HIGHER

6.12 Box Plots: 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

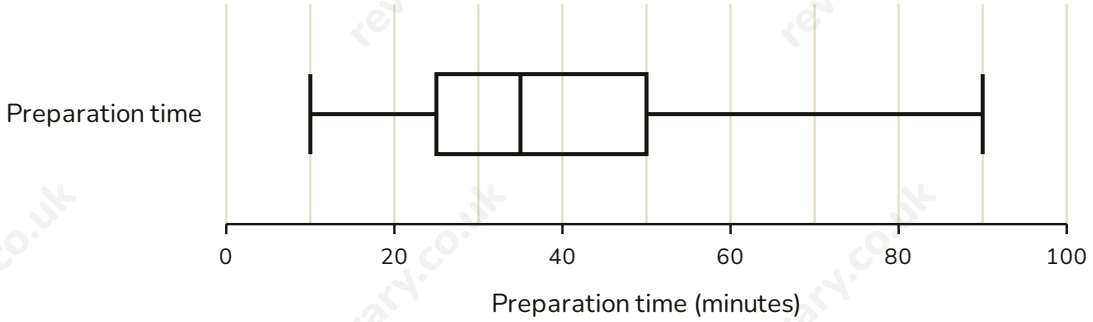
Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A recipe website recorded the preparation time, in minutes, taken by 200 users to make the same lasagne recipe. The five-number summary is:

Minimum = 10, Lower quartile = 25, Median = 35, Upper quartile = 50, Maximum = 90



(a) Write down the interquartile range of the preparation times. **(1)**

.....

(b) Write down the range of the preparation times. **(1)**

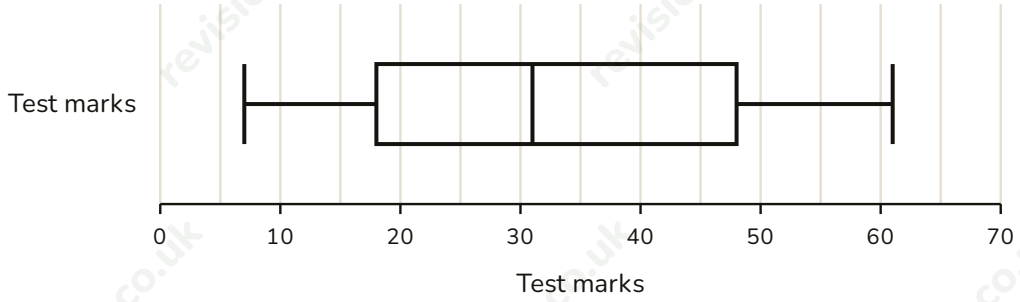
.....

(c) One user takes 65 minutes to prepare the lasagne. State, with a reason, whether this user is in the slowest 25% of users. **(1)**

(Total for Question 1 is 3 marks)

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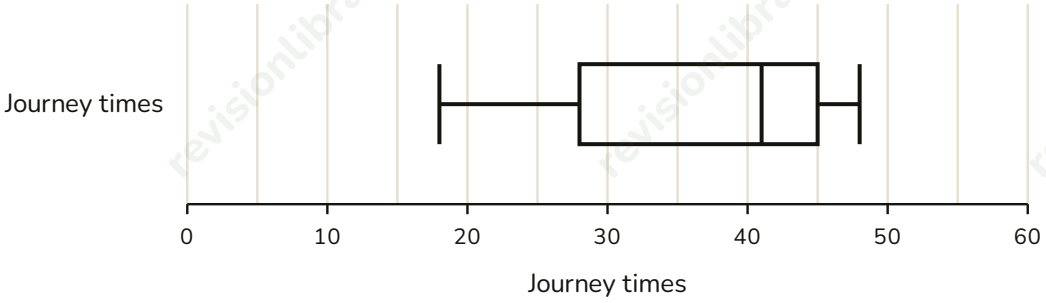
2 A box plot for test marks (marks) is drawn with minimum 7, lower quartile 18, median 31, upper quartile 48 and maximum 61. Work out the range and the interquartile range.



