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Department of Statistics
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Statistical Methods for the Biological,
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STAT 007

Answers to the Make-up Quiz

1. The University of Maryland Medical Center considers low birth weight to be those less than 2495 grams. Assume that birth weights are normally distributed with mean of 3152 grams and standard deviation 300 grams.

   Assume that$x$ is a random variable that describes a birth weight.

   (a) What distribution does (x-3152)/300 have?

   We have subtracted the mean and divided by the standard deviation a random variable that has the normal distribution with mean 3152 and standard deviation 300. So, it has the standard normal distribution ***[3 pts.]****.*

   (b) If a birth weight is randomly selected, what is the probability that it is a "low birth weight"?

$$\begin{aligned} P(low\ birth\ weight) &= P(x < 2495) \textbf{\textit{[1 pts]}} \\ &= P(z < (2495 - 3152)/300) = P(z < -2.19) \textbf{\textit{[1 pts]}} \\ &= 0.0143. \textbf{\textit{[1 pts]}} \end{aligned}$$

   (c) If we stipulate that "high birth weight" are those weights in the highest 3%, find the weight that separates "high birth weight" from "no high birth weight".

   Note that the z value that separates the highest 3% from the other 97% weights is $z = 1.89$ ***[1 pts]****, so the weight that separates "high birth weight" from "no high birth weight" is $x = 300 * 1.89 + 3152 = 3719$* ***[2 pts]****.*
   Other values accepted for z are 1.88 and 1.885, the corresponding weights are x equal to 3716 and 3717.5.

   (d) Compute the probability that the mean weight of 9 randomly selected weights is between 3142 and 3172 grams.

The mean weight, $\overline{x}$, of 9 randomly selected weights follows a normal distribution with mean 3152 and standard deviation $300/sqrt9 = 100$. So

$$\begin{aligned} P(3142 < \overline{x} < 3172) &= P((3142 - 3152)/100 < z < (3172 - 3152)/100) \textbf{\textit{[1 pts]}} \\ &= P(-0.1 < z < 0.2) = P(z < 0.2) - P(z < -0.1) \textbf{\textit{[1 pts]}} \\ &= 0.5793 - 0.4602 = 0.1191. \textbf{\textit{[1 pts]}} \end{aligned}$$