Topic: Descriptive Statistics
IB Math AI SL

Answer all questions. Show all working where appropriate. Total: 87 marks.

1. **[Paper 1 Style, Short Answer, Easy, 4 marks]**
The number of goals scored by a football team in their last seven matches are:

$$4,\ 6,\ 6,\ 8,\ 11,\ 12,\ 16$$

(a) Find the median number of goals scored.

(b) Write down the mode.

(c) Calculate the exact mean number of goals scored.

2. **[Paper 1 Style, Short Answer, Easy, 6 marks]**
The daily wait times, in minutes, for a bus are recorded over 8 days:

$$5,\ 12,\ 14,\ 15,\ 18,\ 21,\ 24,\ 45$$

(a) Find the lower quartile (Q_1) and the upper quartile (Q_3) of the wait times.

(b) Calculate the interquartile range (IQR).

(c) Determine if the wait time of 45 minutes is considered an outlier. Show all your working.

3. **[Paper 1 Style, Short Answer, Easy, 5 marks]**
The annual salaries, in thousands of dollars, for six employees at a small startup are:

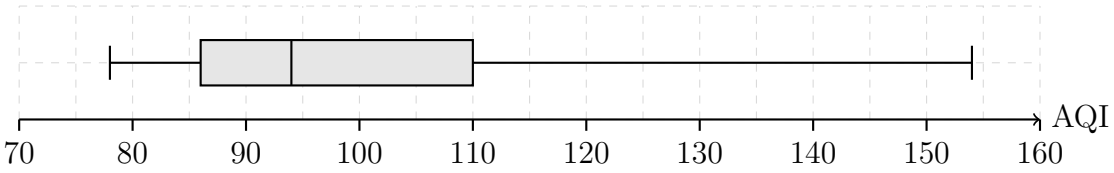
$$20,\ 22,\ 25,\ 28,\ 30,\ 120$$

(a) Calculate the mean salary.

(b) Find the median salary.

(c) State which average (mean or median) is the best measure of central tendency for this data set, and give a reason for your choice.

4. **[Paper 1 Style, Short Answer, Medium, 5 marks]**
The box-and-whisker diagram below shows the Air Quality Index (AQI) measured across 20 cities in Japan.



(a) Write down the median AQI.

(b) Write down the interquartile range for this data.

(c) Estimate the number of cities in Japan that have an AQI between 78 and 94.

5. **[Paper 1 Style, Short Answer, Medium, 5 marks]**
A survey asked 30 families how many pets they own. The results are shown in the frequency table below.

Number of pets (x)	**Frequency (f)**
1	3
2	8
3	12
4	5
5	2

(a) Write down the mode.

(b) Find the median number of pets.

(c) Calculate the mean number of pets per family.

6. **[Paper 1 Style, Short Answer, Medium, 5 marks]**
The time taken, t in minutes, for 50 students to complete a puzzle is recorded in the grouped frequency table below.

Time (t minutes)	**Number of students**
$0 \leq t < 10$	4
$10 \leq t < 20$	14
$20 \leq t < 30$	18
$30 \leq t < 40$	10
$40 \leq t < 50$	4

(a) Write down the modal class.

(b) Calculate an estimate for the mean time taken to complete the puzzle.

(c) Explain why your answer to part (b) is only an estimate.

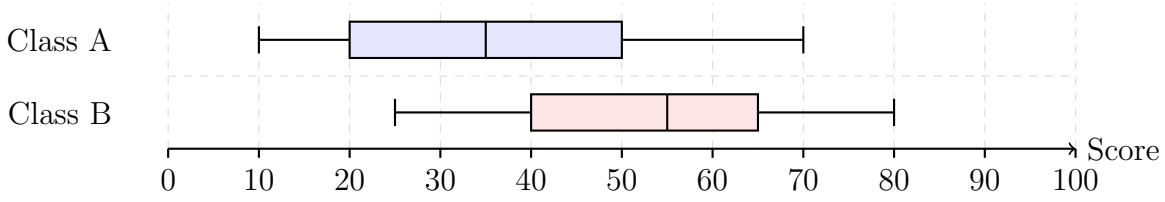
7. **[Paper 2 Style, Longer Question, Medium, 6 marks]**
The mean of five distinct positive integers is 8.5.

(a) Find the sum of these five integers.

(b) A sixth integer, x, is added to the data set. The new mean of all six integers is exactly 9. Find the value of x.

(c) Two different classes took a mathematics test. Class A has 20 students and achieved a mean score of 65 marks. Class B has 30 students and achieved a mean score of 80 marks. Calculate the combined mean score for all 50 students.