(Total for Question 2 is 3 marks)

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3 A box plot for journey times (minutes) is drawn with minimum 18, lower quartile 28, median 41, upper quartile 45 and maximum 48. Work out the range and the interquartile range.



(Total for Question 3 is 3 marks)

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4 Here are 11 values of heights (cm): 38, 23, 77, 47, 31, 13, 7, 39, 25, 30, 62. Work out the values needed to draw a box plot: the minimum, lower quartile, median, upper quartile and maximum.

(Total for Question 4 is 4 marks)

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5 Two box plots show the weekly savings (pounds) for Boys and Girls. For Boys: median 36, interquartile range 22. For Girls: median 53, interquartile range 16. Compare the distributions.

(Total for Question 5 is 4 marks)

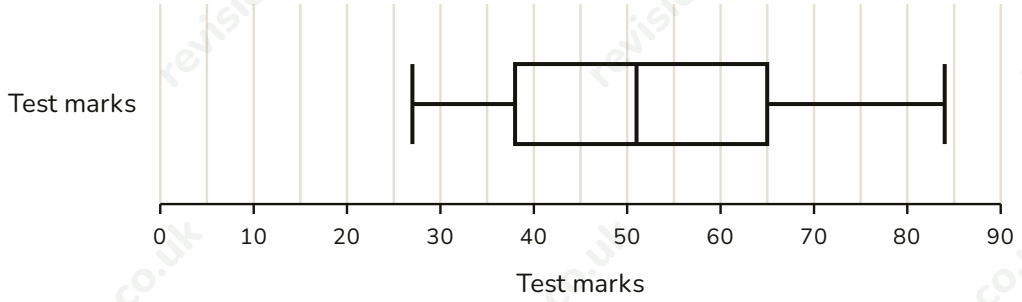
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6 A box plot for the heights (cm) of 100 items has lower quartile 37, median 45 and upper quartile 49. Estimate how many items have a value less than 37.

(Total for Question 6 is 2 marks)

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7 A box plot for test marks (marks) is drawn with minimum 27, lower quartile 38, median 51, upper quartile 65 and maximum 84. Work out the range and the interquartile range.



(Total for Question 7 is 3 marks)

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8 Here are 15 values of test marks (marks): 75, 71, 52, 8, 48, 23, 80, 44, 52, 38, 13, 71, 9, 38, 43. Work out the values needed to draw a box plot: the minimum, lower quartile, median, upper quartile and maximum.

(Total for Question 8 is 4 marks)

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9 A box plot for the daily rainfall (mm) of 100 items has lower quartile 11, median 21 and upper quartile 37. Estimate how many items have a value more than 37.

(Total for Question 9 is 2 marks)

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10 Two box plots show the journey times (minutes) for A and B. For A: median 32, interquartile range 28. For B: median 35, interquartile range 24. Compare the distributions.

(Total for Question 10 is 4 marks)

11 Here are 7 values of heights (cm): 61, 66, 40, 77, 73, 75, 26. Work out the values needed to draw a box plot: the minimum, lower quartile, median, upper quartile and maximum.

(Total for Question 11 is 4 marks)

12 Two box plots show the weekly savings (pounds) for Class 9X and Class 9Y. For Class 9X: median 62, interquartile range 25. For Class 9Y: median 70, interquartile range 28. Compare the distributions.

(Total for Question 12 is 4 marks)

13 Here are 15 values of weekly savings (pounds): 70, 38, 26, 7, 78, 20, 21, 29, 49, 20, 24, 67, 21, 66, 66. Work out the values needed to draw a box plot: the minimum, lower quartile, median, upper quartile and maximum.

(Total for Question 13 is 4 marks)

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14 Two box plots show the weekly savings (pounds) for A and B. For A: median 32, interquartile range 24. For B: median 42, interquartile range 13. Compare the distributions.

(Total for Question 14 is 4 marks)

15 A box plot for the test marks (marks) of 60 items has lower quartile 14, median 16 and upper quartile 19. Estimate how many items have a value less than 16.

