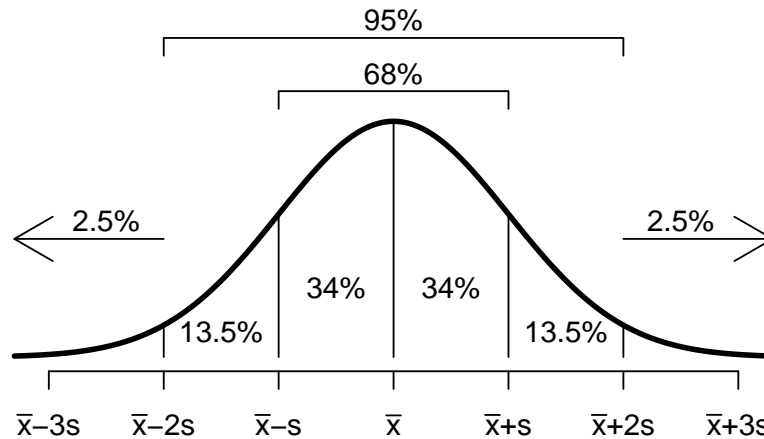


1. Problem:

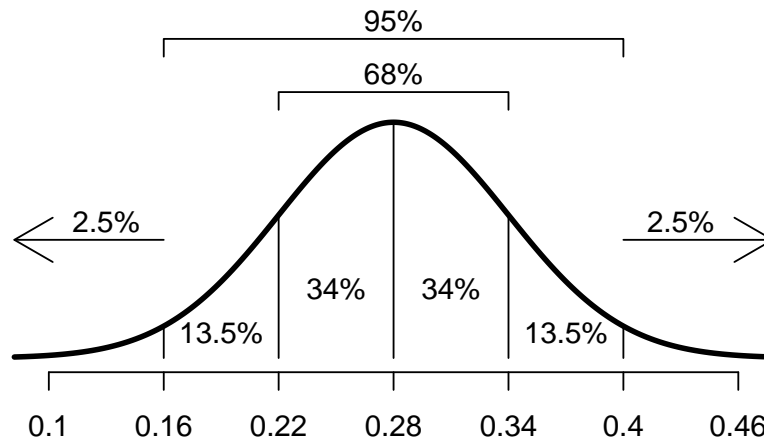
The figure below summarizes the *standard deviation rule* for normal distributions. In the figure, \bar{x} is the mean and s is the standard deviation. The percentages show the fraction of measurements that fall within various intervals.



A specific distribution is approximately normal with mean $\bar{x} = 0.28$ and standard deviation $s = 0.06$.

- (a) What percent of the measurements are greater than 0.34?
- (b) What percent of the measurements are less than 0.28?
- (c) What measurement is greater than 97.5% of the measurements?
- (d) What measurement is less than 84% of the measurements?
- (e) What percent of the measurements are between 0.22 and 0.34?

Solution: It is probably best to start by redrawing (relabeling) the normal distribution with the specific values.



- (a) Because we are asked for the percent of measurements *greater* than 0.34, we add the areas to the right of 0.34.

16%

- (b) Because we are asked for the percent of measurements *less* than 0.28, we add the areas to the left of 0.28.

50%

- (c) We determine which leftward area has a total of 97.5%. This occurs at 0.4.

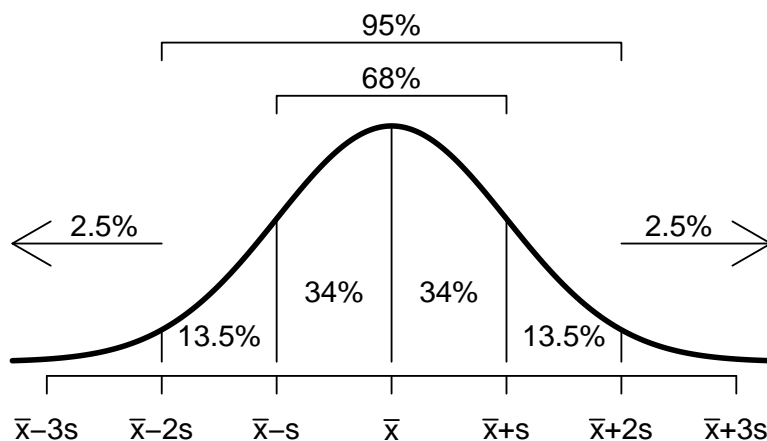
- (d) We determine which rightward area has a total of 84%. This occurs at 0.22.

- (e) We add the areas from 0.22 to 0.34.

68%

2. Problem:

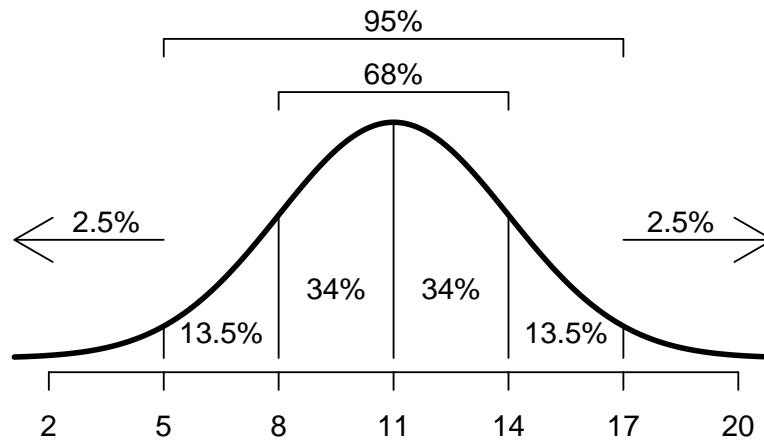
The figure below summarizes the *standard deviation rule* for normal distributions. In the figure, \bar{x} is the mean and s is the standard deviation. The percentages show the fraction of measurements that fall within various intervals.



