PO11Q - Introduction to Quantitative Political Analysis I: Worksheet Week 7

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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?

$\mu = 1000$
$\sigma = 50$
$x = 1082$

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.
$\mu = 1000$
$\sigma = 40$
$x = 870$
$Z = (x - \mu)/\sigma$
$Z = (870 - 1000)/40$
$Z = -3.25$
Probability is now about 0.1%

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