Question 1

Rearrange data.
(needed for Q_2 and useful for histogram)

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
0	1	1	2	2	3	4	4	5	8

a) $n = 10$, i.e., 10 numbers.

b) $\bar{x} = \frac{\sum x_i}{n} = \frac{30}{10} = 3$.

c) Population mean symbol: μ. Value: unknown.

d) Position of Q_2 is $\frac{n+1}{2} = \frac{11}{2} = 5.5$. So Q_2 is the average of the numbers in positions 5 and 6.

$\Rightarrow Q_2 = \frac{2+3}{2} = \frac{5}{2} = 2.5$.

e) width $= \frac{\max(x) - \min(x)}{\#\text{ of classes}} = \frac{8-0}{3} = \frac{8}{3} = 2.67$.

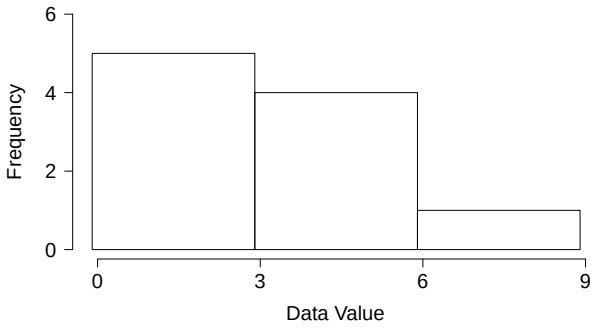
Always round up the width $\Rightarrow$ width $= 3$.

Starting at $0 \Rightarrow$ 0 - 3, 3 - 6, 6 - 9.

Classes: 0 - 2.9, 3 - 5.9, 6 - 8.9.

Class	Freq.	R. Freq.
0 - 2.9	5	$\frac{5}{10} = 0.5$
3 - 5.9	4	$\frac{4}{10} = 0.4$
6 - 8.9	1	$\frac{1}{10} = 0.1$
Total:	$n = 10$	$\frac{10}{10} = 1.0$

f)



Question 2

Rearranged data:

	x_i	x_i^2
1	0.1	0.01
2	0.2	0.04
3	0.2	0.04
4	0.4	0.16
5	0.7	0.49
6	0.7	0.49
7	0.9	0.81
8	1.0	1.00
9	1.0	1.00
10	1.4	1.96
11	1.5	2.25
12	1.6	2.56
13	2.2	4.84
14	2.3	5.29
15	3.0	9.00
16	3.0	9.00
17	3.3	10.89
18	3.4	11.56
19	4.2	17.64
20	5.4	29.16
21	5.6	31.36
22	5.7	32.49
23	6.1	37.21
24	12.9	166.41
25	14.3	204.49
$\sum$	81.1	580.15

a) $$\bar{x} = \frac{\sum x_i}{n} = \frac{81.1}{25} = 3.244.$$

b) $$s^2 = \frac{\sum x_i^2 - n\,\bar{x}^2}{n-1} = \frac{580.15 - 25\,(3.244^2)}{25-1} = \frac{580.15 - 25\,(10.524)}{24} = \frac{317.05}{24} = 13.21\,\text{hours}^2.$$

$$s = \sqrt{13.21} = 3.63\,\text{hours}.$$

c) The population standard deviation is σ. Its value is unknown but we estimate it with $s = 3.63$.

d) μ is the population mean (unknown).

e) This is numeric data $\Rightarrow$ no $\hat{p}$ here.

Question 3

Same data as Question 2.

a) $n = 25$.

b)

		Position	**Value**
	Q_1	$\frac{n+1}{4} = \frac{26}{4} = 6.5$	$\frac{0.7+0.9}{2} = \mathbf{0.8}$
	Q_2	$\frac{n+1}{4} \times 2 = 6.5(2) = 13$	$\mathbf{2.2}$
	Q_3	$\frac{n+1}{4} \times 3 = 6.5(3) = 19.5$	$\frac{4.2+5.4}{2} = \mathbf{4.8}$

c) $IQR = Q_3 - Q_1 = 4.8 - 0.8 = 4$.

d) $\bar{x} = 3.244$ and $Q_2 = 2.2$.

Since $\bar{x} > Q_2$ the data is skewed to the right.

We saw this from the histogram in Question 5 of Lecture 1 also.