(Total for Question 15 is 2 marks)

16 Here are 15 values of heights (cm): 9, 65, 7, 46, 59, 30, 39, 57, 32, 30, 64, 6, 68, 9, 17. Work out the values needed to draw a box plot: the minimum, lower quartile, median, upper quartile and maximum.

(Total for Question 16 is 4 marks)

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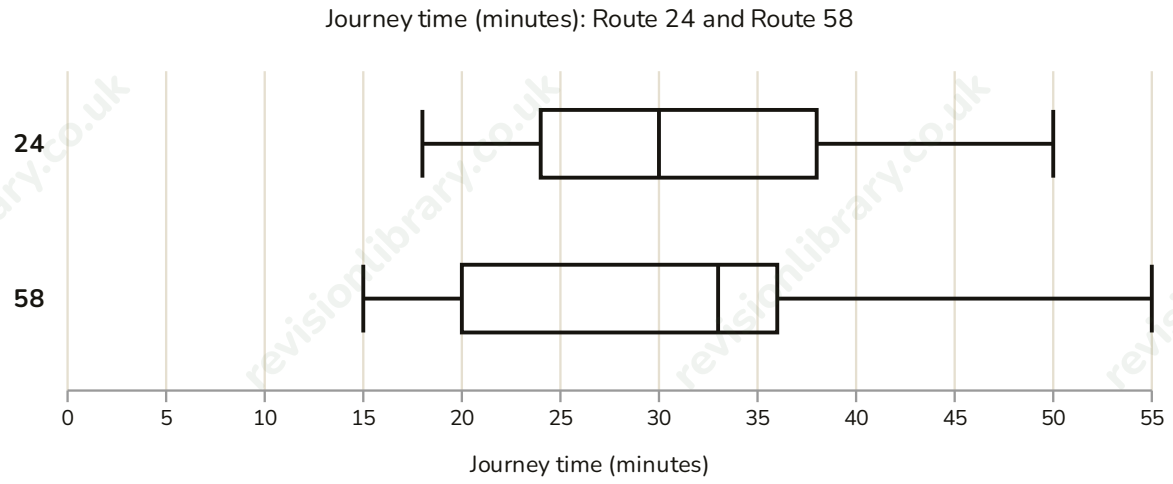
17 Two box plots show the heights (cm) for Class 9X and Class 9Y. For Class 9X: median 54, interquartile range 6. For Class 9Y: median 40, interquartile range 25. Compare the distributions.

(Total for Question 17 is 4 marks)

---

18 Two rival bus routes, the 24 and the 58, were compared by recording the journey time, in minutes, for 40 journeys on each route one weekday morning. The box plots show the results.

Route 24: minimum = 18, lower quartile = 24, median = 30, upper quartile = 38, maximum = 50
Route 58: minimum = 15, lower quartile = 20, median = 33, upper quartile = 36, maximum = 55



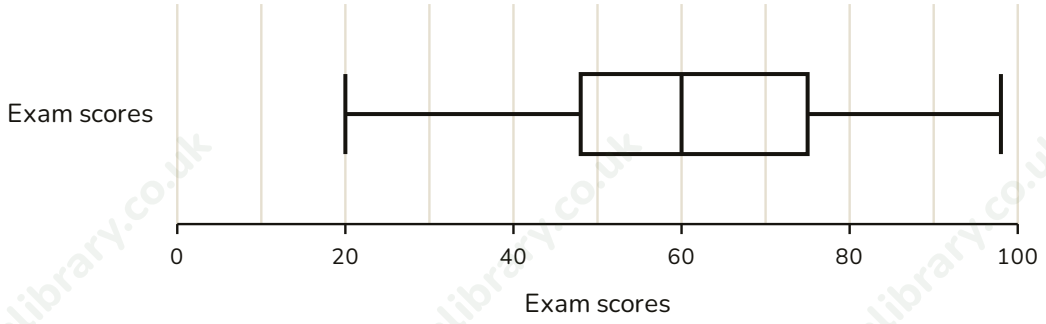
(a) Write down the median journey time for each route. **(2)**

(b) By comparing the interquartile ranges, compare the consistency of journey times on the two routes. **(2)**

(Total for Question 18 is 4 marks)

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19 A school entered 84 pupils for a mock exam. The exam scores are summarised by: minimum = 20, lower quartile = 48, median = 60, upper quartile = 75, maximum = 98. Pupils who score above the upper quartile are awarded a distinction certificate. Pupils who score below the lower quartile are given extra revision support.



