1. **Problem:**
   From a very large population, a small sample of measurements was taken.

168	180	187	195	180	197

   Please calculate the mean absolute deviation using the following formula:

$$\text{MAD} = \frac{\sum |x - \bar{x}|}{n}$$

Solution: We fill out the table column by column.

x	$x - \bar{x}$	$\lvert x - \bar{x}\rvert$
168	-16.5	16.5
180	-4.5	4.5
187	2.5	2.5
195	10.5	10.5
180	-4.5	4.5
197	12.5	12.5
========	========	========
$\sum x = 1107$		$\sum\lvert x - \bar{x}\rvert = 51$
$\bar{x} = 184.5$		

We are ready for the formula.

$$\text{MAD} = \frac{\sum |x - \bar{x}|}{n}$$

$$= \frac{51}{6}$$

$$= \boxed{8.5}$$

2. **Problem:**
From a very large population, a small sample of measurements was taken.

164	153	151	162	160

Please calculate the mean absolute deviation using the following formula:

$$\text{MAD} = \frac{\sum |x - \bar{x}|}{n}$$

Solution: We fill out the table column by column.

x	$x-\bar{x}$	$\lvert x-\bar{x}\rvert$
164	6	6
153	-5	5
151	-7	7
162	4	4
160	2	2
========	========	========
$\sum x = 790$		$\sum\lvert x-\bar{x}\rvert = 24$
$\bar{x} = 158$		

We are ready for the formula.

$$\begin{aligned}\text{MAD} &= \frac{\sum |x-\bar{x}|}{n} \\ &= \frac{24}{5} \\ &= \boxed{4.8}\end{aligned}$$

3. **Problem:**
From a very large population, a small sample of measurements was taken.

40	42	40	40

Please calculate the (Bessel corrected) sample standard deviation using the following formula:

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}}$$

Solution: We fill out the table column by column.

x	$x - \bar{x}$	$(x - \bar{x})^2$
40	-0.5	0.25
42	1.5	2.25
40	-0.5	0.25
40	-0.5	0.25
========	========	========
$\sum x = 162$		$\sum (x - \bar{x})^2 = 3$
$\bar{x} = 40.5$		

We are ready for the formula.

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

$$= \sqrt{\frac{3}{4 - 1}}$$

$$= \sqrt{1}$$

$$= \boxed{1}$$

4. **Problem:**
From a very large population, a small sample of measurements was taken.

150	137	141	139	143

Please calculate the (Bessel corrected) sample standard deviation using the following formula:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Solution: We fill out the table column by column.

x	$x - \bar{x}$	$(x - \bar{x})^2$
150	8	64
137	-5	25
141	-1	1
139	-3	9
143	1	1
========	========	========
$\sum x = 710$		$\sum (x - \bar{x})^2 = 100$
$\bar{x} = 142$		

We are ready for the formula.

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

$$= \sqrt{\frac{100}{5 - 1}}$$

$$= \sqrt{25}$$

$$= \boxed{5}$$

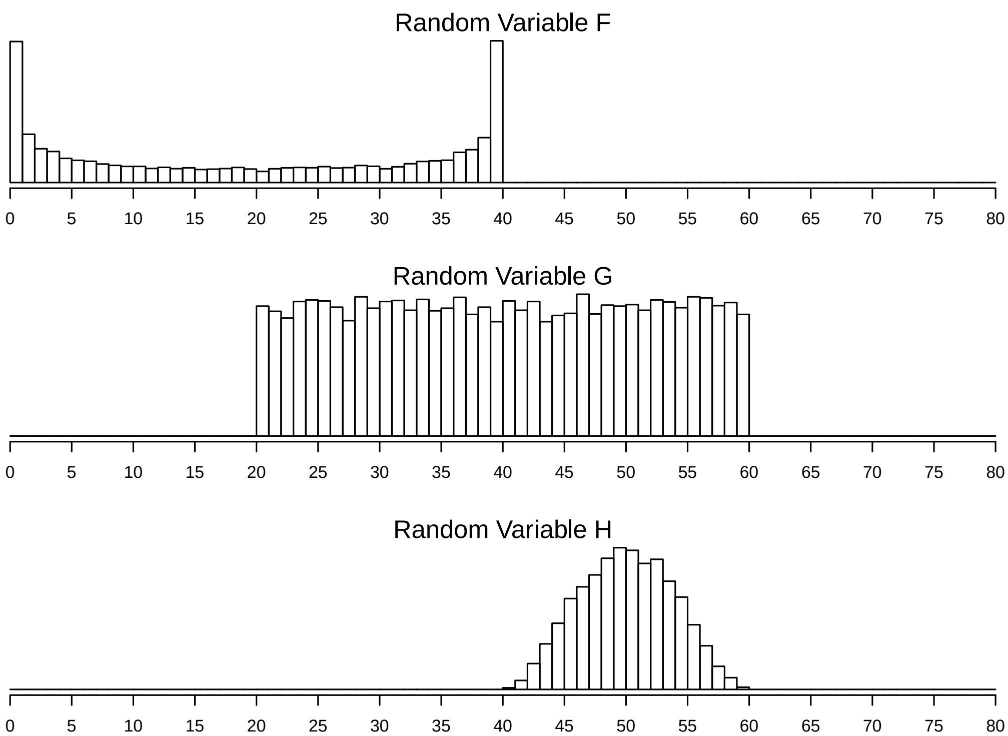
5. **Problem:**
We can estimate the mean of a **symmetric** distribution.

