

# Problem Set 4

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## 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].

Please see the references section for detailed citation information.

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We use documentation in `[logicNot]`, `[proofs]`, `[bars]`, `[packageClash]`, `[curlyBrace]`, `[cases]` to write the L<sup>A</sup>T<sub>E</sub>X source code for this document.

## 2 Time to failure

The first group of problems Orloff and Bloom have for us involve some random variables that follow an exponential distribution.

The exponential distribution they give us to work with has probability density function (pdf):

$$f(x) = \lambda e^{-\lambda x}. \tag{1}$$

### 2.1 $P(X \geq x)$

In order to calculate this probability, we will do a change of variable similar to the technique Orloff and Bloom show in section 3.4 of [1].

We change the variable in the pdf  $f(x)$  to  $u$ ; therefore we rewrite the pdf as  $f(u)$ :

$$f(u) = \lambda e^{-\lambda u}. \quad (2)$$

We use this definition to write the  $P(X \geq x)$ .

## References

- [1] 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](https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/readings/MIT18_05S14_Reading5b.pdf) (Spring 2014).
- [2] Jeremy Orloff and Jonathan Bloom. *Joint Distributions, Independence Covariance and Correlation 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/class-slides/MIT18\\_05S14\\_class7slides.pdf](https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/class-slides/MIT18_05S14_class7slides.pdf) (Spring 2014).