

PROBABILITIES & STATISTICS 1

9709 P5
2020 — 2025

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1 - (9709/52_Summer_2020_Q1)



For n values of the variable x , it is given that

$$\Sigma(x - 50) = 144 \quad \text{and} \quad \Sigma x = 944.$$

Find the value of n .

[3]

2 - (9709/52_Summer_2020_Q3)



Two machines, A and B , produce metal rods of a certain type. The lengths, in metres, of 19 rods produced by machine A and 19 rods produced by machine B are shown in the following back-to-back stem-and-leaf diagram.

A		B
	21	1 2 4
7 6 3 0	22	2 4 5 5 6
8 7 4 3 1 1	23	0 2 6 8 9 9
5 5 5 3 2	24	3 3 4 6
4 3 1 0	25	6

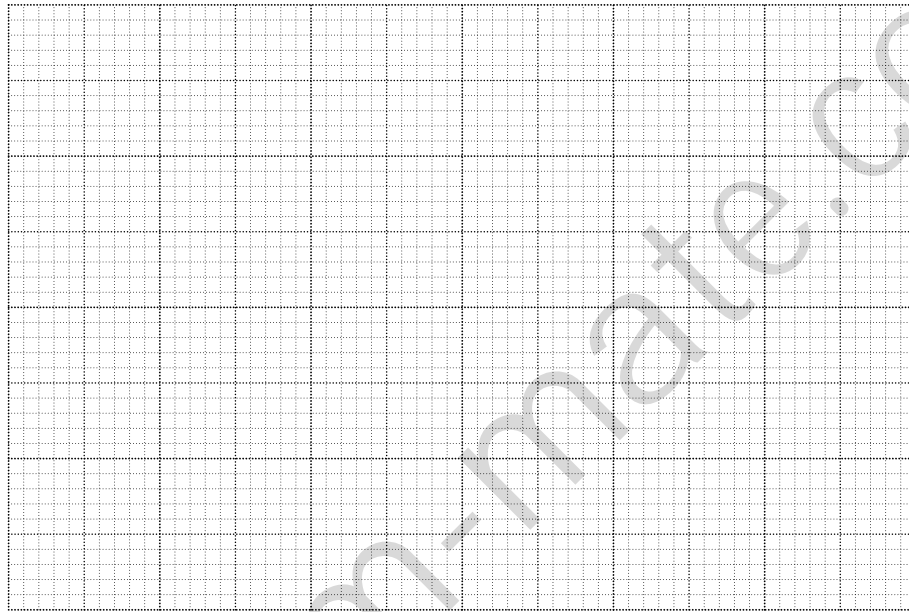
Key: 7 | 22 | 4 means 0.227 m for machine A and 0.224 m for machine B .

(a) Find the median and the interquartile range for machine A .

[3]

It is given that for machine B the median is 0.232 m, the lower quartile is 0.224 m and the upper quartile is 0.243 m.

- (b) Draw box-and-whisker plots for A and B . [3]



- (c) Hence make two comparisons between the lengths of the rods produced by machine A and those produced by machine B . [2]

3 - (9709/53_Summer_2020_Q6)



The annual salaries, in thousands of dollars, for 11 employees at each of two companies *A* and *B* are shown below.

Company <i>A</i>	30	32	35	41	41	42	47	49	52	53	64
Company <i>B</i>	26	47	30	52	41	38	35	42	49	31	42

(a) Represent the data by drawing a back-to-back stem-and-leaf diagram with company *A* on the left-hand side of the diagram. [4]

(b) Find the median and the interquartile range of the salaries of the employees in company *A*. [3]

A new employee joins company *B*. The mean salary of the 12 employees is now \$38 500.