8. **[Paper 2 Style, Longer Question, Medium, 6 marks]**
The box-and-whisker diagrams below show the scores out of 100 for two different classes, Class A and Class B, on a biology exam.



(a) Write down the median score for Class A.

(b) Find the interquartile range for Class B.

(c) Compare the two classes by making one valid statement about their central tendency and one valid statement about their spread.

9. **[Paper 1 Style, Short Answer, Hard, 6 marks]**
The five numbers in a dataset, arranged in ascending order, are:

$$x, \quad x+2, \quad 2x-3, \quad 2x+1, \quad 3x-4$$

The median of this dataset is 11.

(a) Find the value of x.

(b) Hence, list the five numbers in the dataset.

(c) Calculate the mean of the dataset.

10. **[Paper 2 Style, Longer Question, Hard, 6 marks]**
The distances travelled by 60 commuters to work are summarised in the frequency table below.

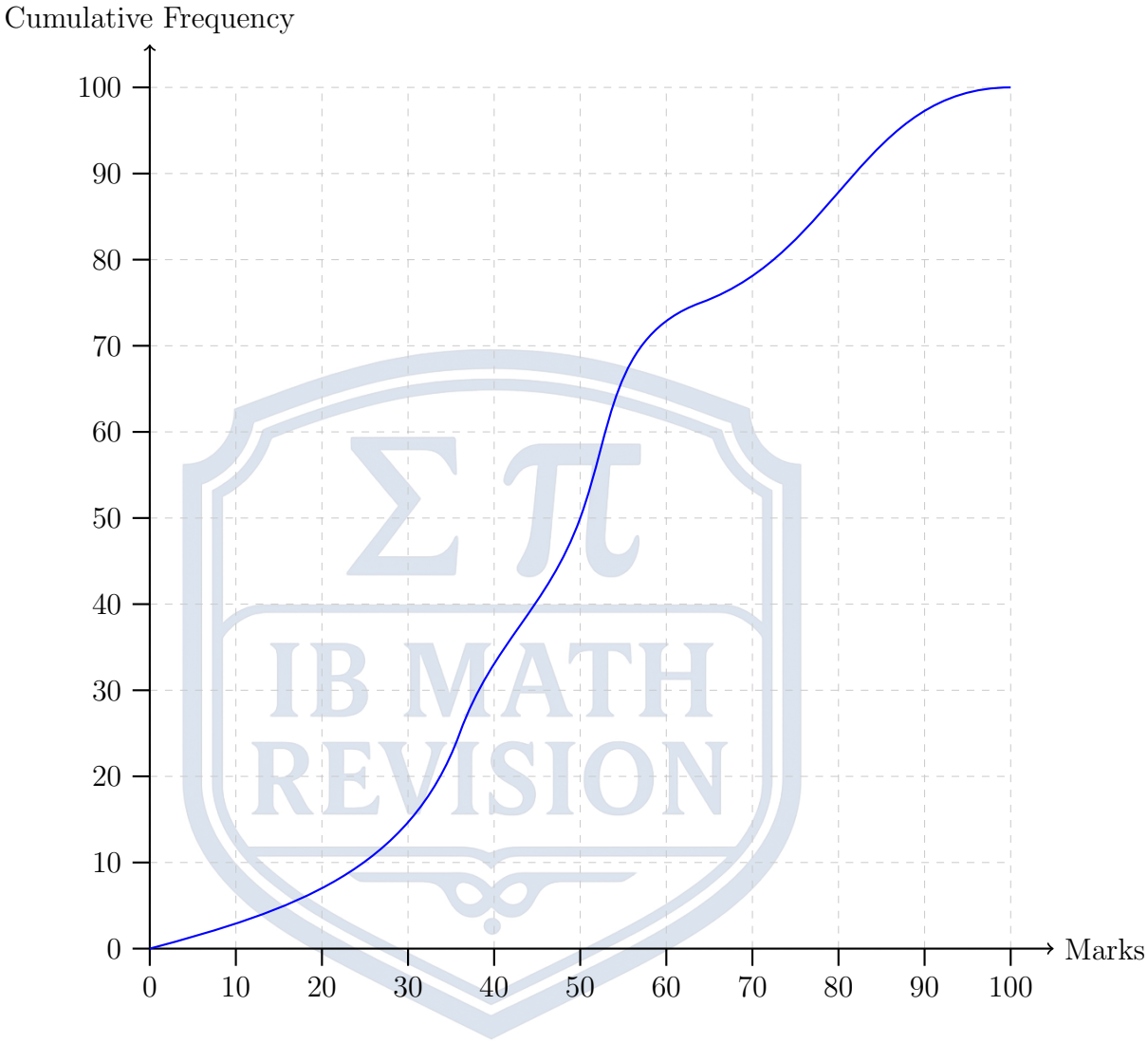
Distance (d km)	**Frequency**	**Cumulative Frequency**
$0 \leq d < 10$	4	
$10 \leq d < 20$	11	
$20 \leq d < 30$	25	
$30 \leq d < 40$	16	
$40 \leq d < 50$	4	

(a) Copy and complete the cumulative frequency column in the table.

