

MITx: 6.008.1x Computational Probability and Inference

Bookmarks

- Introduction
- ▼ 1. Probability and Inference

Introduction to Probability

Exercises due Sep 22, 2016 at 02:30 IST

Probability Spaces and Events

Exercises due Sep 22, 2016 at 02:30 IST

Random Variables

Exercises due Sep 22, 2016 at 02:30 IST

1. Probability and Inference > Random Variables > Exercise: Random Variables

■ Bookmark

Exercise: Random Variables

(4/4 points)

Consider the following probability space:

```
prob_space = {'cat': 0.2, 'dog':0.7, 'shark':0.1}
```

Let's define a random variable \boldsymbol{X} that maps 'cat' and 'dog' both to 5, and 'shark' to 7.

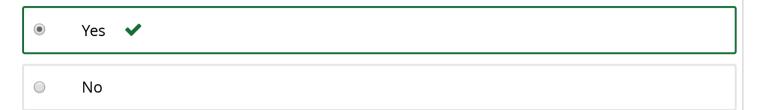
ullet What is the set of values that $oldsymbol{X}$ can take on? Express your answer as a Python set.



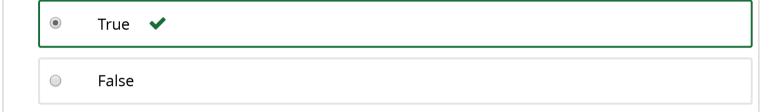
• Express the probability table (also called the probability mass function) p_X of random variable X as a Python dictionary. (Your answer should be the Python dictionary itself, and *not* the dictionary assigned to a variable, so please do not include, for instance, "prob_space =" before specifying your answer. You can use fractions. If you use decimals instead, please be accurate and use at least 5 decimal places.)

(5: 0.9, 7: 0.1) **✓ Answer: (**5: 0.9, 7: 0.1)

• Suppose we have a different random variable Y, where Y=5 with probability 0.9 and Y=7 with probability 0.1. Do X and Y have the same probability mass function, i.e., does $p_X(a)=p_Y(a)$ for $a\in\{5,7\}$?



ullet Random variable $oldsymbol{Y}$ does not have to be associated with the same underlying probability space as $oldsymbol{X}$.



Solution:

ullet What is the set of values that $oldsymbol{X}$ can take on? Express your answer as a Python set.

We see that the outcomes get relabeled to 5 and 7, i.e., the alphabet for X is $\{5, 7\}$.

• Express the probability table (also called the probability mass function) p_X of random variable X as a Python dictionary.

The probability that X=5 corresponds to the event {cat, dog}, which has probability 0.2 + 0.7 = 0.9.

The probability that X=7 corresponds to the event {shark}, which has probability 0.1.

Thus, expressing the PMF as a Python dictionary, we get: **{5: 0.9, 7: 0.1}**

• Suppose we have a different random variable Y, where Y=5 with probability 0.9 and Y=7 with probability 0.1. Do X and Y have the same probability mass function, i.e., does $p_X(a)=p_Y(a)$ for $a\in\{5,7\}$?

Yes: Just compare the answer to the previous part to the PMF for Y.

ullet Random variable $oldsymbol{Y}$ does not have to be associated with the same underlying probability space as $oldsymbol{X}$.

True: Just because random variables X and Y have the same probability distribution does not mean that they have to be associated with the same probability space.

To give a different example that makes this more clear:

Consider a probability space represented in Python by {'heads': 1/2, 'tails': 1/2} (a fair coin flip) and let random variable U map 'heads' to 1 and 'tails' to 0.

Consider a different probability space represented in Python by {1: 1/6, 2: 1/6, 3: 1/6, 4: 1/6, 5: 1/6, 6: 1/6} (a fair six-sided die roll) and let random variable \boldsymbol{V} map even rolls to 1 and odd rolls to 0.

 $oldsymbol{U}$ and $oldsymbol{V}$ have the same PMF but they are associated with different probability spaces.

You have used 1 of 5 submissions

© All Rights Reserved



© 2016 edX Inc. All rights reserved except where noted. EdX, Open edX and the edX and Open EdX logos are registered trademarks or trademarks of edX Inc.

