A specific distribution is approximately normal with mean $\bar{x} = 11$ and standard deviation $s = 3$.

- (a) What percent of the measurements are greater than 11?
- (b) What percent of the measurements are less than 8?
- (c) What measurement is greater than 97.5% of the measurements?
- (d) What measurement is less than 97.5% of the measurements?
- (e) What percent of the measurements are between 5 and 17?

Solution: It is probably best to start by redrawing (relabeling) the normal distribution with the specific values.



- (a) Because we are asked for the percent of measurements *greater* than 11, we add the areas to the right of 11.

50%

- (b) Because we are asked for the percent of measurements *less* than 8, we add the areas to the left of 8.

16%

- (c) We determine which leftward area has a total of 97.5%. This occurs at 17.

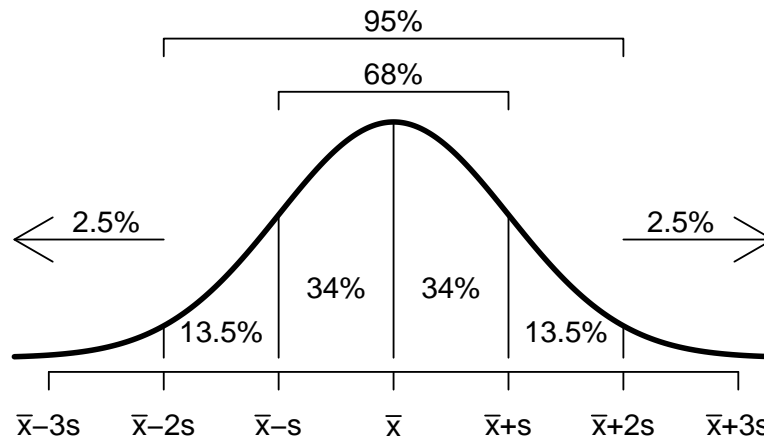
- (d) We determine which rightward area has a total of 97.5%. This occurs at 5.

- (e) We add the areas from 5 to 17.

95%

3. Problem:

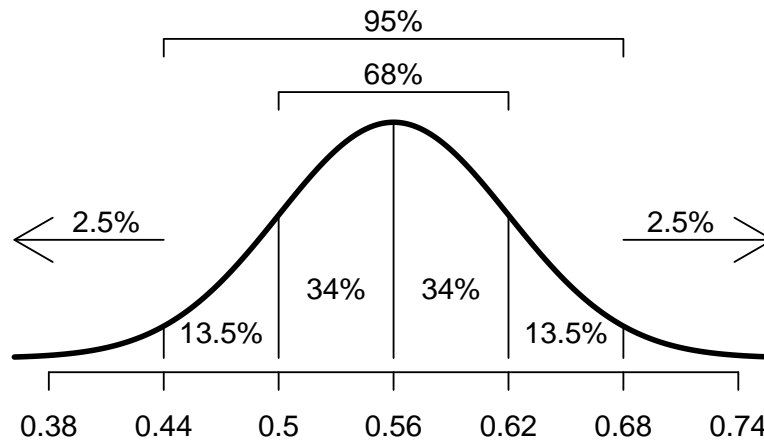
The figure below summarizes the *standard deviation rule* for normal distributions. In the figure, \bar{x} is the mean and s is the standard deviation. The percentages show the fraction of measurements that fall within various intervals.



A specific distribution is approximately normal with mean $\bar{x} = 0.56$ and standard deviation $s = 0.06$.

- (a) What percent of the measurements are greater than 0.5?
- (b) What percent of the measurements are less than 0.68?
- (c) What measurement is greater than 2.5% of the measurements?
- (d) What measurement is less than 50% of the measurements?
- (e) What percent of the measurements are between 0.5 and 0.62?

Solution: It is probably best to start by redrawing (relabeling) the normal distribution with the specific values.



- (a) Because we are asked for the percent of measurements *greater* than 0.5, we add the areas to the right of 0.5.

84%

- (b) Because we are asked for the percent of measurements *less* than 0.68, we add the areas to the left of 0.68.

97.5%

- (c) We determine which leftward area has a total of 2.5%. This occurs at 0.44.

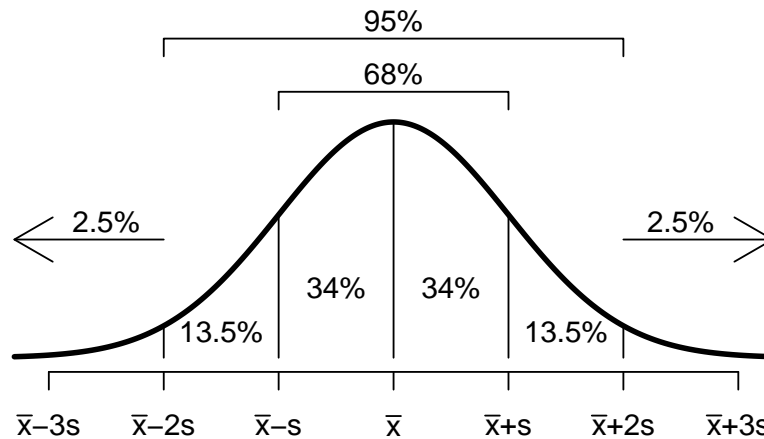
- (d) We determine which rightward area has a total of 50%. This occurs at 0.56.