(b) State the class interval that contains the median distance.

(c) Find an estimate for the mean distance travelled by the commuters.

11. **[Paper 2 Style, Longer Question, Hard, 7 marks]**
The cumulative frequency graph below shows the marks obtained by 100 students in a mathematics examination.



(a) Use the graph to estimate the median mark.

(b) Use the graph to estimate the interquartile range.

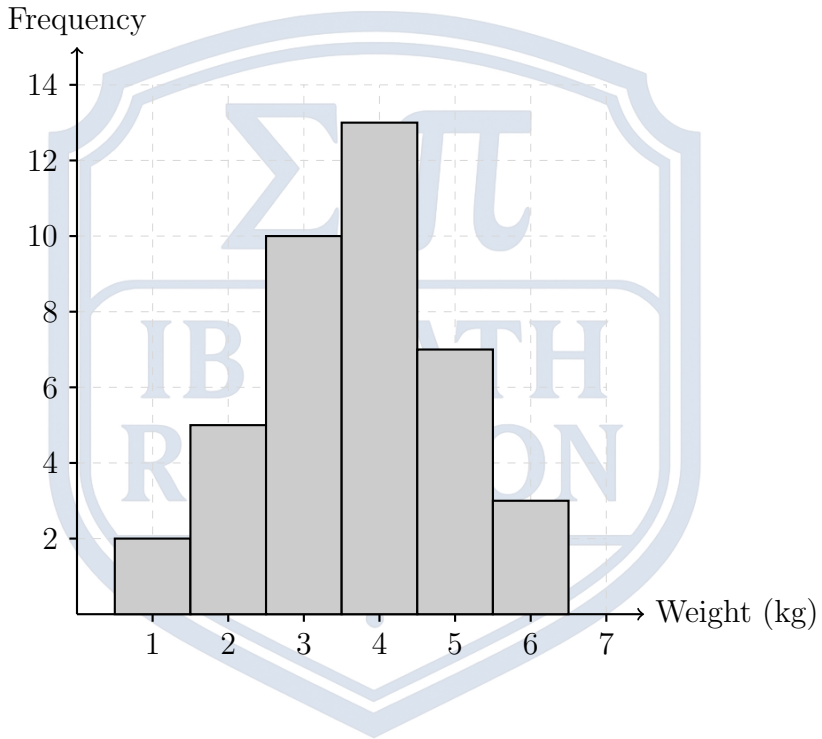
(c) The pass mark for the examination was set at 45 marks. Estimate the percentage of students who passed the examination.

12. **[Paper 2 Style, Longer Question, Hard, 5 marks]**
Refer to the cumulative frequency graph in Question 11. Students who score in the top 15% of the examination are awarded a "Distinction" grade.

(a) Determine the cumulative frequency that corresponds to the minimum mark required for a Distinction.

(b) Use the graph to estimate the minimum mark required to be awarded a Distinction.

13. **[Paper 2 Style, Longer Question, Very Hard, 6 marks]**
The histogram below shows the weights of 40 Honeydew Melons, each measured correct to the nearest kg.



(a) Write down the modal class of the melon weights.

(b) Calculate an estimate for the mean weight of the melons.

(c) The lower quartile is approximately 2.8 kg. Explain how you could estimate the median weight from the histogram.

14. **[Paper 1 Style, Short Answer, Very Hard, 6 marks]**
A dataset has a mean of 15 and a standard deviation of 3. A new dataset is formed by taking every value in the original dataset, multiplying it by 2, and then adding 4.

   (a) Find the mean of the new dataset.

   (b) Find the standard deviation of the new dataset.

   (c) Find the variance of the new dataset.

   (d) A single new data value, which is exactly equal to the original mean (15), is added to the original dataset. State whether the standard deviation of the dataset will increase, decrease, or remain the same. Give a reason for your answer.

15. **[Paper 2 Style, Longer Question, Very Hard, 5 marks]**
Consider the following dataset, written in ascending order:

$$1,\ 4,\ 7,\ 10,\ 15,\ 19,\ y$$

Given that the dataset contains exactly 7 integers and y is the maximum value.

   (a) Write down the median of the dataset.

   (b) Find the lower quartile (Q_1) and the upper quartile (Q_3).

   (c) Find the maximum possible integer value of y such that y is not considered an outlier.