Kaleb Burris
STAT F300 Statistics, Dr. Short
Worksheet 15, Due February 27, 4:15pm

The weights of adult green sea urchin are normally distributed, with a mean of 52.0 grams and standard deviation of 17.2 grams.

1. Find the percentage of such sea urchins with weights between 50 g and 60 g.

$$\begin{aligned}
X &\sim N(\mu = 52, \sigma = 17.2) \\
P(50 < X < 60) &= P\left(Z \le \frac{60-\mu}{\sigma}\right) - P\left(Z \ge \frac{50-\mu}{\sigma}\right) \\
&= \Phi\left(\frac{60-52}{17.2}\right) - \left(1 - \Phi\left(\frac{50-52}{17.2}\right)\right) \\
&= \Phi(0.465) - (1 - \Phi(-0.116)) \leftarrow \text{ round to -0.12} \\
&= \frac{0.6772 + 0.6808}{2} - (1 - 0.45224) \\
&= 0.679 - 0.5477 = \boxed{0.1313}
\end{aligned}$$

2. What percentage weight over 40 g?

$$\begin{aligned}
P(X > 40) &= P\left(Z \ge \frac{40-\mu}{\sigma}\right) \\
&= 1 - \Phi\left(\frac{40-52}{17.2}\right) \\
&= 1 - \Phi(-0.6976) \leftarrow \text{ round to 0.7} \\
&= 1 - 0.24196 = \boxed{0.758}
\end{aligned}$$

3. Find the 90^{th} percentile for weights and interpret this value.

$$\begin{aligned}
x &= \mu + Z\sigma \\
x &= 52 + 1.281(17.2) \\
&= 52 + 22.033 = \boxed{54.033}
\end{aligned}$$

The top 10% in weight of adult green sea urchins are at least 54.033 g.

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4. Find the probability that in a sample of 16 adult green sea urchins, at least one will weigh over 75 grams.

$$\begin{aligned}
P(X > 75) &= P(Z > \frac{75-\mu}{\sigma}) \\
&= 1 - P(Z < \frac{75-52}{17.2}) \\
&= 1 - \Phi(1.337) \leftarrow \text{ round to 1.34} \\
&= 1 - 0.9099 = 0.0901 \\
P(\text{At least 1 in 16} > 75) &= 1 - (1 - P(X > 75))^{16} \\
&= 1 - (1 - 0.0901)^{16} \\
&= 1 - 0.7799 = \boxed{0.221}
\end{aligned}$$