- (e) We add the areas from 0.5 to 0.62.

68%

4. Problem:

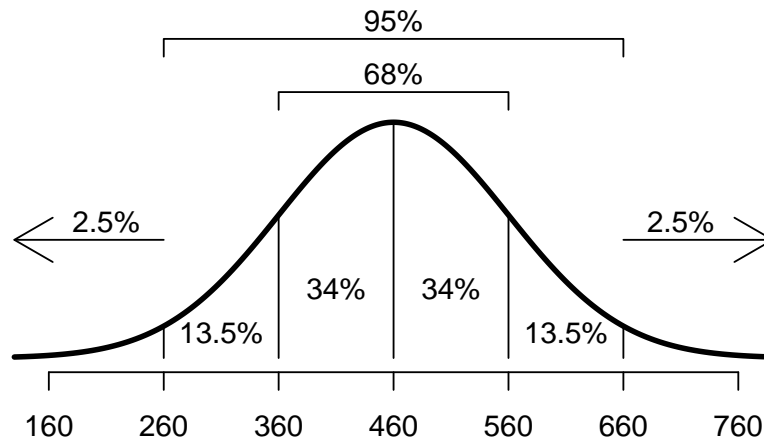
The figure below summarizes the *standard deviation rule* for normal distributions. In the figure, \bar{x} is the mean and s is the standard deviation. The percentages show the fraction of measurements that fall within various intervals.



A specific distribution is approximately normal with mean $\bar{x} = 460$ and standard deviation $s = 100$.

- (a) What percent of the measurements are greater than 260?
- (b) What percent of the measurements are less than 360?
- (c) What measurement is greater than 97.5% of the measurements?
- (d) What measurement is less than 50% of the measurements?
- (e) What percent of the measurements are between 260 and 660?

Solution: It is probably best to start by redrawing (relabeling) the normal distribution with the specific values.



- (a) Because we are asked for the percent of measurements *greater* than 260, we add the areas to the right of 260.

97.5%

- (b) Because we are asked for the percent of measurements *less* than 360, we add the areas to the left of 360.

16%

- (c) We determine which leftward area has a total of 97.5%. This occurs at 660.

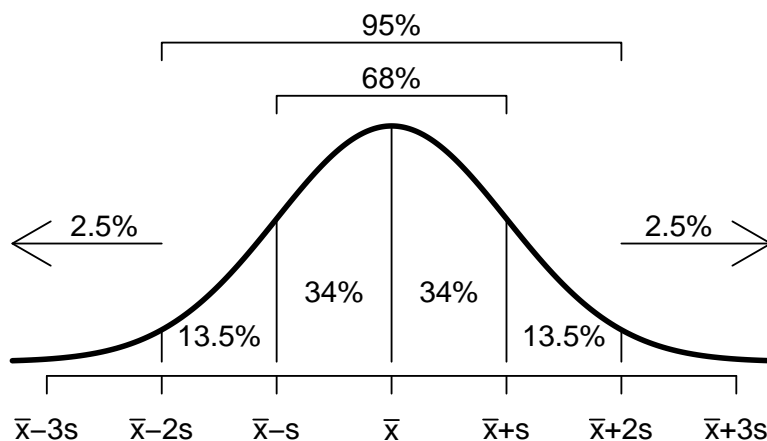
- (d) We determine which rightward area has a total of 50%. This occurs at 460.

- (e) We add the areas from 260 to 660.

95%

5. Problem:

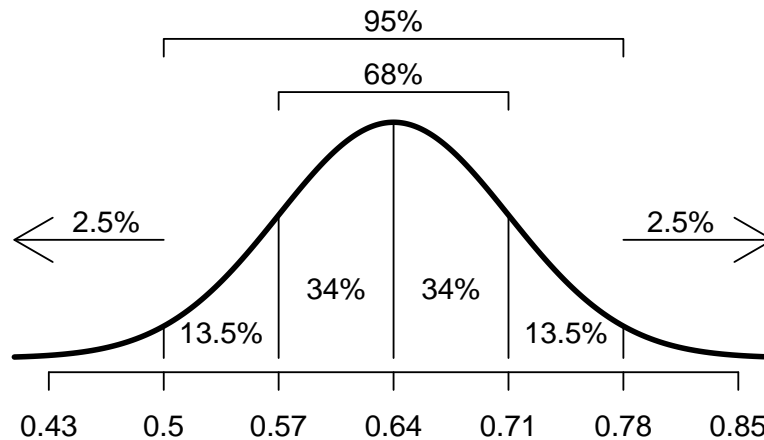
The figure below summarizes the *standard deviation rule* for normal distributions. In the figure, \bar{x} is the mean and s is the standard deviation. The percentages show the fraction of measurements that fall within various intervals.



A specific distribution is approximately normal with mean $\bar{x} = 0.64$ and standard deviation $s = 0.07$.

- (a) What percent of the measurements are greater than 0.78?
- (b) What percent of the measurements are less than 0.71?
- (c) What measurement is greater than 16% of the measurements?
- (d) What measurement is less than 50% of the measurements?
- (e) What percent of the measurements are between 0.57 and 0.71?

