Probability 3.2

GCSE P P P A Level P P P

A biased coin and an unbiased coin are tossed together. By carrying out a large number of trials it is found that the probability of obtaining two heads is 0.30. Find the probabilities of obtaining the following, giving your answers to $2\ \mathrm{sf}$.

Part A A head with the biased coin

Find the probability of obtaining a head with the biased coin.

Part B One head and one tail

The two coins are tossed together. Find the probability of obtaining one head and one tail

Part C Two heads and two tails in two tosses.

The coins are tossed together and the result noted. They are then tossed together again and the result again noted. Find the probability of obtaining two heads and two tails overall.

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Probability 3.3

A Level

A system consists of three magnets side by side; they can be orientated with their north poles pointing upwards (U) or downwards (D). The first one on the left is always U. If one magnet points upwards (U) then the probability that the one next to it points upwards (i.e. the arrangement UU) is 1/4 and the probability that it points downwards (i.e. UD) is 3/4; similarly if one magnet points downwards (D) then the probability that the one next to it points downwards (i.e. DD) is 1/4 and the probability that it points upwards (DU) is 3/4. Thus the probability of the arrangement being UUD is $1/4 \times 3/4$. Construct a tree diagram to illustrate the probabilities of getting the various different arrangements. Hence find the following probabilities.

Part A 3 magnets pointing upwards

Find the probability that all three magnets are pointing upwards. Give your answer in exact form.

Part B 2 magnets pointing upwards

Find the probability that only two magnets are pointing upwards. Give your answer in its simplest exact form.

Part C 1 magnet pointing upwards

Find the probability that only one magnet is pointing upwards. Give your answer in exact form.

Part D No magnets pointing upwards

What is the probability that no magnets are pointing upwards?

Probability 3.1

GCSE C C C A Level P P P

A bag contains four red and five yellow sweets. When a sweet is removed it is not replaced. Find the following probabilities, giving your answers in their simplest exact form.

Part A The first sweet is red

If one sweet is taken out of the bag find the probability that it is red.

Part B The second sweet is yellow

If two sweets are removed from the bag, find the probability that the second one taken out is yellow.

Part C Two red sweets and two yellow sweets are obtained

If four sweets are removed from the bag, find the probability that two of the sweets are red and two are yellow in any order.

Part D Two red sweets are obtained if two already removed

If four sweets are removed from the bag and the first two are red, find the probability that the next two sweets will also be red.

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Probability 3.4

A Level

In a university entrance test there are 18 questions, each of them multiple choice with 5 choices. A group of 100 students taking the test have not studied any of the material being tested so answer each question at random. Find the following.

Part A The probability of getting exactly 4 questions right

Find the probability that a particular student will get exactly 4 questions right. Give your answer to $3\ \mathrm{sf}$.

Part B The probability of getting more than 9 questions right

Find the probability that a particular student will get more than 9 questions right. Give your answer to $2\ \mathrm{sf}$.

Part C The probability of getting no questions right

Find the probability that a particular student will get no questions right. Give your answer to $3\ \mathrm{sf}$.

Part D The number of students scoring above a given level

To pass the test a student must get more than one-third of the questions right. In the group of 100 students how many on average will pass the test? Give your answer to the nearest integer.

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Data analysis 3.4

A Level

280 students carried out an experiment in a practical class to find the acceleration due to gravity g using a rigid pendulum.

(a) The cumulative frequency graph shown in **Figure 1** shows the values of g they each obtained. Deduce the median and the interquartile range.