(a) Work out how many pupils receive a distinction certificate. **(1)**

.....

(b) Work out how many pupils are NOT given extra revision support. **(2)**

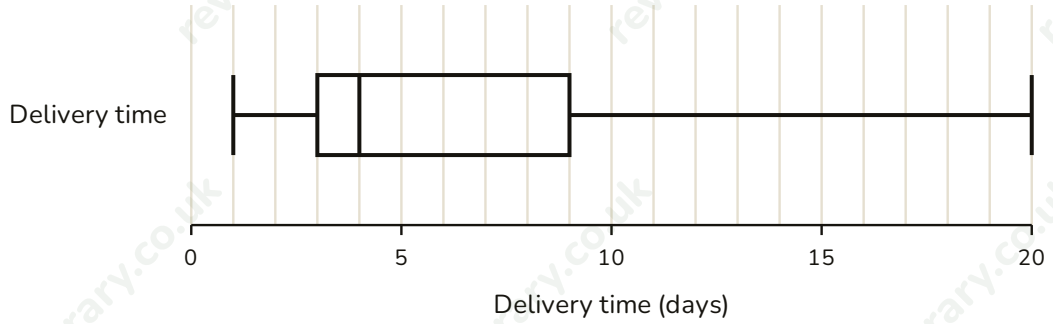
.....

(Total for Question 19 is 3 marks)

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20 The delivery times, in days, for 500 online orders have the five-number summary:

Minimum = 1, Lower quartile = 3, Median = 4, Upper quartile = 9, Maximum = 20



(a) Work out the distance from the lower quartile to the median, and the distance from the median to the upper quartile. **(1)**

(b) Using your answer to part (a), state whether the distribution of delivery times is more likely to be positively skewed (a small number of unusually long delivery times stretching the distribution) or negatively skewed, giving a reason. **(2)**

(c) Suggest one possible reason, in context, for this pattern in delivery times. **(1)**

(Total for Question 20 is 4 marks)

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21 Two box plots, one for Data Set P and one for Data Set Q, have exactly the same five-number summary (minimum, lower quartile, median, upper quartile and maximum). Does this mean the two data sets must contain exactly the same data? Explain your answer.

(Total for Question 21 is 2 marks)

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22 Kwame, a private tutor, recorded the length, in minutes, of 15 one-to-one tutoring sessions, listed in order:

25, 28, 30, 30, 32, 35, 36, 38, 40, 42, 44, 45, 48, 50, 65

(a) Find the median length of a session. **(1)**

(b) Find the lower quartile and the upper quartile of the session lengths. **(2)**

(c) Kwame uses the rule that a session length is an outlier if it is more than 1.5 x IQR above the upper quartile. Determine, showing your working, whether the 65-minute session is an outlier. **(2)**

(Total for Question 22 is 5 marks)

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23 A company tests the battery life, in hours, of two models of wireless earbuds, using a sample of 200 units of each model.

Model A: minimum = 8, lower quartile = 14, median = 18, upper quartile = 24, maximum = 30

Model B has the same median and the same range as Model A. Model B's interquartile range is exactly 3 hours smaller than Model A's, and Model B's lower quartile is 2 hours higher than Model A's lower quartile.

(a) Work out the interquartile range of Model A. **(1)**

.....

(b) Work out the interquartile range of Model B. **(1)**

.....

(c) Work out the lower quartile and the upper quartile of Model B. **(2)**

.....