$$\bar{x} \approx \frac{\max(x) + \min(x)}{2}$$

We can **roughly** estimate the standard deviation of certain distributions.

Shape	SD estimate
bell	range/6
uniform	range/4
bimodal	range/2

Three random variables (F, G, and H) were measured 10000 times each. The resulting histograms show the three distributions.



(a) Estimate the mean of F.

(b) Estimate the mean of G.

(c) Estimate the mean of H.

(d) Estimate the standard deviation of F.

(e) Estimate the standard deviation of G.

(f) Estimate the standard deviation of H.

Solution:

(a) 20
(b) 40
(c) 50
(d) 20
(e) 10
(f) 3.3333333

6. **Problem:**
We can estimate the mean of a **symmetric** distribution.

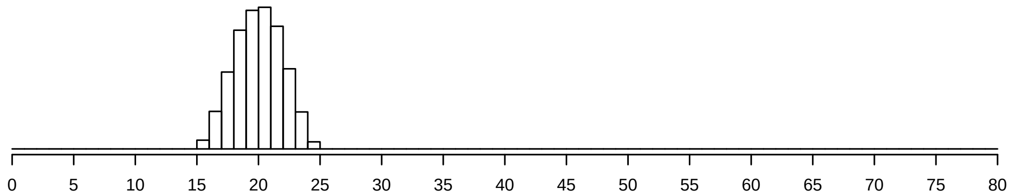
$$\bar{x} \approx \frac{\max(x) + \min(x)}{2}$$

We can **roughly** estimate the standard deviation of certain distributions.

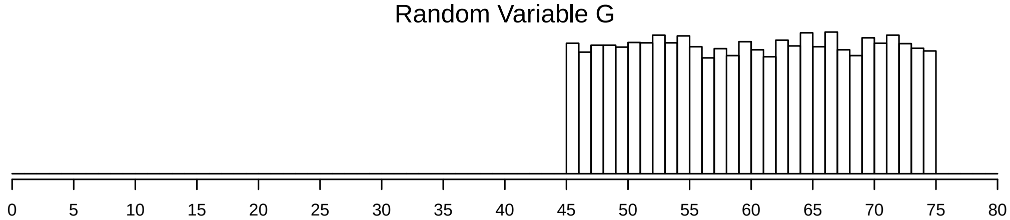
Shape	SD estimate
bell	range/6
uniform	range/4
bimodal	range/2

Three random variables (F, G, and H) were measured 10000 times each. The resulting histograms show the three distributions.

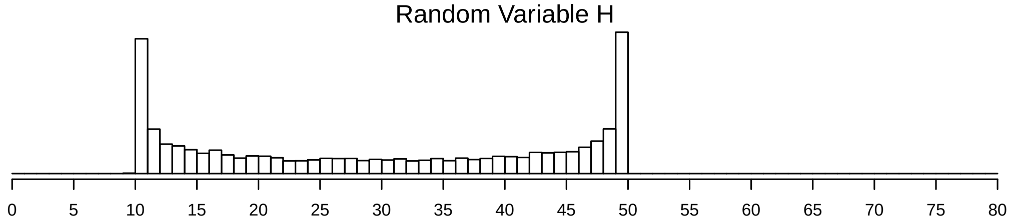
Random Variable F



Random Variable G



Random Variable H



(a) Estimate the mean of F.
(b) Estimate the mean of G.
(c) Estimate the mean of H.
(d) Estimate the standard deviation of F.
(e) Estimate the standard deviation of G.
(f) Estimate the standard deviation of H.

Solution:

(a) 20
(b) 60
(c) 30
(d) 1.6666667
(e) 7.5
(f) 20

7. **Problem:**
   From a very large population, a small sample of measurements was taken.

