Math 58 / 58B - Introduction to (Bio)Statistics

Normal Probabilities and Z scores Worksheet

in class Jan 30, 2020

Name: _____

In class today you have a worksheet[1] that gives you practice calculating Z scores and finding percentages / probabilities associated with the normal distribution.

Instructions

- WORK TOGETHER! Ask your friends what they got for answers. Ask them how to do the problems. Ask them what page in the book to look at. The class should be **loud** during this time.

- Complete the worksheet using pencil (or pen), and turn it in at the end of the class period (to Kathy Sheldon / in the HW box in Kathy's office – down the hall with the big rainbow).

- Do not worry about answering every question, just do your best. [I will post solutions.]

- You may do all of the normal probability calculations using the table in your text (see page 89 for instructions on how to use the table). However, it is probably easier and more powerful to use R for the normal probability calculations. You may want to try out the `xpnorm` function from the `mosaic` package (`library(mosaic)`). Look at the line of code below and convince yourself you understand what it says:

```
xpnorm(-.47, 0, 1, plot = TRUE)
```
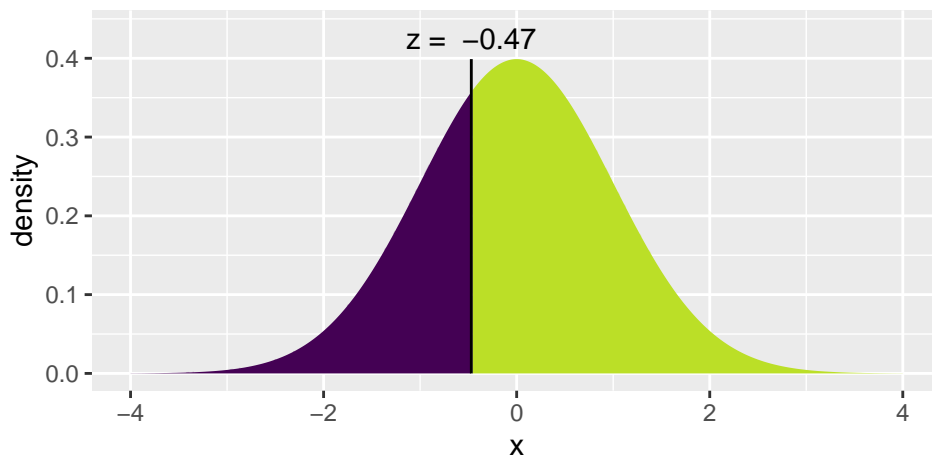


```
## [1] 0.3191775
```

The second argument in `xpnorm` centers the bell around 0. The third argument produces a standard deviation of 1. The first argument indicates that interest is in breaking up the possible values into the percent that are less than -0.47 and the percent that are greater than -0.47. 31.9% of Z scores are less than -0.47.

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[1]questions taken from https://askgoodquestions.blog/2019/08/26/8-end-of-the-alphabet/ by Allan Rossman

1. My dogs, Sequoia and Wrigley, are trying to get into college. As part of the entrance requirements, they both took a standardized test. Sequoia took the SAT and scored a 1250. Wrigley took the ACT and scored a 29.

- Explain why it doesn't make any sense to compare the raw score of 1250 to the raw score of 29.

With some additional information we find out that SAT scores have a mound-shaped (approximately normal) distribution with a mean of about 1050 and a standard deviation of about 200. ACT scores have a mound shaped (approximately normal) distribution with a mean of 21 and a standard deviation of about 5.5.

- Now can you tell who scored higher?
  - Find the Z score for each of Wrigley and Sequoia.
  - Using `xpnorm` (in the mosaic package: `library(mosaic)`), calculate the percent of test takes who are higher than each of Wrigley and Sequoia. Draw a picture. [If you don't have your computer / R, feel free to use the table in the book.]
  - Explain in words who has the higher test score (in terms of getting into college).

2. Some of you may be familiar with Hans Rosling who founded the website https://www.gapminder.org/ and dedicated his life to promoting awareness of global health issues, see his Ted talks here: https://www.ted.com/playlists/474/the_best_hans_rosling_talks_yo. One question he liked to ask is:

Has the percentage of the world's population who live in extreme poverty doubled, halved, or remained about the same over the past twenty years?

- Before you go on, answer the question. Has the extreme poverty doubled, halved, or remained about the same? What do you think?

The correct answer is that this percentage has halved, but only 5% of a sample of 1005 U.S. adults in 2017 got this right. Rosling liked to say that chimpanzees would do better than people: With only three options, we would expect 33.33% of chimpanzees to answer correctly.

- If in fact the students are randomly guessing, how many standard deviations away from the "random guess" value is 0.05? [Hint: use proportions and not percentages in your calculations.]

note: we covered this in class on Tuesday, so it's in the notes, but the formula doesn't show up in your text until the box on page 124 in section 3.1.1.

Do not use the computer here (except as a calculator, and feel free to use a calculator or use the computer / R as a calculator). Note: you need to know how many people were asked, look above.

- What does this say about humans doing so much *worse* than random guessing when answering the question about poverty? (No hypothesis test here, just a reflection on the distance between the observed data and the random guess answer.)

3. Suppose that my turtles, Mir & Elmer, take an exam for which the mean score is 70 and standard deviation of scores is 8. Elmer's score on the exam is 75, and Mir's score is 1.5 standard deviations above Elmer's score. What is Mir's score on the exam?