5.4: Predicting Amounts

You might see how z-scores are useful for determining probabilities of scores, but you can use the z-score, probability, and the characteristics of a standard normal distribution so predict how many people could earn lower (or higher) than scores. To show how, we'll use Final Exam scores (scores on a 100-point final exam from 20 students from an unknown college provided by OpenIntro.org). The average Final Exam score 77.7 points, with a standard deviation of 8.44 points.

Let's start with some context about who and what we are looking at.

Example 5.4.1

1. For the Final Exam scores, who is the sample? *Your answer should include the number of people in the sample.*

2. Based on this sample, who could be the population?

3. What was measured?

4. What information was provided?

a. N: _____

b. Mean: _____ points

c. Standard deviation: _____

Solution

Add text here.

1. 20 students from an unknown college

2. Anything reasonable (probably college students).

3. Final Exam scores (on a 100-point exam)

4. What information was provided?

a. N: 20

b. Mean: 77.70 points

c. Standard deviation: 8.44

The Research Question will be: ***How many students passed the Final Exam (earned a score of 70 points or higher)?*** And we'll use z-scores and the z-table to figure that out! Let's walk through each step.

Example 5.4.2

1. What's the formula for computing a z-score?

2. Compute the z-score for X (70 points, from the Research Question).

3. Find the p-value from the z Table for that z-score.

4. To answer the Research Question, do we need to subtract this from 1 (or 18.141% from 100%)? Why or why not? If so, do it.

5. You're not done yet! The Research Question asks *how many students*, not what proportion (percentage).

6. Write a concluding sentence for the Research Question. Round to the nearest whole person.

Solution

1. What's the formula for computing a z-score?

$$z = \frac{x - \overline{X}}{s}$$

2. Compute the z-score for X (70 points, from the Research Question).

$$z=\frac{x-\overline{X}}{s}=\frac{70-77.70}{8.44}=\frac{-7.7}{8.44}=-0.91$$

3. z = -0.91 so p = 0.18141

4. Yes, we do need to subtract because the p-value is telling us that 18.141% of the Final Exam scores are *lower* than our 70 points (z=-0.91), but the Research Question asked how many students scored *higher* then 70 points.

$$1-0.18141=0.81859(or 100\%-18.14\%=81.86\%)$$

5. We have 20 students (N = 20). To find the amount of students, we multiply the N by the proportion (before it is a percentage):

$$Amount=20\times 0.81859=16.37$$

6. Based on the mean, standard deviation, and size of this sample, 16 of the 20 students should pass the Final Exam (earned a score of 70 points or higher).

Your turn! We'll use the same sample of Final Exam scores (scores on a 100-point final exam from 20 students from an unknown college, with the average Final Exam score of 77.7 points and the standard deviation of 8.44 points. The Research Question will be: ***How many students earned 90 points or higher on the Final Exam?***

Exercise 5.4.1

1. Compute the z-score for X (90 points, from the Research Question).
2. Find the p-value from the z Table for that z-score.
3. To answer the Research Question, do we need to subtract this from 1 (or 100%)? Why or why not? If so, do it.
4. You're not done yet! The Research Question asks *how many students*, not what proportion (percentage).
5. Write a concluding sentence for the Research Question. Round to the nearest whole person.

Answer

1. Compute the z-score for X (90 points, from the Research Question).

$$z=\frac{x-\overline{X}}{s}=\frac{90-77.70}{8.44}=\frac{12.3}{8.44}=1.46$$

2. z=1.46 so p = 0.92785

3. Yes, we do need to subtract because the p-value is telling us that 92.79% of the Final Exam scores are *lower* than 90 points (z = 1.46), but the Research Question asked how many students scored *higher* then 90 points.

$$1-0.92785=0.07215(or 100\%-92.79\%=7.21\%)$$

4. We have 20 students (N = 20). To find the amount of students, we multiply the N by the proportion (before it is a percentage):

$$Amount=20\times 0.07215=1.44$$

5. Based on the mean, standard deviation, and size of this sample, 1 of the 20 students should earn 90 points or higher on the Final Exam.

We're Getting There!

The Standard Normal Curve and z-scores are a small piece of the puzzle to get to where we're heading, to statistically comparing sample means. It's okay if you're not quite on board with z-scores yet, we'll keep working on the concept! We use z-scores to compare one sample to compare with another sample. It's okay if you're still confused about the Standard Normal Curve, too. These are building blocks to get us to the exciting statistical comparisons that will be coming up.