Solution: It is probably best to start by redrawing (relabeling) the normal distribution with the specific values.



- (a) Because we are asked for the percent of measurements *greater* than 0.78, we add the areas to the right of 0.78.

2.5%

- (b) Because we are asked for the percent of measurements *less* than 0.71, we add the areas to the left of 0.71.

84%

- (c) We determine which leftward area has a total of 16%. This occurs at 0.57.

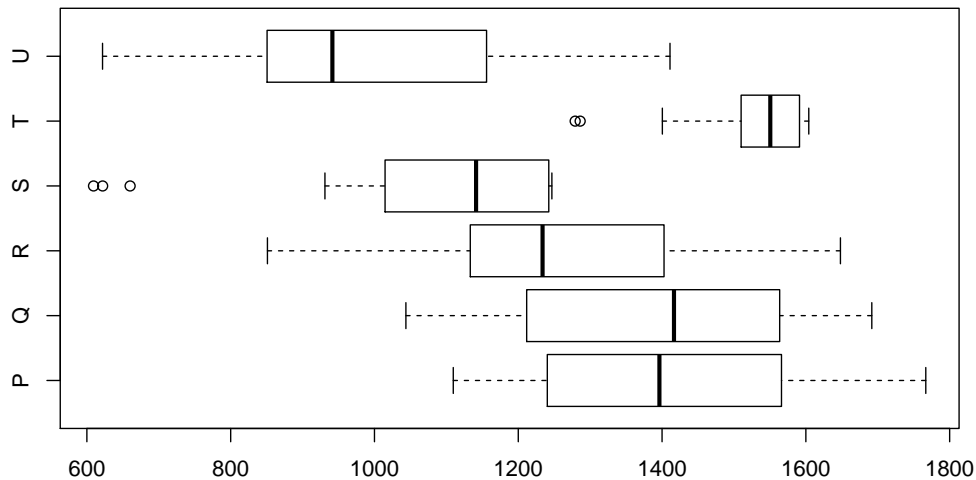
- (d) We determine which rightward area has a total of 50%. This occurs at 0.64.

- (e) We add the areas from 0.57 to 0.71.

68%

6. Problem:

Six random variables were each measured 25 times. The resulting boxplots are shown.



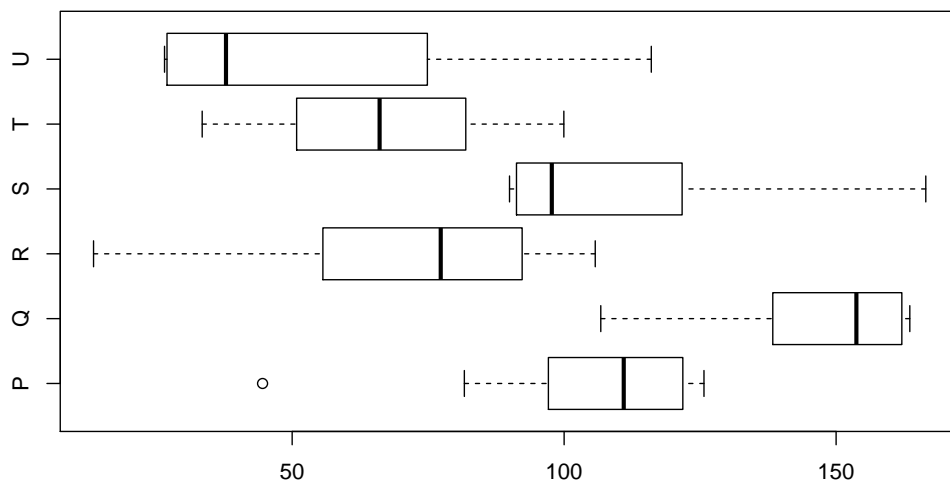
- (a) Which variable produced the largest measurement?
- (b) Which variable produced the smallest measurement?
- (c) Which distribution has the largest median?
- (d) Which distribution has the smallest median?
- (e) Which distribution has the largest 25th percentile?
- (f) Which distribution has the smallest 25th percentile?
- (g) Which distribution has the largest 75th percentile?
- (h) Which distribution has the smallest 75th percentile?
- (i) Which distribution has the largest IQR?
- (j) Which distribution has the smallest IQR?

Solution:

- (a) P
- (b) S
- (c) T
- (d) U
- (e) T
- (f) U
- (g) T
- (h) U
- (i) Q
- (j) T

7. Problem:

Six random variables were each measured 25 times. The resulting boxplots are shown.