134	114	144	139	124

Please calculate the mean absolute deviation using the following formula:

$$\text{MAD} = \frac{\sum |x - \bar{x}|}{n}$$

Solution: We fill out the table column by column.

x	$x - \bar{x}$	$\lvert x - \bar{x}\rvert$
134	3	3
114	-17	17
144	13	13
139	8	8
124	-7	7
========	========	========
$\sum x = 655$		$\sum\lvert x - \bar{x}\rvert = 48$
$\bar{x} = 131$		

We are ready for the formula.

$$\text{MAD} = \frac{\sum |x - \bar{x}|}{n}$$

$$= \frac{48}{5}$$

$$= \boxed{9.6}$$

8. **Problem:**
From a very large population, a small sample of measurements was taken.

146	150	146	152

Please calculate the (Bessel corrected) sample standard deviation using the following formula:

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}}$$

Solution: We fill out the table column by column.

x	$x - \bar{x}$	$(x - \bar{x})^2$
146	-2.5	6.25
150	1.5	2.25
146	-2.5	6.25
152	3.5	12.25
========	========	========
$\sum x = 594$		$\sum(x - \bar{x})^2 = 27$
$\bar{x} = 148.5$		

We are ready for the formula.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

$$= \sqrt{\frac{27}{4 - 1}}$$

$$= \sqrt{9}$$

$$= \boxed{3}$$

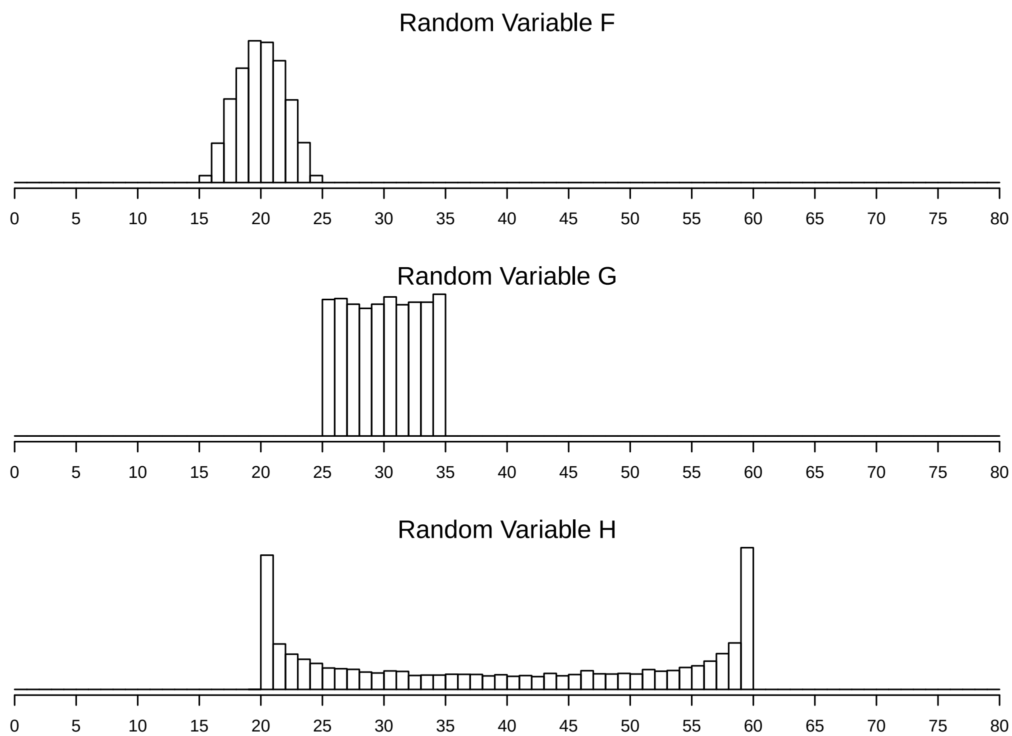
9. **Problem:**
We can estimate the mean of a **symmetric** distribution.

$$\bar{x} \approx \frac{\max(x) + \min(x)}{2}$$

We can **roughly** estimate the standard deviation of certain distributions.

Shape	SD estimate
bell	range/6
uniform	range/4
bimodal	range/2

Three random variables (F, G, and H) were measured 10000 times each. The resulting histograms show the three distributions.



(a) Estimate the mean of F.

(b) Estimate the mean of G.

(c) Estimate the mean of H.

(d) Estimate the standard deviation of F.

(e) Estimate the standard deviation of G.

(f) Estimate the standard deviation of H.

Solution:

(a) 20

(b) 30

(c) 40

(d) 1.6666667

(e) 2.5

(f) 20