(c) Find the salary of the new employee. [3]

4 - (9709/51_Winter_2020_Q6)

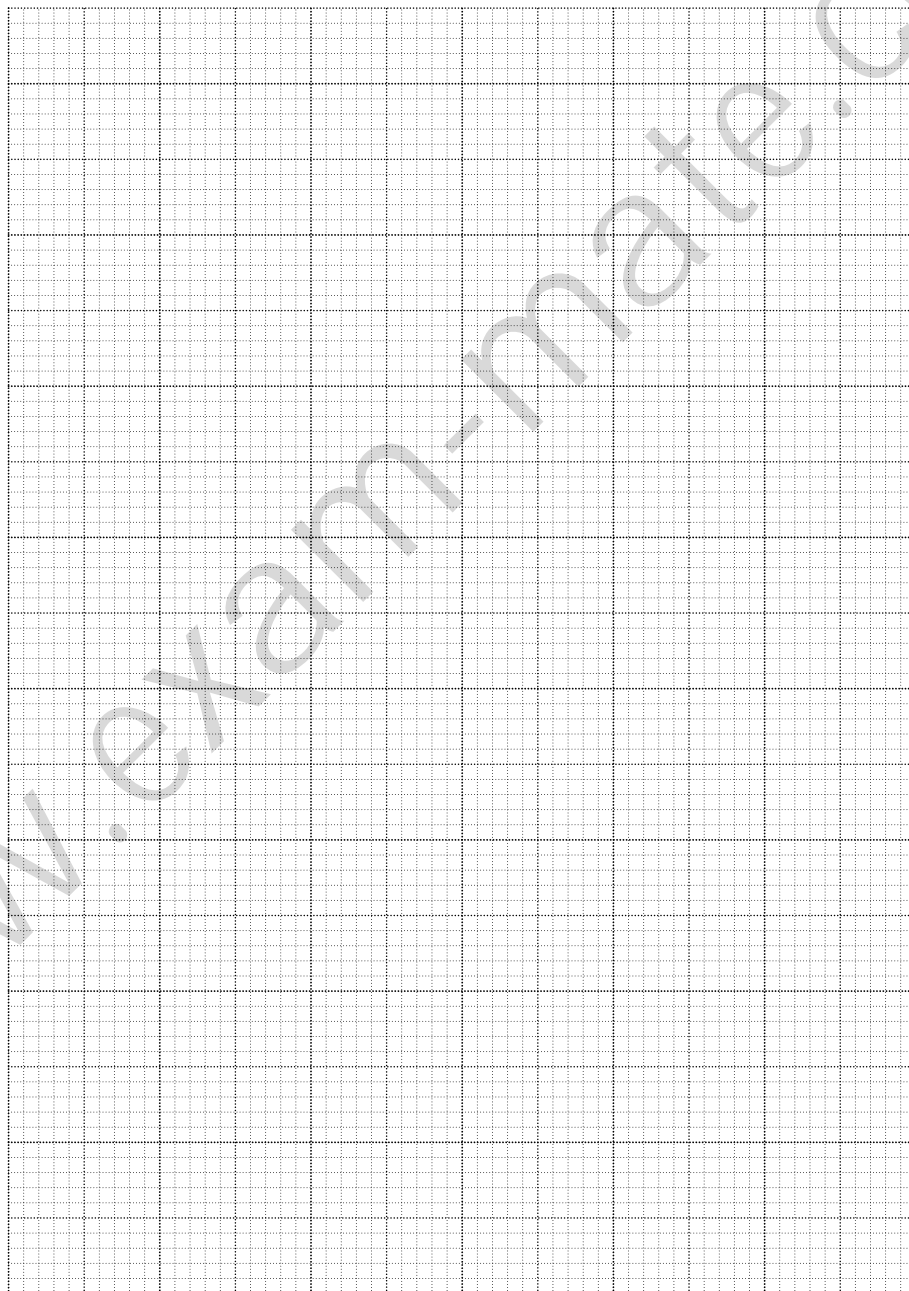


The times, t minutes, taken by 150 students to complete a particular challenge are summarised in the following cumulative frequency table.

