MIT Introduction to Statistics 18.05 Reading 4 - *Think* Questions

John Hancock

February 17, 2017

Contents

1 References and License

We are answering questions in the material from MIT OpenCourseWare course 18.05, Introduction to Probability and Statistics.
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 are answering the questions that Orloff and Bloom ask after the word, "think," in [1].
We use documentation in [2] LaTeXsource code of this document.

2 The Probability Mass Function for $Z(i,j) = i + j$

We write the *pmf* for the events that we roll two dice and the sum of the values we roll is a particular value of a:

Value a	2	3	4	5	6	7	8	9	10	11	12
pmf $p(a)$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

Orloff and Bloom ask if this looks familiar. It does not look familiar to us at this time.

3 Properties of Cumulative Distribution Functions (cdf's)

3.1 cdf's are non-decreasing

Cdf's are non-decreasing because they are sums of probability mass function (pmf) values.
Orloff and Bloom define probability mass functions in [1], and they state that the value of a probability mass function p, for any input a is always greater than or equal to 0.
If we assume that for some cdf F that $F\left(b\right) < F\left(a\right), b > a$, that would mean that for some value $c, a < c \leq b$, $p\left(c\right) < 0$. Our assumption thus forces a contradiction of the definition of probability mass functions, so it must be wrong. Therefore cdf's are non-decreasing.

3.2 Cdf's have values between 0 and 1

A distinct value of a pmf is the probability that a random variable takes a given value $\lfloor a \rfloor$.

References

[1] Jeremy Orloff and Jonathan Bloom. *Discrete Random Variables Class 4, 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_Reading4a.pdf` (Spring 2014).

[2] Scott Pakin. *The Comprehensive Latex Symbol List.* Available at `https://math.uoregon.edu/wp-content/uploads/2014/12/compsymb-1qyb3zd.pdf`(2002/10/8).