

OCR

Oxford Cambridge and RSA

Wednesday 24 May 2017 – Morning

AS GCE MATHEMATICS (MEI)

4766/01 Statistics 1

Solutions

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

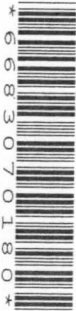
OCR supplied materials:

- Question Paper 4766/01 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:

- Scientific or graphical calculator

Duration: 1 hour 30 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number					
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INSTRUCTIONS TO CANDIDATES

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

- The Question Paper will be found inside 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.** If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 barcodes.
- 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.



Section A (36 marks)

1(i)

$$n = 50 \quad \sum x = 17100 \quad \sum x^2 = 6,115,108$$

$$\bar{x} = \frac{\sum x}{n} = \frac{17100}{50} = 342$$

$$s.d. = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}} = \sqrt{\frac{6115108 - 50 \times 342^2}{49}}$$

$$s.d. = 73.8 \quad \text{to 3 s.f.}$$

1(ii)

$$y = 0.108x + 7.2$$

$$\begin{aligned} \bar{y} &= 0.108\bar{x} + 7.2 = 0.108 \times 342 + 7.2 \\ &= \pounds 44.14 \quad \text{to nearest penny} \end{aligned}$$

$$s.d.y = 0.108 s.d.x = 0.108 \times 73.8 = 7.97$$

$$= \pounds 7.97$$

to nearest penny



$$2(i) \quad {}^{50}C_4 = 230,300$$

$$2(ii) \quad \frac{17}{50} \times \frac{16}{49} \times \frac{15}{48} \times \frac{14}{47} \quad \text{OR} \quad \frac{{}^{17}C_4}{{}^{50}C_4}$$

$$= 0.0103 \quad = 0.0103$$

2(iii)

$$P(\text{At least 2 used same method})$$

$$= 1 - P(\text{All used different methods})$$

$$= 1 - \left(\frac{17}{50} \times \frac{9}{49} \times \frac{13}{48} \times \frac{11}{47} \times 4! \right)$$

$$= 0.9050$$

Note, I am calculating prob that
 1st choice walks
 2nd choice cycles
 3rd choice By bus
 4th choice by car

Multiplying by $4!$ since the 4 different choices can occur in $4!$ different orders but give same physical outcome



3 (i) $(4, 3)$ $(3, 2)$ $(2, 1)$ $(1, 2)$ $(2, 3)$ $(3, 4)$ options

$$P(\text{first } 4, \text{ second } 3) = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$

$$\text{Same for other options so } 6 \times \frac{1}{16} = \frac{3}{8}$$

3 (ii)

$$E(x) = \frac{1}{4} \times 0 + \frac{3}{8} \times 1 + \frac{1}{4} \times 2 + \frac{1}{8} \times 3$$

$$= 0 + \frac{3}{8} + \frac{4}{8} + \frac{3}{8}$$

$$= \frac{10}{8} = 1.25$$

$$E(x^2) = \frac{1}{4} \times 0 + \frac{3}{8} \times 1^2 + \frac{1}{4} \times 2^2 + \frac{1}{8} \times 3^2$$

