

AS Level Further Mathematics B (MEI)

Y412 Statistics a

Sample Question Paper

Version 2

Date – Morning/Afternoon

Time allowed: 1 hour 15 minutes

You must have:

- Printed Answer Booklet
- Formulae Further Mathematics B (MEI)

You may use:

- a scientific or graphical calculator



INSTRUCTIONS

- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes provided on the Printed Answer Booklet with your name, centre number and candidate number.
- Answer **all** the questions.
- **Write your answer to each question in the space provided in the Printed Answer Booklet.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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

- The total number of marks for this paper is **60**.
- The marks for each question are shown in brackets [].
- 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 used. You should communicate your method with correct reasoning.
- The Printed Answer Booklet consists of **12** pages. The Question Paper consists of **8** pages.

Answer **all** the questions

- 1** The number of failures of a machine each week at a factory is modelled by a Poisson distribution with mean 0.45.

- (i) Write down the variance of the distribution. [1]
- (ii) Find the probability that there are exactly 2 failures in a week. [1]
- (iii) State a distribution which can be used to model the number of failures in a period of 4 weeks. [2]
- (iv) Find the probability that there are at least 2 failures in a period of 4 weeks. [2]

- 2** The discrete random variable Y is uniformly distributed over the values $\{12, 13, \dots, 20\}$.

- (i) Write down $P(Y < 15)$. [1]
- (ii) Two independent observations of Y are taken. Find the probability that one of these values is less than 15 and the other is greater than 15. [3]
- (iii) Find $P(Y > E(Y))$. [2]

- 3** In this question you must show detailed reasoning.

A student is investigating what people think about organic food. She wishes to see if there is any difference between the opinions of females and males. She takes a random sample of 100 people and asks each of them if they think that organic food is better for their health than non-organic food. She will use the data to conduct a hypothesis test. The table below shows the opinions of these 100 people.

		Sex	
		Female	Male
Opinion on organic food	Organic better	35	18
	Not better	22	25

- (i) Explain why the student should use a random sample. [2]
- (ii) Carry out a test at the 5% significance level to examine whether there is any association between a person's sex and their opinion on organic food. Show your calculations. [8]

- 4 The discrete random variable X has probability distribution defined by

$$P(X=r) = k(2r-1) \quad \text{for } r = 1, 2, 3, 4, 5, 6, \text{ where } k \text{ is a constant.}$$

- (i) Complete the table in the Printed Answer Booklet giving the probabilities in terms of k .

r	1	2	3	4	5	6
$P(X=r)$						

[1]

- (ii) Show that the value of k is $\frac{1}{36}$.

[2]

- (iii) Draw a graph to illustrate the distribution.

[2]

- (iv) In this question you must show detailed reasoning.

Find

- $E(X)$
- $\text{Var}(X)$.

[5]

A game consists of a player throwing two fair dice. The score is the maximum of the two values showing on the dice.

- (v) Show that the probability of a score of 3 is $\frac{5}{36}$.

[2]

- (vi) Show that the probability distribution for the score in the game is the same as the probability distribution of the random variable X .

[3]

- (vii) The game is played three times.

Find

- the mean of the total of the three scores.
- the variance of the total of the three scores.

[3]

- 5** In a recent report, it was stated that 40% of working people have a degree. For the whole of this question, you should assume that this is true.

A researcher wishes to interview a working person who has a degree. He asks working people at random whether they have a degree and counts the number of people he has to ask until he finds one with a degree.

(i) Find the probability that he has to ask 5 people. [2]

(ii) Find the mean number of people the researcher has to ask. [1]

Subsequently, the researcher decides to take a random sample from the population of working people.

(iii) A random sample of 5 working people is chosen. What is the probability that at least one of them has a degree? [2]

(iv) How large a random sample of working people would the researcher need to take to ensure that the probability that at least one person has a degree is 0.99 or more? [3]

- 6** A motorist decides to check the fuel consumption, y miles per gallon, of her car at particular speeds, x mph, on flat roads. She carries out the check on a suitable stretch of motorway. Fig.6 shows her results.

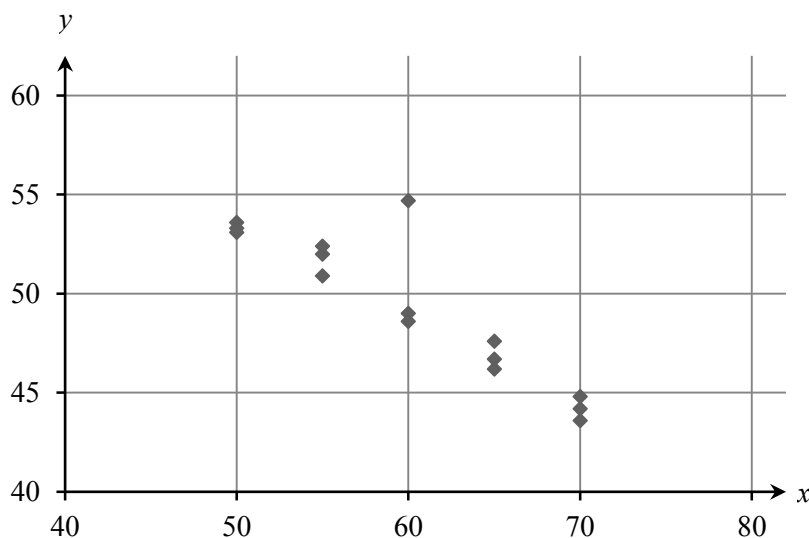


Fig.6

(i) Explain why it would not be appropriate to carry out a hypothesis test for correlation based on the product moment correlation coefficient. [2]

(ii) (A) One of the results is an outlier. Circle the outlier on the copy of Fig. 6 in the Printed Answer Booklet. [1]

(B) Suggest one possible reason for the outlier in part (ii) (A) not being used in any analysis. [1]

The motorist decides to remove this item of data from any analysis. The table below shows part of a spreadsheet that was used to analyse the 14 remaining data items (with the outlier removed). Some rows of the spreadsheet have been deliberately omitted.

Data item	x	y	x^2	y^2	xy
1	50	53.6	2500	2872.96	2680
2	50	53.3	2500	2840.89	2665
13	70	44.8	4900	2007.04	3136
14	70	44.2	4900	1953.64	3094
Sum	840	686	51150	33779.7	40812

(iii) Calculate the equation of the regression line of y on x . [4]

(iv) Use the equation of the regression line to predict the fuel consumption of the car at

(A) 58 mph,

(B) 30 mph. [2]

(v) Comment on the reliability of your predictions in part (iv). [2]

END OF QUESTION PAPER

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