Time taken (t minutes)	$t \leq 20$	$t \leq 30$	$t \leq 40$	$t \leq 60$	$t \leq 100$
Cumulative frequency	12	48	106	134	150

(a) Draw a cumulative frequency graph to illustrate the data.

[2]



- (b) 24% of the students take k minutes or longer to complete the challenge. Use your graph to estimate the value of k . [2]
- (c) Calculate estimates of the mean and the standard deviation of the time taken to complete the challenge. [6]

5 - (9709/52_Winter_2020_Q5)



The following table gives the weekly snowfall, in centimetres, for 11 weeks in 2018 at two ski resorts, Dados and Linva.

Dados	6	8	12	15	10	36	42	28	10	22	16
Linva	2	11	15	16	0	32	36	40	10	12	9

- (a) Represent the information in a back-to-back stem-and-leaf diagram. [4]
- (b) Find the median and the interquartile range for the weekly snowfall in Dados. [3]
- (c) The median, lower quartile and upper quartile of the weekly snowfall for Linva are 12, 9 and 32 cm respectively. Use this information and your answers to part (b) to compare the central tendency and the spread of the weekly snowfall in Dados and Linva. [2]

1 - (9709/52_Summer_2020_Q1)



$\sum x - 50n = 144$	B1
$50n + 144 = 944$	M1
$n = 16$	A1
	3

2 - (9709/52_Summer_2020_Q3)



(a)	Median = 0.238					B1																		
	UQ = 0.245, LQ = 0.231, So IQR = 0.245 – 0.231					M1																		
	0.014					A1																		
						3																		
(b)	<table border="1"> <thead> <tr> <th></th> <th></th> <th>LQ</th> <th>M</th> <th>UQ</th> <th></th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.220</td> <td>0.231 FT</td> <td>0.238 FT</td> <td>0.245 FT</td> <td>0.254</td> </tr> <tr> <td>B</td> <td>0.211</td> <td>0.224</td> <td>0.232</td> <td>0.243</td> <td>0.256</td> </tr> </tbody> </table>							LQ	M	UQ		A	0.220	0.231 FT	0.238 FT	0.245 FT	0.254	B	0.211	0.224	0.232	0.243	0.256	
			LQ	M	UQ																			
	A	0.220	0.231 FT	0.238 FT	0.245 FT	0.254																		
	B	0.211	0.224	0.232	0.243	0.256																		
	Medians and quartiles correctly plotted for <i>A</i> or <i>B</i>					B1																		
	End points correct for <i>A</i> or <i>B</i>					B1																		
Completely correct, including scale					B1																			
					3																			
(c)	Lengths of rods produced by machine <i>A</i> are longer. (B1 for comparison of central tendency)					B1																		
	Lengths of rods produced by machine <i>A</i> are less spread out (B1 for comparison of spread)					B1																		
						2																		

3 - (9709/53_Summer_2020_Q6)



(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="width: 100px;">A</th> <th style="width: 10px;"></th> <th style="width: 10px;"></th> <th style="width: 100px;">B</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">2</td> <td style="text-align: center;">6</td> <td></td> </tr> <tr> <td style="text-align: center;">5 2 0</td> <td style="text-align: center;">3</td> <td style="text-align: center;">0 1 5 8</td> <td></td> </tr> <tr> <td style="text-align: center;">9 7 2 1 1</td> <td style="text-align: center;">4</td> <td style="text-align: center;">1 2 2 7 9</td> <td></td> </tr> <tr> <td style="text-align: center;">3 2</td> <td style="text-align: center;">5</td> <td style="text-align: center;">2</td> <td></td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">6</td> <td></td> <td></td> </tr> </tbody> </table>	A			B		2	6		5 2 0	3	0 1 5 8		9 7 2 1 1	4	1 2 2 7 9		3 2	5	2		4	6			
	A			B																						
		2	6																							
	5 2 0	3	0 1 5 8																							
	9 7 2 1 1	4	1 2 2 7 9																							
	3 2	5	2																							
4	6																									
KEY 1 4 2 means \$41 000 for A and \$42 000 for B																										
Correct stem	B1																									
Correct A on LHS	B1																									
Correct B on same diagram	B1																									
Correct key for <i>their</i> diagram, both companies identified and correct units	B1																									
	4																									
(b)	Median = [\\$]42 000	B1																								
	LQ = [\\$]35 000 UQ = [\\$]52 000	B1																								
	IQR = [\\$]17 000 (FT if $49000 \leq UQ \leq 53000 - 32000 \leq LQ \leq 41000$)	B1 FT																								
		3																								

