

All nontrivial calculations must be shown.

1. For the data in the table below (raw scores from an exam), do the following.

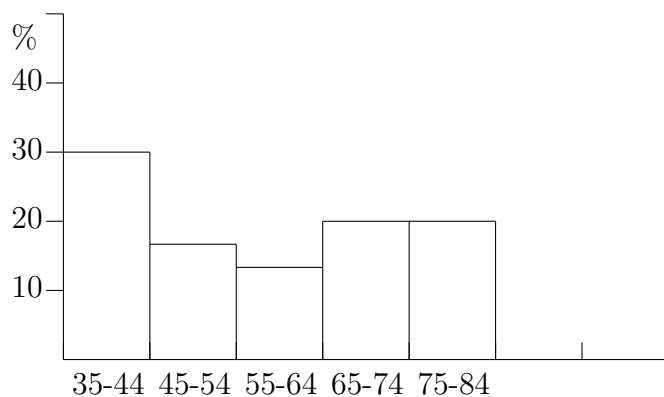
84 36 48 43 63
 53 39 74 49 41
 35 84 40 57 57
 82 60 76 67 68
 40 43 72 52 71
 78 48 83 70 39

- (a) Make a frequency distribution table with 35 as the first cutpoint and classes of equal width 10.

Class	Frequency	Rel. Freq.
35-44	9	30.00%
45-54	5	16.67%
55-64	4	13.33%
65-74	6	20.00%
75-84	6	20.00%

Note: The relative frequency column was not asked for, but is included because we will use these values for part (b).

- (b) Make a *relative* frequency histogram of the data, using the same cutpoints as above.



- (c) Construct an ordered stem and leaf diagram using two leaves per stem.

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3 | 5699
4 | 00133
4 | 889
5 | 23
5 | 77
6 | 03
6 | 78
7 | 0124
7 | 68
8 | 2344

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(d) Compute the five number summary for this data.

There are 30 scores (an even number) so the median is the average of $30/2=15$ th score and the 16th score, in numerical order.

$$\text{Median} = \frac{57 + 57}{2} = 57$$

Q_1 is the median of the lower half. There are 15 (an odd number) scores in the lower half, so the median is score number $\frac{15+1}{2} = 8$.

$$Q_1 = 43$$

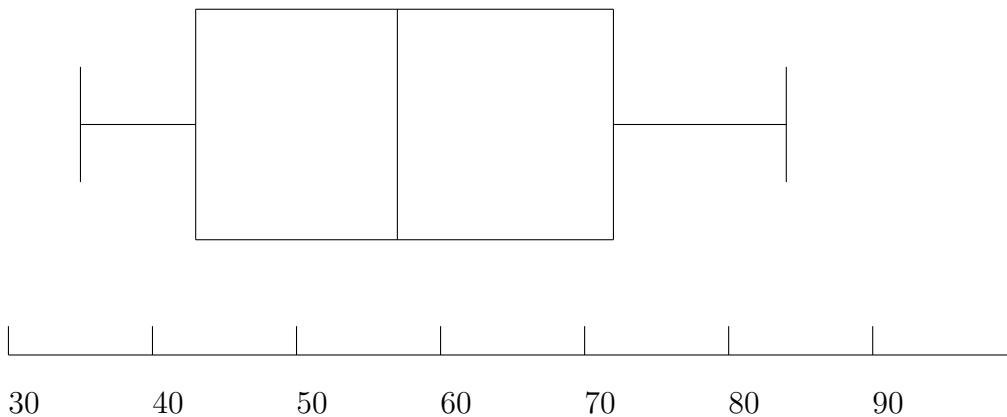
Q_3 is the 8th score in the upper half, which is the 23rd score in the data set.

$$Q_3 = 72$$

The five number summary, then is

Min	Q_1	Median	Q_3	Max
35	43	57	72	84

(e) Draw a boxplot for this data.



(f) Compute the mean for this data.