$$= 0 + \frac{3}{8} + 1 + \frac{9}{8}$$

$$= \frac{20}{8} = 2.5$$

$$\text{Var}(x) = E(x^2) - (E(x))^2$$

$$= 2.5 - 1.25^2$$

$$= 0.9375$$

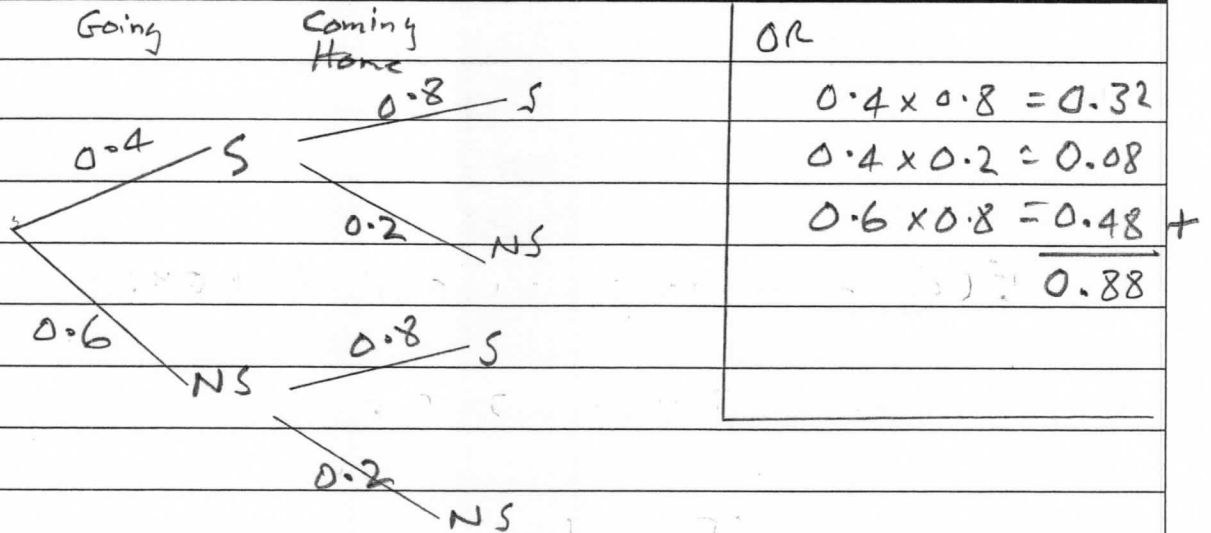
$$\text{or } \frac{15}{16}$$



$$4 (i) \quad P(\text{no seat on way to work}) = 1 - 0.4 = 0.6$$

$$P(\text{no seat going \& n; seat coming home}) = 0.6 \times 0.8 = 0.48$$

4 (ii)



$$P(\text{At least one seat}) = 1 - P(\text{No seats at all})$$

$$= 1 - 0.6 \times 0.2 = 0.88$$

4 (iii)

$$P(2 \text{ seats} \mid \text{At least 1 seat})$$

$$= \frac{P(2 \text{ seats} \cap \text{At least 1 seat})}{P(\text{At least 1 seat})}$$

$$= \frac{0.4 \times 0.8}{0.88} = \frac{0.32}{0.88} = \frac{4}{11}$$

$$\text{or } 0.3636$$



$$\begin{aligned}
 5(i) \quad P(\text{Wins 3 straight games}) &= 0.55^3 \\
 &= 0.166375 \\
 &= 0.1664 \quad \text{to 4 s.f.}
 \end{aligned}$$

5(ii)

Emily wins (3-0) (3-1) or (3-2)

$$P(\text{Emily wins 3-0}) = 0.45^3 = 0.091125$$

$$P(\text{Emily wins 3-1}) = 0.45^3 \times 0.55 \times 3 = 0.15035625$$

(represents SEEE, ESEE and EESE)

$$P(\text{Emily wins 3-2})$$

First 4 must be 2 for S and 2 for E so E wins 5th

$$0.45^2 \times 0.55^2 \times \frac{4!}{2!2!} \times 0.45 = 0.165391875$$

(represents SSEEE, SESEE, SEESE, ESSEE, ESESE, EESSE)

(The first 4 can be arranged $\frac{4!}{2!2!} = 6$ ways)

