MIT introduction to statistics 18.05 reading 5c questions

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March 12, 2017

Contents

1 References and License

We are answering questions in the material from MIT OpenCourseWare course 18.05, Introduction to Probability and Statistics.
In this document we are answering questions Orloff and Bloom ask in [2]. We rely on the material in [1] to answer these questions.
Please see the references section for detailed citation information.

We use documentation in to write LaTeXsource code for this document.

2 Use r pnorm function to calculate probability

Orloff and Bloom ask us to use the pnorm function of the R programming language to calculate $P(Z < 1.5)$.
The on-line documentation for the pnorm function we accesed with

help(pnorm)

states that pnorm$(x, \mu, \sigma, lower.tail)$ returns $P(Z \leq x)$ if lower.tail has the value TRUE, and $P(Z > x)$ otherwise.
Orloff and bloom are asking us to calculate $P(Z < 1.5)$, but strictly speaking, we cannot use the pnorm function to calculate this value because pnorm returns either $P(Z \leq x)$ or $P(Z > x)$.
However, we call the pnorm function and get the output listed below:

```
> pnorm(1.5, 0, 1)
[1] 0.9331928
```

When we enter this value into the checker for this problem, the checker reports that this is the correct value. This begs the question: for a random variable Z that follows the normal distribution, is

$$P(Z < x) = P(Z \leq x)? \tag{1}$$

For the second reading question, Orloff and Bloom ask us to calculate $P(-1 < Z < 1)$.
Since pnorm returns $P(Z \leq x)$, we will use the fact that the area under the curve over the interval $(-1, 1)$ is equal to the area under the curve from $(-\infty, 1)$ minus the area under the curve from $(-\infty, -1)$.
Therefore, we invoke the pnorm function twice to calculate the probability $P(-1 \leq Z \leq 1)$.

```
> pnorm(1, 0, 1) - pnorm(-1, 0, 1)
[1] 0.6826895
```

Once again, when we enter the result above into the checker for this question, the checker indicates that this is the correct answer. However, this is $P(-1 \leq Z \leq 1)$, not $P(-1 < Z < 1)$ that Orloff and Bloom are asking for.

References

[1] Jeremy Orloff and Jonathan Bloom. *Gallery of Continuous Random Variables Class 5, 18.05, Spring 2014 Jeremy Orloff and Jonathan Bloom.* Available at `https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/readings/MIT18_05S14_Reading5c.pdf` (Spring 2014).

[2] Jeremy Orloff and Jonathan Bloom. *Reading Questions 5c.* Available at `https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/readings/reading-questions-5c/` (Spring 2014).