

The following data were gathered for an analysis on Manganese in some engineering system. Read the data and answer the questions based on the data.

74 79 77 81
 68 79 81 76
 81 80 80 78
 88 83 79 91
 79 75 74 73

- Draw the stem and leaf diagram:

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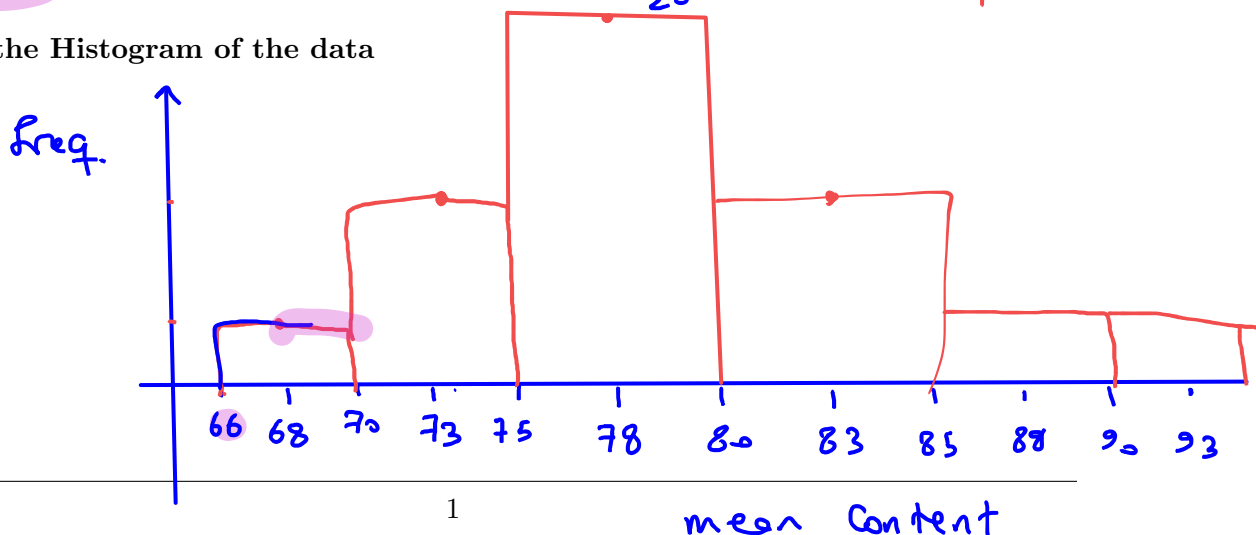
6 | 8
7 | 3 4 4
7 | 5 6 7 8 9 9 9 9
8 | 0 0 1 1 1 3
8 | 8 0
9 | 1
    
```

(Divide leaf for [0-4] & [5-9] digits)

- Make a frequency table

Class	Interval Center	Tally	Frequency	Relative Frequency	Cumulative r.f
66-70	68		1	.05 = $\frac{1}{20}$.05
71-75	73		4	.20 = $\frac{4}{20}$.25
76-80	78	###	9	.45	.7
81-85	83		4	.20	.9
86-90	88		1	.05	.95
91-95	93		1	.05	1

- Draw the Histogram of the data



- Calculate the quantiles

i	1	2	3	4	5	6	7	8	9	10
Data	68	73	74	74	75	76	77	78	79	79
$P = \frac{i-0.5}{n}$	0.025	0.075	0.125	0.175	0.225	0.275	0.325	0.375	0.425	0.475
Q(p)	68	73	74	74	75	76	77	78	79	79
$Q_N(p)$	-1.96	-1.44	-1.15	-0.94	-0.76	-0.59	-0.45	-0.31	-0.18	-0.06

i	11	12	13	14	15	16	17	18	19	20
Data	79	79	80	80	81	81	81	83	88	91
$\frac{i-0.5}{n}$	0.525	0.575	0.625	0.675	0.725	0.775	0.825	0.875	0.925	0.975
Q(p)	79	79	80	80	81	81	81	83	88	91
$Q_N(p)$	+0.06	+0.18	+0.31	+0.45	+0.59	+0.75	+0.93	+1.15	+1.43	+1.96

- Find the median, 1st quartile and 3rd quartile

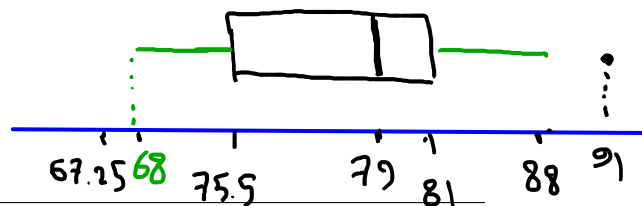
$P=0.5 \rightarrow [n \cdot P + 0.5] = [10.5] = 10 \equiv i$, $P=0.75 \rightarrow [n \cdot P + 0.5] = [15.5] = 15 \equiv i$

$P=0.25 \rightarrow [n \cdot P + 0.5] = [5.5] = 5 \equiv i$

- Find the Normal quantiles and add them to the quantile table above
- Plot the Normal quantiles vs. the data quantiles

$$\begin{aligned}
 Q(.25) &= 75.5 & Q(.25) - 1.52QR &= 75.5 - 8.25 \\
 Q(.5) &= 79 & &= \boxed{67.25} \\
 Q(.75) &= 81 & Q(.75) + 1.5 \cdot 2QR &= 81 + 8.25 \\
 & & &= \boxed{89.25} \\
 IQR &= Q(.75) - Q(.25) \\
 &= 81 - 75.5 = 5.5 \\
 1.5 \cdot 2IQR &= (1.5)(5.5) = 8.25
 \end{aligned}$$

- Draw the boxplot



$$Q(.5) = x_{10} + [n \cdot p - i + 0.5] (x_{11} - x_{10}) = 79$$

$$Q(.25) = x_5 + [n \cdot p - i + 0.5] (x_6 - x_5) = 75.5$$

$$= 75 + [(0.5)(76 - 75)] = 75 + (0.5)(1) = 75.5$$

$$Q(.75) = x_{15} + [n \cdot p - i + 0.5] (x_{16} - x_{15}) = 81$$

Questions

- Give the coordinates (on a regular paper graph) of the upper right & lower left point that would appear on a normal plot of data.

$$\begin{aligned} \text{upper right} \equiv \text{largest quantile} &\equiv \left. \begin{aligned} Q_N(.975) &= 1.96 \\ Q(.975) &= 91 \end{aligned} \right\} \\ \text{lower left} \equiv \text{lowest quantile} & \end{aligned}$$

$\left. \begin{aligned} \text{Normal Paper} &\equiv \text{using normal quantile} \\ \text{regular paper} &\equiv \text{Data set quantiles.} \end{aligned} \right\}$

$$\text{lower left} \equiv \left\{ \begin{aligned} Q_N(0.025) &= -1.96 \\ Q(0.025) &= 68 \end{aligned} \right.$$

Coordinates : $(P, Q(P))$

So, the "coordinates" are

on regular paper = $\left\{ \begin{array}{l} \text{lower left : } (0.025, 68) \\ \text{upper right : } (0.975, 91) \end{array} \right.$

on normal paper = $\left\{ \begin{array}{l} \text{lower left : } (0.025, -1.96) \\ \text{upper right : } (0.975, 1.96) \end{array} \right.$

* Normal
(Theoretical)
Quantile
 $Q_N(p)$