Summing for answer

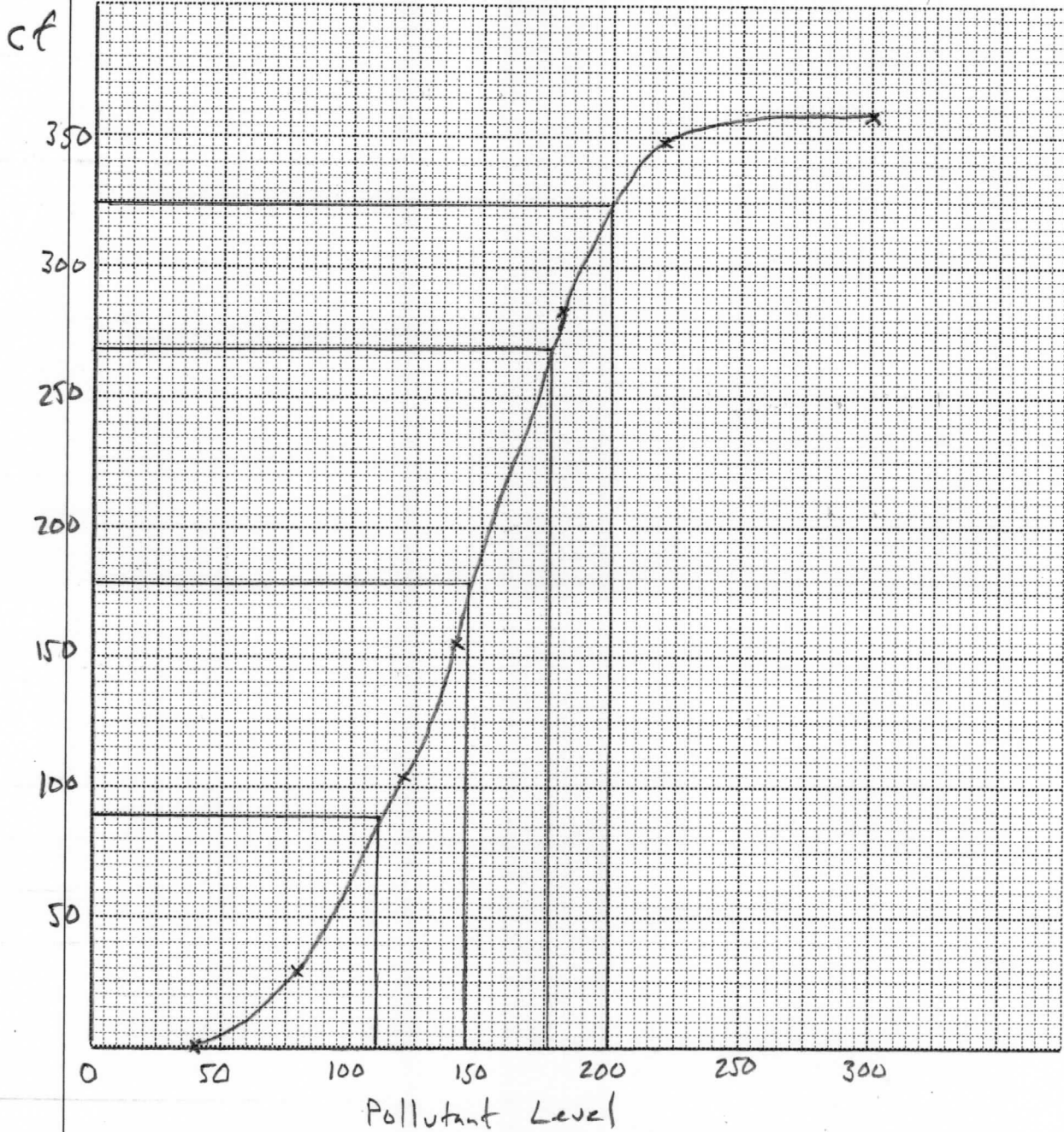
$$0.091125 + 0.15035625 + 0.165391875$$

$$= 0.406873125 = 0.4069 \quad \text{to 4 s.f.}$$



Section B (36 marks)

6(i) c.f. 29, 103, 155, 284, 348, 358



$$6 \text{ (ii)} \quad \frac{325}{358} = 90.8\%$$

$$6 \text{ (iii)} \quad \text{Median} \approx 145$$

$$UQ \ 176$$

$$IQR \approx 176 - 111$$

$$LQ \ 111$$

$$IQR \approx 65$$

6 (iv)

$$\text{Top end } UQ + 1.5 IQR = 176 + 1.5 \times 65 = 273.5$$

Possible outliers at top end since 10 between 220 - 300,
but not definite

Bottom end

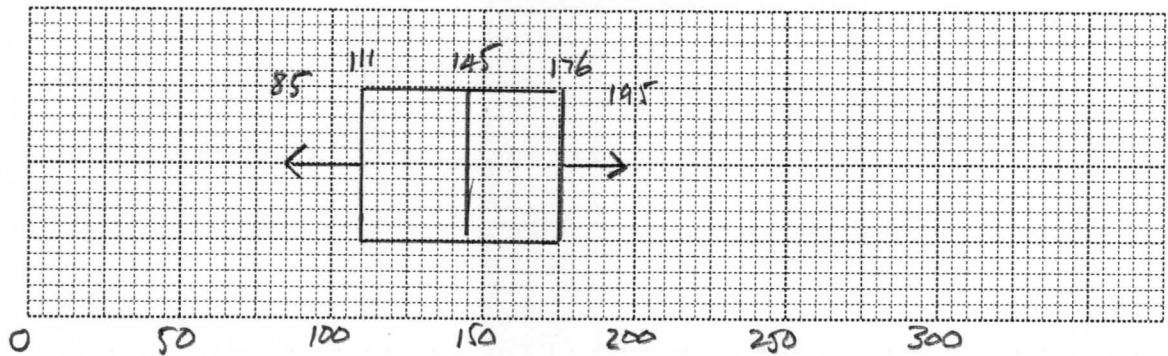
$$LQ - 1.5 IQR = 111 - 1.5 \times 65 = 13.5$$

No outliers at bottom since no data below 40
and $40 > 13.5$



6 (v)

Whiskers drawn to 10th and 90th percentiles



6 (vi)

Tower Hamlets shows distinct positive skew

Marylebone Road is relatively symmetrical



7(i)(A)

$$X \sim B(\overset{n, p}{12}, 0.75)$$

$$\begin{aligned} P(X=9) &= {}^{12}C_9 \times 0.75^9 \times 0.25^3 \\ &= 0.2581 \end{aligned}$$

7(i)(B)

$$\begin{aligned} P(X \geq 9) &= 1 - P(X \leq 8) \\ &= 1 - 0.3512 \\ &= 0.6488 \end{aligned}$$

7(ii)

$$H_0: p = 0.75$$

$$H_1: p > 0.75$$

where p is probability a randomly chosen dog with the allergy has symptoms relieved

H_1 chosen because testing to see if higher proportion of dogs have symptoms relieved



$$7(\text{iii})(A) \quad X \sim B(18, 0.75)$$

$$P(X \geq 16) = 1 - P(X \leq 15)$$

$$= 1 - 0.8647$$

$$= 0.1353 > 10\%$$

Accept H_0

There is not sufficient evidence to suggest new shampoo has increased proportion of dogs having symptoms relieved. So accept proportion remains at 75%.

$$7(\text{iii})(B) \quad X \sim B(50, 0.75)$$

$$P(X \geq 42) = 1 - P(X \leq 41)$$

$$= 1 - 0.9084$$

$$= 0.0916 < 10\%$$

Reject H_0 and accept H_1

There is sufficient evidence to suggest that the new shampoo relieves the symptoms of more than 75% of dogs with the allergy.