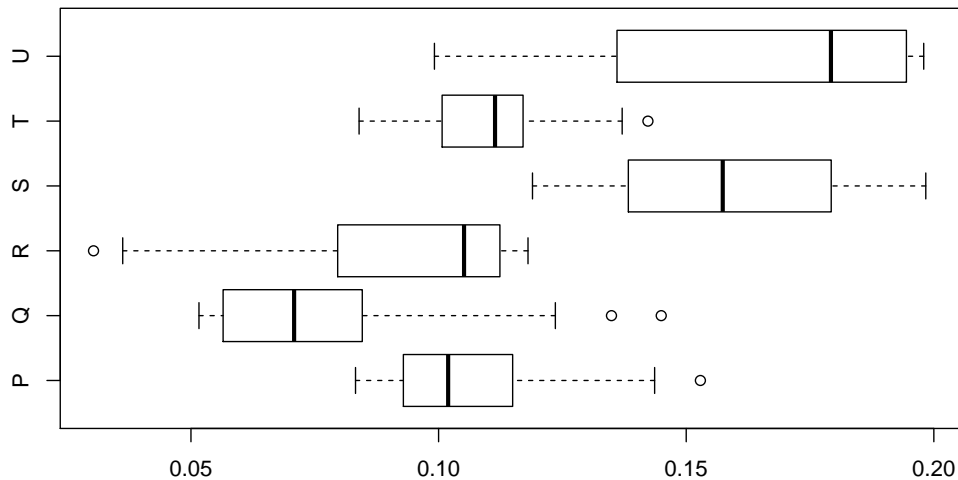
- (a) Which variable produced the largest measurement?
- (b) Which variable produced the smallest measurement?
- (c) Which distribution has the largest median?
- (d) Which distribution has the smallest median?
- (e) Which distribution has the largest 25th percentile?
- (f) Which distribution has the smallest 25th percentile?
- (g) Which distribution has the largest 75th percentile?
- (h) Which distribution has the smallest 75th percentile?
- (i) Which distribution has the largest IQR?
- (j) Which distribution has the smallest IQR?

Solution:

- (a) S
- (b) R
- (c) Q
- (d) U
- (e) Q
- (f) U
- (g) Q
- (h) U
- (i) U
- (j) Q

8. Problem:

Six random variables were each measured 25 times. The resulting boxplots are shown.



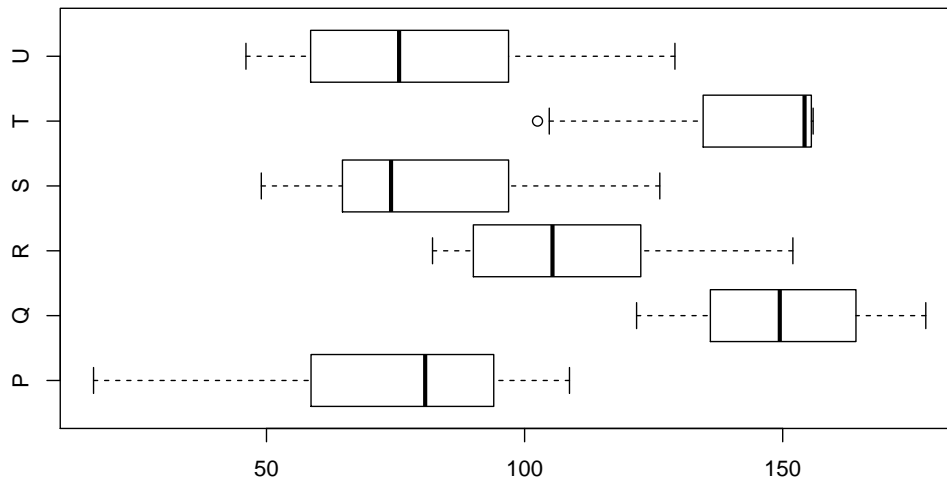
- (a) Which variable produced the largest measurement?
- (b) Which variable produced the smallest measurement?
- (c) Which distribution has the largest median?
- (d) Which distribution has the smallest median?
- (e) Which distribution has the largest 25th percentile?
- (f) Which distribution has the smallest 25th percentile?
- (g) Which distribution has the largest 75th percentile?
- (h) Which distribution has the smallest 75th percentile?
- (i) Which distribution has the largest IQR?
- (j) Which distribution has the smallest IQR?

Solution:

- (a) S
- (b) R
- (c) U
- (d) Q
- (e) S
- (f) Q
- (g) U
- (h) Q
- (i) U
- (j) T

9. Problem:

Six random variables were each measured 25 times. The resulting boxplots are shown.



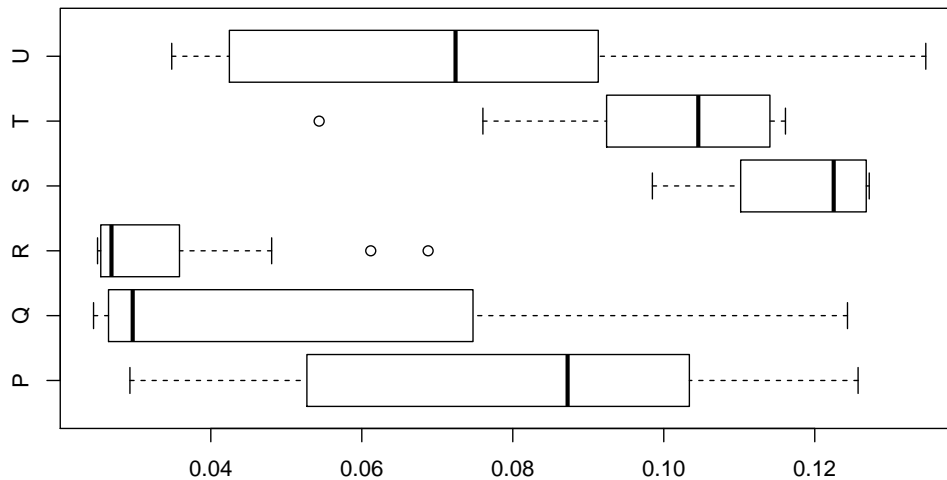
- (a) Which variable produced the largest measurement?
- (b) Which variable produced the smallest measurement?
- (c) Which distribution has the largest median?
- (d) Which distribution has the smallest median?
- (e) Which distribution has the largest 25th percentile?
- (f) Which distribution has the smallest 25th percentile?
- (g) Which distribution has the largest 75th percentile?
- (h) Which distribution has the smallest 75th percentile?
- (i) Which distribution has the largest IQR?
- (j) Which distribution has the smallest IQR?