(c)	Sum of given 11 numbers is 433 000	M1
	Sum of 12 numbers, including new = $38\,500 \times 12 = 462\,000$	M1
	Difference = new salary = [\\$]29 000	A1
		3

4 - (9709/51_Winter_2020_Q6)



(a)		<p>M1 At least 4 points plotted at upper end points, with both scales linear with at least 3 values indicated</p>
	Correct cumulative frequency curve	<p>A1 All plotted correctly with curve drawn joined to (0, 0), axes labelled cumulative frequency, time, minutes</p>
		<p>2</p>
(b)	$150 \times 0.76 = 114$	<p>M1 114 SOI, may be on graph</p>
	$k = 45$ (mins)	<p>A1 FT Clear indication that <i>their</i> graph has been used, tolerance ± 1mm</p>
		<p>2</p>

(c)	Frequencies: 12 36 58 28 16	B1	Correct frequencies seen
	Mean = $\frac{10 \times 12 + 25 \times 36 + 35 \times 58 + 50 \times 28 + 80 \times 16}{150}$	B1	At least 4 correct midpoints seen and used
	$\frac{120 + 900 + 2030 + 1400 + 1280}{150}$	M1	Correct formula with <i>their</i> midpoints (not upper boundary, lower boundary, class width or frequency density).
	38.2, $38\frac{1}{5}$	A1	
	Variance = $\frac{12 \times 10^2 + 36 \times 25^2 + 58 \times 35^2 + 28 \times 50^2 + 16 \times 80^2}{150} - \text{mean}^2$ = $\frac{1200 + 22500 + 71050 + 70000 + 102400}{150} - \text{mean}^2$	M1	Substitute <i>their</i> midpoints and frequencies (condone use of cumulative frequency) in correct variance formula, must have ' <i>- their mean</i> ² '
	(Standard deviation = $\sqrt{321.76}$) = 17.9	A1	
	6		

5 - (9709/52_Winter_2020_Q5)



(a)	<i>Dados</i>		<i>Linva</i>	B1	Correct stem can be upside down, ignore extra values
	8 6	0	0 2 9	B1	Correct Dados labelled, leaves in order and lined up vertically (less than midway to next column), no commas etc, no extra terms
	6 5 2 0 0	1	0 1 2 5 6	B1	Correct Linva on opposite side of stem labelled, leaves in order and lined up vertically (less than midway to next column), no commas etc, no extra terms
	8 2	2		B1	Correct single key for their diagram, need both resorts identified and 'cm' stated at least once here or in leaf headings or title.
	6 3	2	6	B1	SC If 2 separate diagrams drawn, SCB1 if both keys meet these criteria B0B1B0SCB1 max.
	2 4	0			4
	KEY 6 3 2 means 36 cm (snow) in Dados and 32 cm (snow) in Linva				
(b)	Median or Q2 = 15 (cm)			B1	Correct
	UQ or Q3 = 28 cm, LQ or Q1 = 10 cm IQR = 28 – 10			M1	$22 \leq \text{UQ} \leq 36 - 8 \leq \text{LQ} \leq 10$
	18 (cm)			A1	WWW
				3	
(c)	On average the snowfall in Davos is higher			B1 FT	FT from <i>their 5(b)</i> values for Dados. Statement comparing central tendency in context
	The amount of snowfall in Linva varies more than in Davos			B1 FT	Statement comparing spread in context Note: simply stating and comparing the values is not sufficient.
				2	