(d) A marketing claim states: 'Model B's battery life is more consistent, and at least as long-lasting, as Model A's.' Using your answers, and the fact that both models share the same median and range, evaluate this claim. **(1)**

.....

(Total for Question 23 is 5 marks)

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Mark scheme · 6.12 Box Plots: 2-hour Pack

Question 1

(a) 25 minutes cao **B1**

(a) Answer: 25 minutes

(b) 80 minutes cao **B1**

(b) Answer: 80 minutes

(c) oe: yes, since 65 > 50 (the upper quartile), so this time is in the top 25% (slowest quarter) of preparation times **B1**

(c) Answer: Yes - since 65 minutes is greater than the upper quartile of 50 minutes, this user is in the slowest 25%.

Question 2

61 - 7 or 48 - 18 **M1**

range = 54 **A1**

IQR = 30 **A1**

Answer: range = 54, IQR = 30

Question 3

48 - 18 or 45 - 28 **M1**

range = 30 **A1**

IQR = 17 **A1**

Answer: range = 30, IQR = 17

Question 4

puts the values in order **M1**

min = 7 and max = 77 **A1**

median = 31 **A1**

LQ = 23 and UQ = 47 **A1**

Answer: min = 7, LQ = 23, median = 31, UQ = 47, max = 77

Question 5

compares medians: Girls higher by 17 **B1**

comment in context on typical value **B1**

compares IQRs: Girls smaller by 6 **B1**

comment in context on consistency **B1**

Answer: Girls: higher median (53 compared with 36); Girls: smaller IQR (16 compared with 22), so more consistent

Question 6

uses the correct fraction of the data, e.g. 1/4 or 1/2 or 25% or 50% **M1**

25 cao **A1**

Answer: 25

Question 7

84 - 27 or 65 - 38 **M1**

range = 57 **A1**

IQR = 27 **A1**

Answer: range = 57, IQR = 27

Question 8

puts the values in order **M1**

min = 8 and max = 80 **A1**

median = 44 **A1**

LQ = 23 and UQ = 71 **A1**

Answer: min = 8, LQ = 23, median = 44, UQ = 71, max = 80

Question 9

uses the correct fraction of the data, e.g. 1/4 or 1/2 or 25% or 50% **M1**

25 cao **A1**

Answer: 25

Question 10

compares medians: B higher by 3 **B1**

comment in context on typical value **B1**

compares IQRs: B smaller by 4 **B1**

comment in context on consistency **B1**

Answer: B: higher median (35 compared with 32); B: smaller IQR (24 compared with 28), so more consistent

Question 11

puts the values in order **M1**

min = 26 and max = 77 **A1**

median = 66 **A1**

LQ = 40 and UQ = 75 **A1**

Answer: min = 26, LQ = 40, median = 66, UQ = 75, max = 77

Question 12

compares medians: Class 9Y higher by 8 **B1**

comment in context on typical value **B1**

compares IQRs: Class 9X smaller by 3 **B1**

comment in context on consistency **B1**

Answer: Class 9Y: higher median (70 compared with 62); Class 9X: smaller IQR (25 compared with 28), so more consistent

Question 13

puts the values in order **M1**

min = 7 and max = 78 **A1**

median = 29 **A1**

LQ = 21 and UQ = 66 **A1**

Answer: min = 7, LQ = 21, median = 29, UQ = 66, max = 78

Question 14

compares medians: B higher by 10 **B1**

comment in context on typical value **B1**

compares IQRs: B smaller by 11 **B1**

comment in context on consistency **B1**

Answer: B: higher median (42 compared with 32); B: smaller IQR (13 compared with 24), so more consistent

Question 15

uses the correct fraction of the data, e.g. 1/4 or 1/2 or 25% or 50% **M1**

30 cao **A1**

Answer: 30

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Question 16

puts the values in order **M1**

min = 6 and max = 68 **A1**

median = 32 **A1**

LQ = 9 and UQ = 59 **A1**

Answer: min = 6, LQ = 9, median = 32, UQ = 59, max = 68

Question 17

compares medians: Class 9X higher by 14 **B1**

comment in context on typical value **B1**

compares IQRs: Class 9X smaller by 19 **B1**

comment in context on consistency **B1**

Answer: Class 9X: higher median (54 compared with 40); Class 9X: smaller IQR (6 compared with 25), so more consistent

