PO91Q: Fundamentals in Quantitative Research Methods

Worksheet Week 3 - Solutions

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Exercises - Calculations

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?

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\mu = 1000
\sigma = 50
x = 1082
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Normally distributed, so find a z-score for the observed value. Heavier means right tail.

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

 $Z = (1082 - 1000)/50$
 $Z = 1.64$

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?

$$\mu = 1000$$
 $\sigma = 50$
 $x = 870$

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

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

 $Z = (870 - 1000)/50$
 $Z = -2.6$

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.

 $\mu = 1000$

 σ = 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%

R Exercises

See RScript in the Online Companion