Question 4

a) Type 1: $\bar{x}_1 = \frac{17.1}{11} = 1.55$.

Type 2: $\bar{x}_2 = \frac{64}{14} = 4.57$.

b) $n_1 = 11$ and $n_2 = 14$.

c) Type 1

	Position	Value
Q_1	$\frac{n+1}{4} = \frac{12}{4} = 3$	**0.2**
Q_2	$\frac{n+1}{4} \times 2 = 3(2) = 6$	**0.9**
Q_3	$\frac{n+1}{4} \times 3 = 3(3) = 9$	**2.3**

$IQR = Q_3 - Q_1 = 2.3 - 0.2 = 2.1$.

$LF = Q_1 - 1.5\,IQR = 0.2 - 1.5(2.1) = -2.95$.
$UF = Q_3 + 1.5\,IQR = 2.3 + 1.5(2.1) = 5.45$.

$\Rightarrow$ 5.6 is an outlier.

Smallest non-outlier: 0.1.

Largest non-outlier: 4.2.

Type 2

	Position	Value
Q_1	$\frac{n+1}{4} = \frac{15}{4} = 3.75$	$\frac{1.4+1.6}{2} = \mathbf{1.5}$
Q_2	$\frac{n+1}{4} \times 2 = 3.75(2) = 7.5$	$\frac{3.0+3.3}{2} = \mathbf{3.15}$
Q_3	$\frac{n+1}{4} \times 3 = 3.75(3) = 11.25$	$\frac{5.7+6.1}{2} = \mathbf{5.9}$

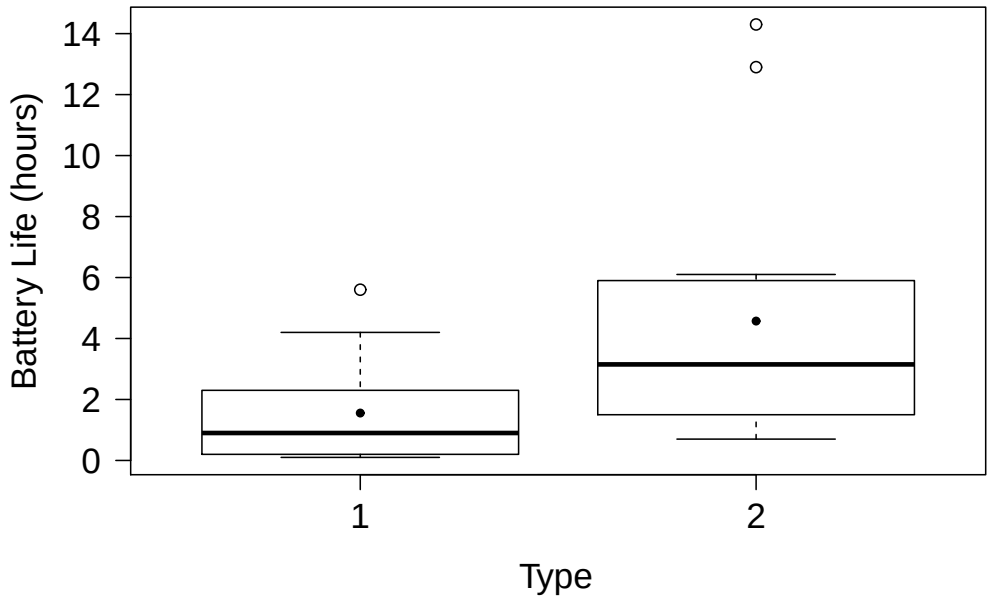
$IQR = Q_3 - Q_1 = 5.9 - 1.5 = 4.4$.

$LF = Q_1 - 1.5\,IQR = 1.5 - 1.5(4.4) = -5.1$.
$UF = Q_3 + 1.5\,IQR = 5.9 + 1.5(4.4) = 12.5$.

$\Rightarrow$ 12.9 and 14.3 are outliers.

Smallest non-outlier: 0.7.

Largest non-outlier: 6.1.



Laptops of Type 2 clearly have a greater battery life.

d) Group 1 outlier: 5.6. Group 2 outliers: 12.9 and 14.3.

e) Both are skewed to the right. In both cases $\bar{x} > Q_2$ and also there are outliers in the right tail.