# Topic Y4 Statistics AS (Post-TT A) [53]

1.

The masses, $x$ kg, of 50 bags of flour were measured and the results were summarised as follows.

$$n = 50 \qquad \Sigma(x - 1.5) = 1.4 \qquad \Sigma(x - 1.5)^2 = 0.05$$

Calculate the mean and standard deviation of the masses of these bags of flour. **[6]**

(Total 6 marks)

2.

The head teacher of a school asks for volunteers from among the pupils to take part in a survey on political interests.

**(i)** Explain why a sample consisting of all the volunteers is unlikely to give a true picture of the political interests of all pupils in the school. [2]

**(ii)** Describe a better method of obtaining the sample. [3]

(Total 5 marks)

3.

The diameters of 100 pebbles were measured. The measurements rounded to the nearest millimetre, $x$, are summarised in the table.

| $x$ | $10 \leqslant x \leqslant 19$ | $20 \leqslant x \leqslant 24$ | $25 \leqslant x \leqslant 29$ | $30 \leqslant x \leqslant 49$ |
|---|---|---|---|---|
| Number of stones | 25 | 22 | 29 | 24 |

These data are to be presented on a statistical diagram.

**(i)** For a histogram, find the frequency density of the $10 \leqslant x \leqslant 19$ class. **[2]**

**(ii)** For a cumulative frequency graph, state the coordinates of the first two points that should be plotted. **[2]**

**(iii)** Why is it not possible to draw an exact box-and-whisker plot to illustrate the data? **[1]**

(Total 5 marks)

4.

It is known that, on average, one match box in 10 contains fewer than 42 matches. Eight boxes are selected, and the number of boxes that contain fewer than 42 matches is denoted by $Y$.

**(i)** State two conditions needed to model $Y$ by a binomial distribution. [2]

Assume now that a binomial model is valid.

**(ii)** Find

**(a)** $P(Y = 0)$, [2]

**(b)** $P(Y \geqslant 2)$. [2]

**(iii)** On Wednesday 8 boxes are selected, and on Thursday another 8 boxes are selected. Find the probability that on one of these days the number of boxes containing fewer than 42 matches is 0, and that on the other day the number is 2 or more. [3]

(Total 9 marks)

5.

The stem-and-leaf diagram shows the masses, in grams, of 23 plums, measured correct to the nearest gram.

| | |
|---|---|
| 5 | 5 6 7 8 8 9 |
| 6 | 1 2 3 5 6 8 9 |
| 7 | 0 0 2 4 5 6 7 8 |
| 8 | 0 |
| 9 | 7 |

Key : 6 | 2 means 62

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

**(ii)** State one advantage of using the interquartile range rather than the standard deviation as a measure of the variation in these masses. **[1]**

**(iii)** State one advantage and one disadvantage of using a stem-and-leaf diagram rather than a box-and-whisker plot to represent data. **[2]**

**(iv)** James wished to calculate the mean and standard deviation of the given data. He first subtracted 5 from each of the digits to the left of the line in the stem-and-leaf diagram, giving the following.

| | |
|---|---|
| 0 | 5 6 7 8 8 9 |
| 1 | 1 2 3 5 6 8 9 |
| 2 | 0 0 2 4 5 6 7 8 |
| 3 | 0 |
| 4 | 7 |

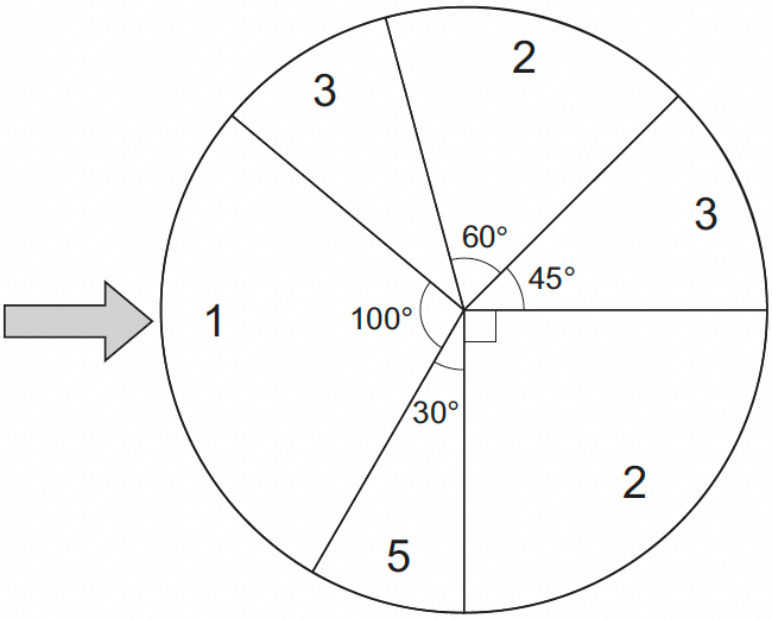
Key : 1 | 2 means 12

The mean and standard deviation of the data in this diagram are 18.1 and 9.7 respectively, correct to 1 decimal place. Write down the mean and standard deviation of the data in the original diagram. **[2]**

(Total 8 marks)

6.

A game consists of spinning a circular wheel divided into numbered sectors as shown below.




On each spin the score, $X$, is the value shown in the sector that the arrow points to when the spinner stops.

The probability of the arrow pointing at a sector is proportional to the angle subtended at the centre by that sector.

**(a)** Show that $P(X = 1) = \frac{5}{18}$

**[1 mark]**

**(b)** Complete the probability distribution for $X$ in the table below.

| $x$ | 1 | | | |
|---|---|---|---|---|
| $P(X = x)$ | $\frac{5}{18}$ | | | |

**[2 marks]**

(Total 3 marks)

7.

**(i)** A biased coin is thrown twice. The probability that it shows heads both times is 0.04. Find the probability that it shows tails both times. [3]

**(ii)** Another coin is biased so that the probability that it shows heads on any throw is $p$. The probability that the coin shows heads exactly once in two throws is 0.42. Find the two possible values of $p$. [5]

(Total 8 marks)

8.

**5.** (a) The discrete random variable $X \sim B(40, 0.27)$

Find $P(X \geqslant 16)$

**(2)**

Past records suggest that 30% of customers who buy baked beans from a large supermarket buy them in single tins. A new manager suspects that there has been a change in the proportion of customers who buy baked beans in single tins. A random sample of 20 customers who had bought baked beans was taken.

(b) Write down the hypotheses that should be used to test the manager's suspicion.

**(1)**

(c) Using a 10% level of significance, find the critical region for a two-tailed test to answer the manager's suspicion. You should state the probability of rejection in each tail, which should be less than 0.05

**(3)**

(d) Find the actual significance level of a test based on your critical region from part (c).

**(1)**

One afternoon the manager observes that 12 of the 20 customers who bought baked beans, bought their beans in single tins.

(e) Comment on the manager's suspicion in the light of this observation.

**(1)**

Later it was discovered that the local scout group visited the supermarket that afternoon to buy food for their camping trip.

(f) Comment on the validity of the model used to obtain the answer to part (e), giving a reason for your answer.

**(1)**

(Total 9 marks)