The following table is not necessary, but serves to illustrate the calculation for parts (f) and (g).

x	$x - \mu$	$(x - \mu)^2$	x	$x - \mu$	$(x - \mu)^2$
84	25.6	655.36	76	17.6	309.76
53	-5.4	29.16	72	13.6	184.96
35	-23.4	547.56	83	24.6	605.16
82	23.6	556.96	43	-15.4	237.16
40	-18.4	338.56	49	-9.4	88.36
78	19.6	384.16	57	-1.4	1.96
36	-22.4	501.76	67	8.6	73.96
39	-19.4	376.36	52	-6.4	40.96
84	25.6	655.36	70	11.6	134.56
60	1.6	2.56	63	4.6	21.16
43	-15.4	237.16	41	-17.4	302.76
48	-10.4	108.16	57	-1.4	1.96
48	-10.4	108.16	68	9.6	92.16
74	15.6	243.36	71	12.6	158.76
40	-18.4	338.56	39	-19.4	376.36
		Sum	1752		7713.2

There are 30 scores, so the mean is

$$\mu = \frac{\Sigma x}{N} = \frac{84 + 53 + 35 + \cdots + 39}{30} = \frac{1752}{30} = 58.4$$

(g) Compute the standard deviation. (Consider this to be a population.)

$$\begin{aligned} \sigma &= \sqrt{\frac{\Sigma(x - \mu)^2}{N}} \\ &= \sqrt{\frac{(84 - 58.4)^2 + (53 - 58.4)^2 + \cdots + (39 - 58.4)^2}{30}} \\ &= \sqrt{\frac{7713.2}{30}} \\ &= 16.0 \end{aligned}$$

2. The weights in pounds of a sample of two month old schmoozer puppies are summarized below.

9.4 6.2 5.9 8.8 9.2 7.1 7.1 8.5
8.9 9.2 7.0 7.6 6.9 6.0 4.7 5.9

(a) Calculate the sample mean for this data.

Again, the table is not necessary, but serves to illustrate the calculations.

x	$x - \bar{x}$	$(x - \bar{x})^2$
9.4	2.00	4.00
8.9	1.50	2.25
6.2	-1.20	1.44
9.2	1.80	3.24
5.9	-1.50	2.25
7	-0.40	0.16
8.8	1.40	1.96
7.6	0.20	0.04
9.2	1.80	3.24
6.9	-0.50	0.25
7.1	-0.30	0.09
6	-1.40	1.96
7.1	-0.30	0.09
4.7	-2.70	7.29
8.5	1.10	1.21
5.9	-1.50	2.25
118.4	Sum	31.72

The mean is

$$\bar{x} = \frac{\Sigma x}{n} = \frac{118.4}{16} = 7.4$$

(b) Calculate the sample standard deviation for this data.

$$\begin{aligned}
 s &= \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}} \\
 &= \sqrt{\frac{(9.4 - 7.4)^2 + (8.9 - 7.4)^2 + \dots + (5.9 - 7.4)^2}{16 - 1}} \\
 &= \sqrt{\frac{31.72}{15}} \\
 &= 1.45
 \end{aligned}$$

(c) Give the range for this data.

$$\text{Range} = \text{max} - \text{min} = 9.4 - 4.7 = 4.7$$

3. The age distribution for a group of 70 students is given below.

Age	Number of people
18-22	13
23-27	17
28-32	15
33-37	9
38-42	8
43-47	5
48-52	3

(a) Calculate the approximate mean.

Class	f	midpoint x	$x \cdot f$	$x - \bar{x}$	$(x - \bar{x})^2$	$(x - \bar{x})^2 \cdot f$
18-22	13	20	260	-10.64	113.27	1472.52
23-27	17	25	425	-5.64	31.84	541.31
28-32	15	30	450	-0.64	0.41	6.20
33-37	9	35	315	4.36	18.98	170.86
38-42	8	40	320	9.36	87.56	700.45
43-47	5	45	225	14.36	206.13	1030.64
48-52	3	50	150	19.36	374.70	1124.10
sum	70		2145			5046.07

$$\bar{x} = \frac{\sum x \cdot f}{\sum f} = \frac{2145}{70} = 30.64$$

(b) Calculate the approximate *sample* standard deviation.

$$\begin{aligned}
 s &= \sqrt{\frac{\sum (x - \bar{x})^2 \cdot f}{(\sum f) - 1}} \\
 &= \sqrt{\frac{(20 - 30.64)^2 \cdot 13 + (25 - 30.64)^2 \cdot 17 + \cdots + (50 - 30.64)^2 \cdot 3}{13 + 17 + \cdots + 3 - 1}} \\
 &= \sqrt{\frac{5046.07}{69}} \\
 &= 8.55
 \end{aligned}$$

4. The distribution of typographical errors in a certain book is given below.

# of errors per page	# of pages
0	319
1	42
2	8
3	2
4	1

What is the mean number of errors per page?

$$\mu = \frac{\sum x \cdot w}{\sum w} = \frac{0 \cdot 319 + 1 \cdot 42 + 2 \cdot 8 + 3 \cdot 2 + 4 \cdot 1}{319 + 42 + 8 + 2 + 1} = \frac{68}{372} = 0.183$$