unit level raw mark and UMS grade boundaries June 2013 series
AS GCE / Advanced GCE / AS GCE Double Award / Advanced GCE Double Award

GCE Mathematics (MEI)

			Max Mark	a	b	c	d	e	u
4751/01	(C1) MEI Introduction to Advanced Mathematics	Raw	72	62	56	51	46	41	0
		UMS	100	80	70	60	50	40	0
4752/01	(C2) MEI Concepts for Advanced Mathematics	Raw	72	54	48	43	38	33	0
		UMS	100	80	70	60	50	40	0
4753/01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	58	52	46	40	33	0
4753/02	(C3) MEI Methods for Advanced Mathematics with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4753/82	(C3) MEI Methods for Advanced Mathematics with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
4753	(C3) MEI Methods for Advanced Mathematics with Coursework	UMS	100	80	70	60	50	40	0
4754/01	(C4) MEI Applications of Advanced Mathematics	Raw	90	66	59	53	47	41	0
		UMS	100	80	70	60	50	40	0
4755/01	(FP1) MEI Further Concepts for Advanced Mathematics	Raw	72	63	57	51	45	40	0
		UMS	100	80	70	60	50	40	0
4756/01	(FP2) MEI Further Methods for Advanced Mathematics	Raw	72	61	54	48	42	36	0
		UMS	100	80	70	60	50	40	0
4757/01	(FP3) MEI Further Applications of Advanced Mathematics	Raw	72	60	52	44	36	28	0
		UMS	100	80	70	60	50	40	0
4758/01	(DE) MEI Differential Equations with Coursework: Written Paper	Raw	72	62	56	51	46	40	0
4758/02	(DE) MEI Differential Equations with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4758/82	(DE) MEI Differential Equations with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
4758	(DE) MEI Differential Equations with Coursework	UMS	100	80	70	60	50	40	0
4761/01	(M1) MEI Mechanics 1	Raw	72	57	49	41	33	25	0
		UMS	100	80	70	60	50	40	0
4762/01	(M2) MEI Mechanics 2	Raw	72	50	43	36	29	22	0
		UMS	100	80	70	60	50	40	0
4763/01	(M3) MEI Mechanics 3	Raw	72	64	56	48	41	34	0
		UMS	100	80	70	60	50	40	0
4764/01	(M4) MEI Mechanics 4	Raw	72	56	49	42	35	29	0
		UMS	100	80	70	60	50	40	0
4766/01	(S1) MEI Statistics 1	Raw	72	55	48	41	35	29	0
		UMS	100	80	70	60	50	40	0
4767/01	(S2) MEI Statistics 2	Raw	72	58	52	46	41	36	0
		UMS	100	80	70	60	50	40	0
4768/01	(S3) MEI Statistics 3	Raw	72	61	55	49	44	39	0
		UMS	100	80	70	60	50	40	0
4769/01	(S4) MEI Statistics 4	Raw	72	56	49	42	35	28	0
		UMS	100	80	70	60	50	40	0
4771/01	(D1) MEI Decision Mathematics 1	Raw	72	58	52	46	40	35	0
		UMS	100	80	70	60	50	40	0
4772/01	(D2) MEI Decision Mathematics 2	Raw	72	58	52	46	41	36	0
		UMS	100	80	70	60	50	40	0
4773/01	(DC) MEI Decision Mathematics Computation	Raw	72	46	40	34	29	24	0
		UMS	100	80	70	60	50	40	0
4776/01	(NM) MEI Numerical Methods with Coursework: Written Paper	Raw	72	56	50	44	38	31	0
4776/02	(NM) MEI Numerical Methods with Coursework: Coursework	Raw	18	14	12	10	8	7	0
4776/82	(NM) MEI Numerical Methods with Coursework: Carried Forward Coursework Mark	Raw	18	14	12	10	8	7	0
4776	(NM) MEI Numerical Methods with Coursework	UMS	100	80	70	60	50	40	0
4777/01	(NC) MEI Numerical Computation	Raw	72	55	47	39	32	25	0
		UMS	100	80	70	60	50	40	0
4798/01	(FPT) Further Pure Mathematics with Technology	Raw	72	57	49	41	33	26	0
		UMS	100	80	70	60	50	40	0

GCE Statistics (MEI)

			Max Mark	a	b	c	d	e	u
G241/01	(Z1) Statistics 1	Raw	72	55	48	41	35	29	0
		UMS	100	80	70	60	50	40	0
G242/01	(Z2) Statistics 2	Raw	72	55	48	41	34	27	0
		UMS	100	80	70	60	50	40	0
G243/01	(Z3) Statistics 3	Raw	72	56	48	41	34	27	0
		UMS	100	80	70	60	50	40	0