Solution:

- (a) Q
- (b) P
- (c) T
- (d) S
- (e) Q
- (f) U
- (g) Q
- (h) P
- (i) U
- (j) T

10. Problem:

Six random variables were each measured 25 times. The resulting boxplots are shown.



- (a) Which variable produced the largest measurement?
- (b) Which variable produced the smallest measurement?
- (c) Which distribution has the largest median?
- (d) Which distribution has the smallest median?
- (e) Which distribution has the largest 25th percentile?
- (f) Which distribution has the smallest 25th percentile?
- (g) Which distribution has the largest 75th percentile?
- (h) Which distribution has the smallest 75th percentile?
- (i) Which distribution has the largest IQR?
- (j) Which distribution has the smallest IQR?

Solution:

- (a) U
- (b) Q
- (c) S
- (d) R
- (e) S
- (f) R
- (g) S
- (h) R
- (i) P
- (j) R

11. **Problem:**

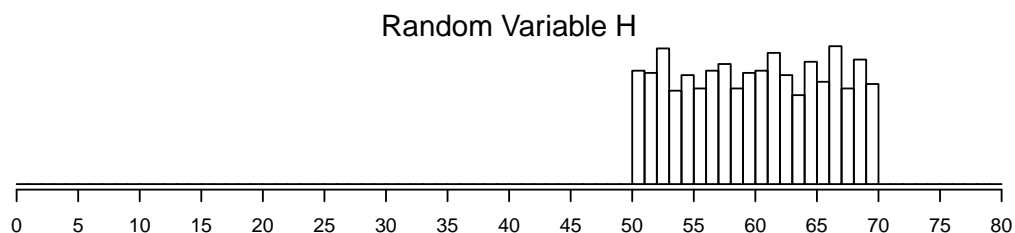
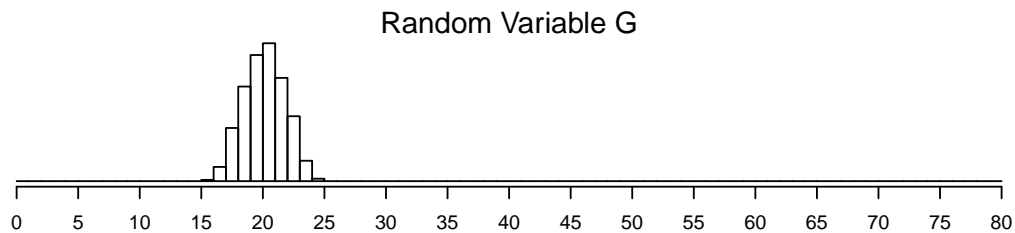
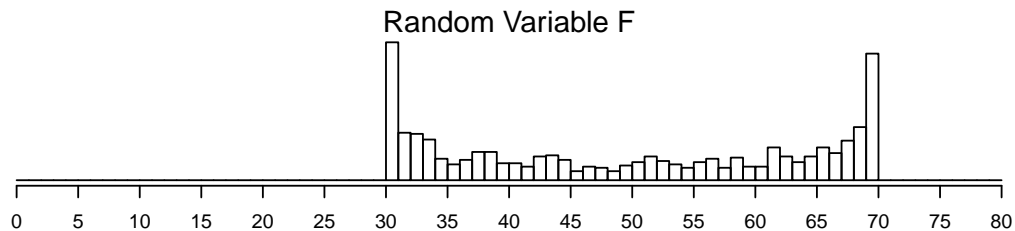
We can estimate the mean of **symmetric** distributions.

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

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 1000 times each. The resulting histograms show the three distributions.



- Estimate the mean of F.
- Estimate the mean of G.
- Estimate the mean of H.
- Estimate the standard deviation of F.
- Estimate the standard deviation of G.
- Estimate the standard deviation of H.

Solution:

- (a) 50
- (b) 20
- (c) 60
- (d) 20
- (e) 1.6666667
- (f) 5

12. **Problem:**

We can estimate the mean of **symmetric** distributions.

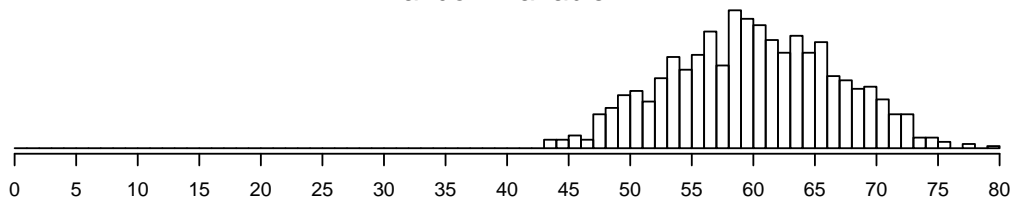
$$\bar{x} \approx \frac{\max(x) + \min(x)}{2}$$

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

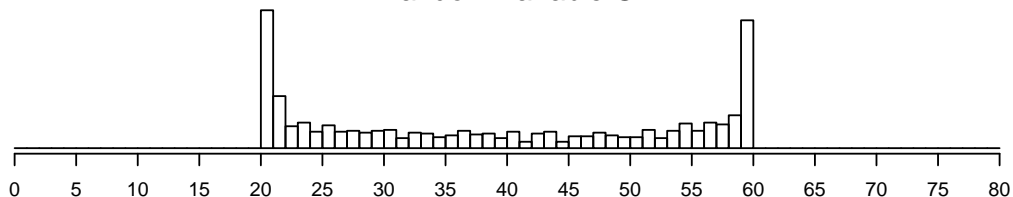
Shape	SD estimate
bell	range/6
uniform	range/4
bimodal	range/2

Three random variables (F, G, and H) were measured 1000 times each. The resulting histograms show the three distributions.

