MIT Introduction to Statistics 18.05 Reading 7a Questions

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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 [3].
Please see the references section for detailed citation information.
The material for the course is licensed under the terms at `http://ocw.mit.edu/terms`.
We use documentation in to write LATEXsource code for this document.

2 Join pdf

The first question Orloff and Bloom ask is what the value of the constant c is, where $f(x, y)$ is a pdf. They give further details on f:

- f is defined on $[0, 1] \times [0, 1]$, and

- $f(x, y) = cxy$.

In order for f to be a pdf:

$$\int_0^1 \int_0^1 cxy \, dy \, dx = 1. \tag{1}$$

Equation 1 comes from the definition and properties of a join pdf that Orloff and Bloom state in [2].

We use properties of double integrals from [1], and methods of integration in [4] to replace the integral on the left hand side of 1 with its anti-derivative evaluated over the region $[0, 1] \times [0, 1]$

$$c\frac{x^2}{2}\bigg|_{x=0}^{1} \frac{y^2}{2}\bigg|_{y=0}^{1} = 1. \tag{2}$$

We evaluate the left hand side of 3 to get

$$c\frac{1}{4} = 1. \tag{3}$$

Therefore $c = 4$.

References

[1]   Paul Dawkins. *Paul's Online Math Notes*. Available at `http://tutorial.math.lamar.edu/Classes/CalcIII/DIGeneralRegion.aspx` (2017).

[2]   Jeremy Orloff and Jonathan Bloom. *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_Reading5b.pdf` (Spring 2014).

[3]   Jeremy Orloff and Jonathan Bloom. *Reading Questions 7a*. Available at `https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/readings/reading-questions-7a/` (Spring 2014).

[4]   Unknown. *Double integrals*. Available at `http://www.stankova.net/statistics_2012/double_integration.pdf` (Accessed 4/11/2017).