



MITx: 6.041x Introduction to Probability - The Science of Uncertainty



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Exercise: People in the park

(2/2 points)

Busy people arrive at the park according to a Poisson process with rate $\lambda_1 = 3$ /hour and stay in the park for exactly $1/6$ of an hour. Relaxed people arrive at the park according to a Poisson process with rate $\lambda_2 = 2$ /hour and stay in the park for exactly half an hour. The arrivals of busy and relaxed people are independent processes. An observer visits the park at a specific time and sees B busy and R relaxed people at the park at that moment.

For both parts below, use standard notation. If your answer involves the exponential function, use notation such as $e^{(3)}$.


a) Find that probability that $B = 0$. *Hint:* Think about what must have happened in the immediate past. Recall also the formula for the Poisson PMF with parameter λ :

$$\frac{\lambda^k e^{-\lambda}}{k!}, \quad \text{for } k = 0, 1, 2, \dots$$


- ▶ Unit 6: Further topics on random variables
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Unit overview

Lec. 21: The Bernoulli process

Exercises 21 due May 11, 2016 at 23:59 UTC 

Lec. 22: The Poisson process

Exercises 22 due May 11, 2016 at 23:59 UTC 

Lec. 23: More on the Poisson process

$$e^{-1/2}$$



$$\mathbf{P}(B = 0) = \text{Answer: } e^{-0.5}$$

b) Find the probability that $B + R = 1$.

$$(3/2) * e^{-3/2}$$



$$\mathbf{P}(B + R = 1) = \text{Answer: } 1.5 * e^{-1.5}$$


Answer:

a) The busy people that the observer sees are exactly those busy people who arrived during the last $(1/6)$ th of an hour. It is therefore a Poisson random variable with parameter $3 \cdot (1/6) = 1/2$. The desired probability is $e^{-1/2}$.

b) By the same argument, R is an independent Poisson random variable with parameter $2 \cdot (1/2) = 1$. Thus, $B + R$ is a Poisson random variable with parameter 1.5 . Using the formula for the Poisson PMF,

$$\mathbf{P}(B + R = 1) = 1.5e^{-1.5}.$$


You have used 2 of 2 submissions

Exercises 23 due May 11, 2016
at 23:59 UTC 

Solved problems

**Additional theoretical
material**

Problem Set 9

Problem Set 9 due May 11,
2016 at 23:59 UTC 

Unit summary

► Unit 10: Markov
chains

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