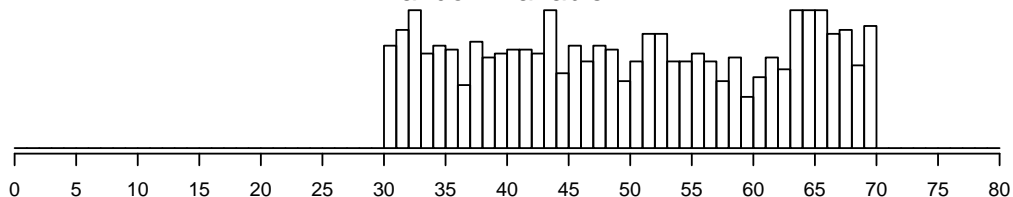
Random Variable F



Random Variable G



Random Variable H



- Estimate the mean of F.
- Estimate the mean of G.
- Estimate the mean of H.
- Estimate the standard deviation of F.
- Estimate the standard deviation of G.
- Estimate the standard deviation of H.

Solution:

- (a) 60
- (b) 40
- (c) 50
- (d) 6.6666667
- (e) 20
- (f) 10

13. **Problem:**

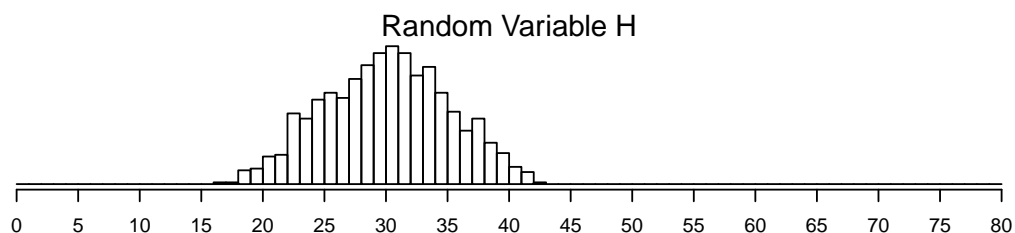
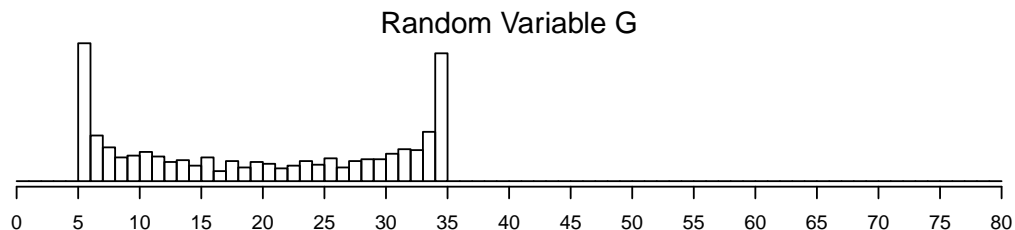
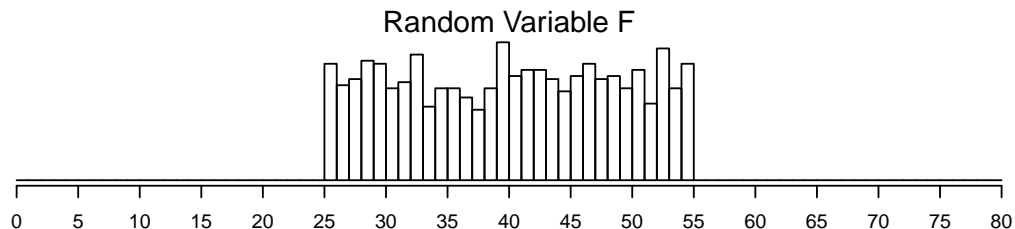
We can estimate the mean of **symmetric** distributions.

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

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 1000 times each. The resulting histograms show the three distributions.



- Estimate the mean of F.
- Estimate the mean of G.
- Estimate the mean of H.
- Estimate the standard deviation of F.
- Estimate the standard deviation of G.
- Estimate the standard deviation of H.

