



1 | Conceptual Exercises

1.

- a. Billy is looking for the heaviest bag possible and finds one that is 1082 g. What is the probability of finding a heavier bag?

$$\begin{aligned}\mu &= 1000 \\ \sigma &= 50 \\ x &= 1082\end{aligned}$$

Normally distributed, so find a z-score for the observed value. Heavier means right tail.

$$\begin{aligned}Z &= (x - \mu) / \sigma \\ Z &= (1082 - 1000) / 50 \\ Z &= 1.64\end{aligned}$$

Consult tables area under right tail, close to 0.05. Therefore, probability is 5%.

- b. What is the probability that Billy will find a bag lighter than 870g?

$$\begin{aligned}\mu &= 1000 \\ \sigma &= 50 \\ x &= 870\end{aligned}$$

Normally distributed so find a z-score for the observed value.

$$\begin{aligned}Z &= (x - \mu) / \sigma \\ Z &= (870 - 1000) / 50 \\ Z &= -2.6\end{aligned}$$

Consult table's area under right tail, probability is equal to 0.0047. For a positive z-score this would indicate the probability of a heavier bag, but because our z score is negative, it shows the probability of a lighter bag. This probability is less than 0.5%.

c. How would the results of a. and b. change if the standard deviation was only 40g?

For a.

$$\mu = 1000$$

$$\sigma = 40$$

$$x = 1082$$

$$Z = (x - \mu) / \sigma$$

$$Z = (1082 - 1000) / 40$$

$$Z = 2.05$$

Probability is 2% now.

For b.

$$\mu = 1000$$

$$\sigma = 40$$

$$x = 870$$

$$Z = (x - \mu) / \sigma$$

$$Z = (870 - 1000) / 40$$

$$Z = -3.25$$

Probability is now about 0.1%

Both of these probabilities are smaller and are a direct reflection of a more narrow distribution.

2. 1.96

3. 12.92%

4. $\frac{50-62.3}{8.5} = -1.447059 \rightarrow 7.35\%$

2 | R Exercises

See RScript in the [Online Companion](#)