Question 18

(a) Route 24 median = 30 minutes cao **B1**

(a) Route 58 median = 33 minutes cao **B1**

(a) Answer: Route 24: 30 minutes; Route 58: 33 minutes

(b) IQR(24) = 38 - 24 = 14 minutes and IQR(58) = 36 - 20 = 16 minutes, both correct **B1**

(b) oe in context: Route 58's IQR is slightly larger, so its middle 50% of journey times were slightly more spread out/less consistent than Route 24's, even though Route 58 has the higher median **B1**

(b) Answer: IQR(24) = 14 minutes, IQR(58) = 16 minutes. Route 58's journey times were slightly less consistent (more spread out in the middle 50%) than Route 24's, despite Route 58 having the higher median journey time.

Question 19

(a) Cannot be determined exactly: pupils tied at 75 do not score above the upper quartile. **B1**

(a) Answer: Cannot be determined exactly from the summary.

(b) Identifying that pupils scoring exactly 48 are not given support, so ties at the lower quartile affect the count. **M1**

(b) Cannot be determined exactly from the summary. **A1**

(b) Answer: Cannot be determined exactly from the summary.

Question 20

(a) both correct: lower quartile to median = 1 day; median to upper quartile = 5 days **B1**

(a) Answer: Lower quartile to median = 1 day; median to upper quartile = 5 days

(b) comparing the two distances: 5 days (median to UQ) is much greater than 1 day (LQ to median) **B1**

(b) ft: positively skewed, since the upper half of the middle 50% of delivery times is far more spread out than the lower half oe **B1**

(b) Answer: Positively skewed

(c) oe: a small number of orders were delayed for reasons such as stock shortages, customs checks, or being lost in transit, which stretches out the slower end of the delivery times **B1**

(c) Answer: A small number of orders may have been delayed by problems such as stock shortages, customs delays, or parcels being lost in transit.

Question 21

correct conclusion: No, the data sets do not have to be identical **B1**

valid justification, e.g. a box plot only summarises five key values; the individual data values between the minimum and lower quartile, between the quartiles, and between the upper quartile and maximum could differ between the two sets while still producing the same five-number summary oe **B1**

Answer: No; a box plot only shows five summary values, so two different data sets can share the same five-number summary without containing identical data.

Question 22

(a) 38 minutes cao **B1**

(a) Answer: 38 minutes

(b) lower quartile = 30 minutes cao **B1**

(b) upper quartile = 45 minutes cao **B1**

(b) Answer: Lower quartile = 30 minutes; upper quartile = 45 minutes

(c) IQR = 45 - 30 = 15, and 1.5 x 15 = 22.5, used to find the upper boundary 45 + 22.5 = 67.5 **M1**

(c) ft: not an outlier (cao), since 65 < 67.5 **A1**

(c) Answer: Not an outlier - the upper boundary is 67.5 minutes, and 65 < 67.5

Question 23

(a) 10 hours cao **B1**

(a) Answer: 10 hours

(b) ft: 7 hours cao **B1**

(b) Answer: 7 hours

(c) ft: LQ(B) = 14 + 2 = 16 hours **M1**

(c) ft: UQ(B) = 16 + 7 = 23 hours **A1**

(c) Answer: Lower quartile = 16 hours; upper quartile = 23 hours

(d) Partly supported: Model B has a smaller IQR (7 hours versus 10 hours), so its middle 50% is more consistent; equal medians (18 hours) show equal median life, but equal ranges (22 hours) do not establish that B is at least as long-lasting overall. **B1**

(d) Answer: Partly supported. Model B's smaller IQR (7 hours versus 10 hours) shows greater consistency in the middle 50%. Both have median life 18 hours, but the summaries do not establish that Model B is at least as long-lasting overall.

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