Solution:

- (a) 40
- (b) 20
- (c) 30
- (d) 7.5
- (e) 15
- (f) 5

14. **Problem:**

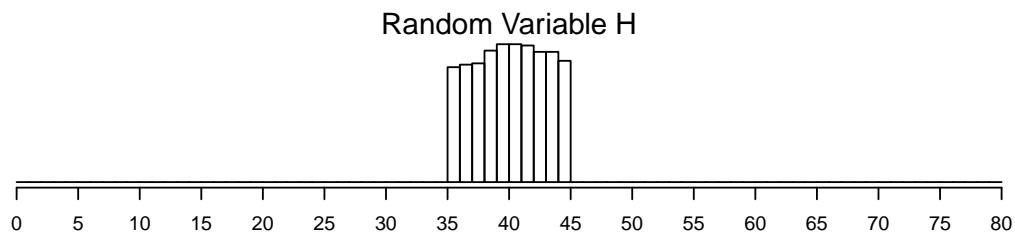
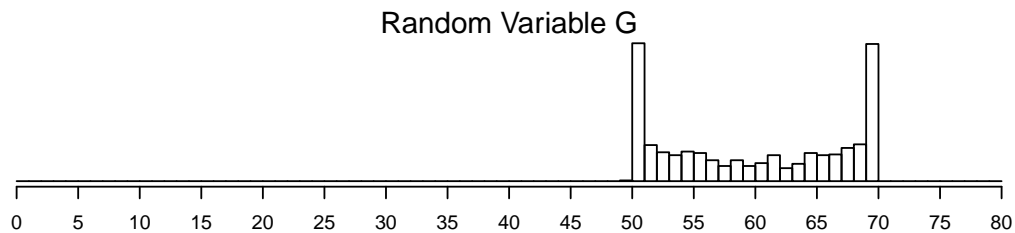
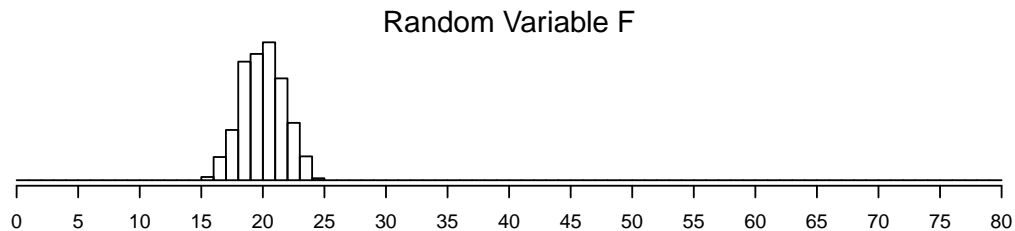
We can estimate the mean of **symmetric** distributions.

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

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 1000 times each. The resulting histograms show the three distributions.



- Estimate the mean of F.
- Estimate the mean of G.
- Estimate the mean of H.
- Estimate the standard deviation of F.
- Estimate the standard deviation of G.
- Estimate the standard deviation of H.

Solution:

- (a) 20
- (b) 60
- (c) 40
- (d) 1.6666667
- (e) 10
- (f) 2.5

15. **Problem:**

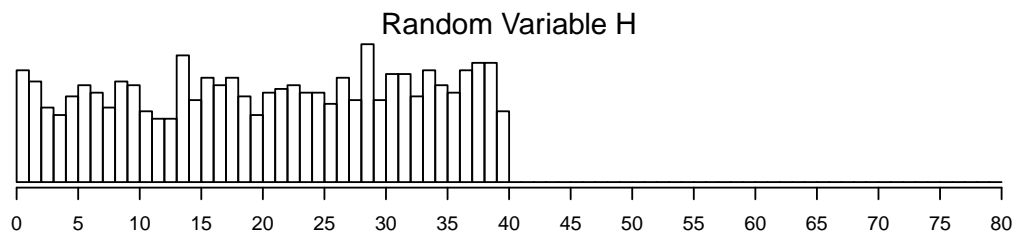
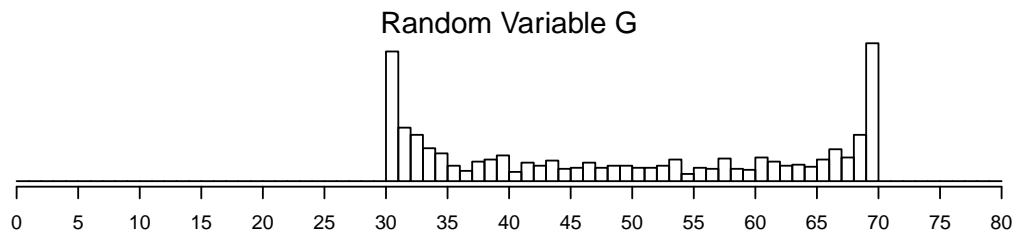
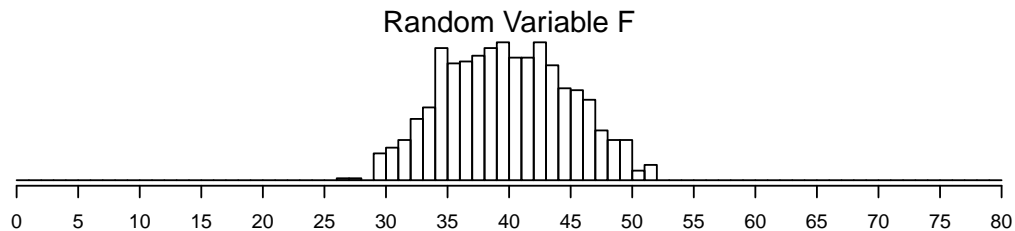
We can estimate the mean of **symmetric** distributions.

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

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 1000 times each. The resulting histograms show the three distributions.



- Estimate the mean of F.
- Estimate the mean of G.
- Estimate the mean of H.
- Estimate the standard deviation of F.
- Estimate the standard deviation of G.
- Estimate the standard deviation of H.

Solution:

- (a) 40
- (b) 50
- (c) 20
- (d) 5
- (e) 20
- (f) 10