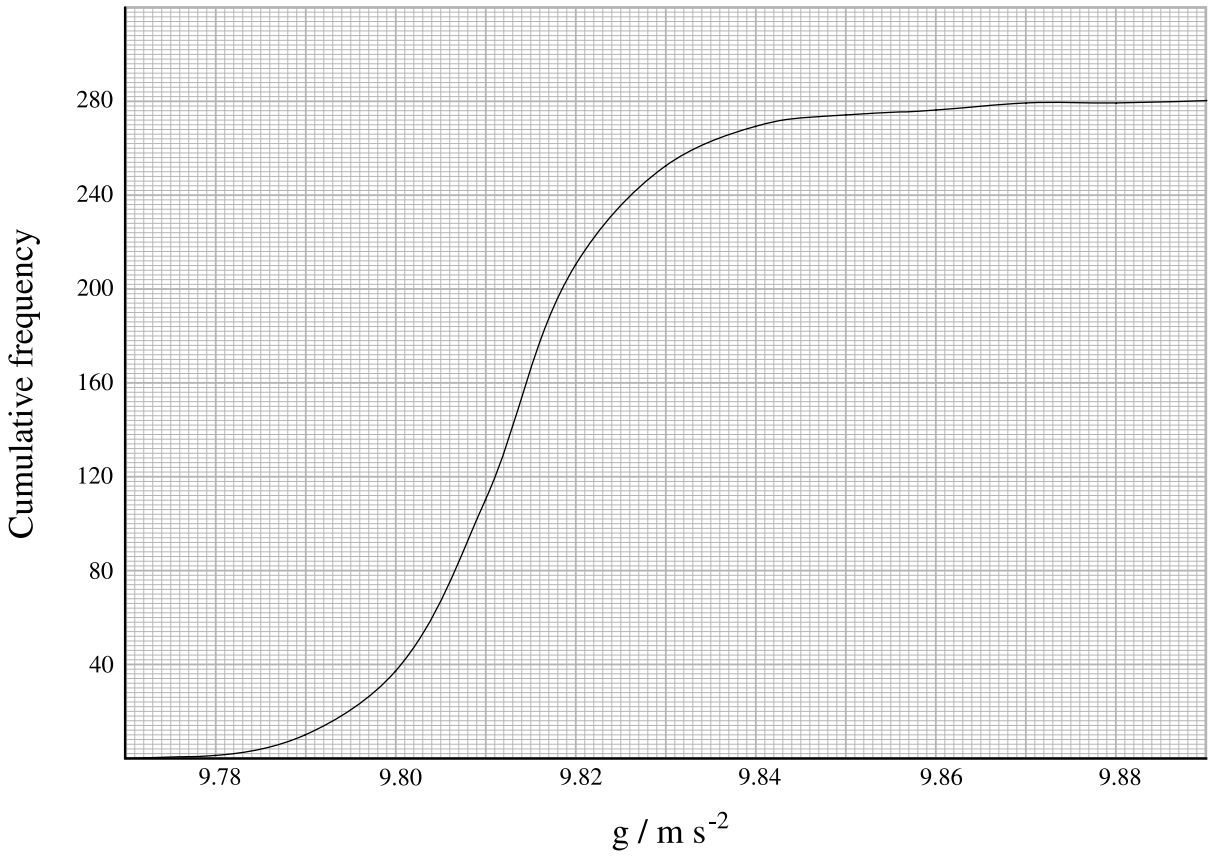

Figure 1: A cumulative frequency graph showing the values of g on the horizontal axis and the cumulative frequency on the vertical axis.

(b) The same data is presented in a frequency table below where g is in $\mathrm{m\,s^{-2}}$. From the table estimate the mean and the standard deviation of the distribution.

g / m s^{-2}	Frequency	g / m s^{-2}	Frequency
>9.75-9.76	0	>9.82-9.83	42
>9.76-9.77	0	>9.83-9.84	17
>9.77-9.78	1	>9.84-9.85	5

>9.78-9.79	9	>9.85-9.86	2
>9.79-9.80	27	>9.86-9.87	3
>9.80-9.81	73	>9.87-9.88	0
>9.81-9.82	100	>9.88-9.89	1

Part A Cumulative frequency graph

From the cumulative frequency graph shown in **Figure 1** find (i) the median and (ii) the interquartile range of the distribution of values

(i) Deduce the median of the distribution (give your answer to 4 sf).

(ii) Deduce the interquartile range (give your answer to 2 sf).

Part B Frequency table

From the frequency table estimate (i) the mean and (ii) the standard deviation of the distribution.

(i) Estimate the mean of the distribution (give your answer to 4 sf).

(ii) Estimate the standard deviation of the distribution (give your answer to 2 sf).

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Data analysis 3.2

A Level

Ten measurements were made of the frequency with which a mass oscillates on a spring. The mean was $0.585\,\mathrm{Hz}$ and the standard deviation σ was $0.024\,\mathrm{Hz}$. One of the measurements could be regarded as an outlier in the sense that it is almost exactly 2σ greater than the mean (see Representing data - Outliers). It is omitted from the dataset and the mean and standard deviation are recalculated; find (a) the new value of the mean and (b) the new value of the standard deviation.

Part A (a) The new value of the mean

Find the new value of the mean (give your answer to 3 sf).

Part B (b) The new value of the standard deviation

Find the new value of the standard deviation (give your answer to 2 sf).

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Data analysis 3.3

A Level

Consider the following set of data:

$21.61, 21.59, 21.65, 21.40, 21.55, 21.59$

Find the mean and standard deviation. You have been given a criterion by which to determine whether or not one of the values is an outlier, namely, the value is more than 2σ from the mean (see Representing data - Outliers). Are there any values for which this applies? Recalculate the mean and standard deviation omitting this value.

Part A The mean

Find the mean for the full dataset (give your answer to 3 decimal places).

Part B The standard deviation

Find the standard deviation for the full dataset (give your answer to 3 sf).

Part C The mean omitting the outlier

Find the mean of the dataset omitting the outlier (give your answer to 3 decimal places).

Part D The standard deviation omitting the outlier

Find the standard deviation omitting the outlier (give your answer to 3 sf).

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Data analysis 3.1

A Level

Nine measurements were made of the time taken by a pendulum to perform six swings. The mean of the values was $10.240\,\text{s}$ with a standard deviation of $0.073\,\text{s}$. A tenth measurement was included changing the mean to $10.253\,\text{s}$. Find (a) the value of the tenth measurement and (b) the new value of the standard deviation.

Part A (a) The value of the tenth measurement

Find the value of the tenth measurement; give your answer to 3 decimal places.

Part B (b) The new value of the standard deviation

Find the value of the new standard deviation; give your answer to 2 sf.

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