

MITx: 6.008.1x Computational Probability and Inference

Heli

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Bookmarks

- Introduction
- ▼ 1. Probability and Inference

## Introduction to Probability (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST

(d)

## Probability Spaces and Events (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST

#### Random Variables (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST

## Jointly Distributed Random Variables (Week 2)

Exercises due Sep 29, 2016 at 02:30 IST

# Conditioning on Events (Week 2)

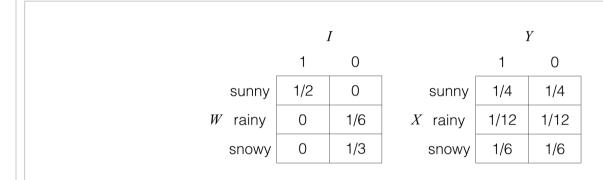
Exercises due Sep 29, 2016 at 02:30 IST

1. Probability and Inference > Jointly Distributed Random Variables (Week 2) > Exercise: Marginalization

Exercise: Marginalization

(5 points possible)

Consider the following two joint probability tables.



• Express the probability table for random variable X as a Python dictionary (the keys should be the Python strings 'sunny', 'rainy', and 'snowy'). (Your answer should be the Python dictionary itself, and not the dictionary assigned to a variable, so please do not include, for instance, "prob\_table =" before specifying your answer. You can use fractions. If you use decimals instead, please be accurate and use at least 5 decimal places.)

{1: 1/2, 0: 1/2}

**?** Answer: {'sunny': 1/2, 'rainy': 1/6, 'snowy': 1/3}

Homeworl	k 1	(Week	2)
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Homework due Sep 29, 2016 at 02:30 IST

## Inference with Bayes' Theorem for Random Variables (Week 3)

Exercises due Oct 06, 2016 at 02:30 IST

{1: 1/2, 0: 1/2}

decimal places.)

**?** Answer: {1: 1/2, 0: 1/2}

### **Independence Structure** (Week 3)

Exercises due Oct 06, 2016 at 02:30 IST

(A)

(A)

#### Homework 2 (Week 3)

Homework due Oct 06, 2016 at 02:30 IST

(A)

## **Notation Summary (Up** Through Week 3)

## Mini-project 1: Movie **Recommendations (Weeks 3** and 4)

Mini-projects due Oct 13, 2016 at 02:30 IST

### **Decisions and Expectations** (Week 4)

Exercises due Oct 13, 2016 at 02:30 IST

(A)

### **Measuring Randomness** (Week 4)

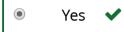
Exercises due Oct 13, 2016 at 02:30 IST

ullet For two random variables U and V that take on values in the same alphabet, we say that U and Vhave the same distribution if  $p_U(a) = p_V(a)$  for all a. For the above tables:

ullet Express the probability table for random variable Y as a Python dictionary (the keys should be the Python integers o and 1). (Your answer should be the Python dictionary itself, and *not* the dictionary

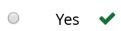
assigned to a variable, so please do not include, for instance, "prob\_table =" before specifying your answer. You can use fractions. If you use decimals instead, please be accurate and use at least 5

Do W and X have the same distribution?





Do  $\boldsymbol{I}$  and  $\boldsymbol{Y}$  have the same distribution?





Towards Infinity in Modeling Uncertainty (Week 4)

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Exercises due Oct 13, 2016 at 02:30 IST

Homework 3 (Week 4)

Homework due Oct 13, 2016 at 02:30 IST

• For a pair of random variables (S,T), and another pair (U,V), we say that the pair (S,T) and the pair (U,V) have the same joint distribution if  $p_{S,T}(a,b)=p_{U,V}(a,b)$  for all a,b.

True or false: Consider two random variables (S,T) and (U,V), where S and U have the same distribution, and T and V have the same distribution. Then (S,T) and (U,V) have the same joint distribution.

True

False	<b>~</b>

?

#### **Solution:**

• Express the probability table for random variable X as a Python dictionary (the keys should be the Python strings 'sunny', 'rainy', and 'snowy').

**Solution:** To get the probability table  $p_X$ , we sum across the columns in the table shown for  $p_{X,Y}$ :

$$\mathbb{P}( ext{sunny}) = 1/4 + 1/4 = 1/2, \ \mathbb{P}( ext{rainy}) = 1/12 + 1/12 = 1/6, \ \mathbb{P}( ext{snowy}) = 1/6 + 1/6 = 1/3.$$

As a Python dictionary: {'sunny': 1/2, 'rainy': 1/6, 'snowy': 1/3}"

ullet Express the probability table for random variable  $m{Y}$  as a Python dictionary (the keys should be the Python integers 0 and 1).

**Solution:** To get the probability table  $p_Y$ , we sum across the rows in the table shown for  $p_{X,Y}$ :

$$\mathbb{P}(1) = 1/4 + 1/12 + 1/6 = 1/2, \ \mathbb{P}(0) = 1/4 + 1/12 + 1/6 = 1/2.$$

As a Python dictionary: **{1: 1/2, 0: 1/2}** 

ullet For two random variables U and V that take on values in the same alphabet, we say that U and V have the same distribution if  $p_U(a)=p_V(a)$  for all a. For the above tables:

Do W and X have the same distribution?

**Solution:** To get the probability table  $p_W$ , we sum across the columns in the table shown for  $p_{W,I}$ :

$$\mathbb{P}( ext{sunny}) = 1/2 + 0 = 1/2, \ \mathbb{P}( ext{rainy}) = 0 + 1/6 = 1/6, \ \mathbb{P}( ext{snowy}) = 0 + 1/3 = 1/3.$$

**Yes**, this is the same distribution as  $p_X$ .

Do *I* and *Y* have the same distribution?

**Solution:** To get the probability table  $p_I$ , we sum across the rows in the table shown for  $p_{W,I}$ :

$$\mathbb{P}(1) = 1/2 + 0 + 0 = 1/2, \ \mathbb{P}(0) = 0 + 1/6 + 1/3 = 1/2.$$

**Yes**, this is the same distribution as  $p_Y$ .

• For a pair of random variables (S,T), and another pair (U,V), we say that the pair (S,T) and the pair (U,V) have the same joint distribution if  $p_{S,T}(a,b)=p_{U,V}(a,b)$  for all a,b.

True or false: Consider two random variables (S,T) and (U,V), where S and U have the same distribution, and T and V have the same distribution. Then (S,T) and (U,V) have the same joint distribution.

**Solution:False**. We just saw a counter-example! Consider when the pair (S,T) is equal to the pair (W,I) above, and when (U,V) is equal to the pair (X,Y) above. W and X have the same distribution. I and Y have the same distribution. However, the joint distribution for W and I is different from the joint distribution for X and Y, as we can see from their two tables above.

You have used 0 of 5 submissions

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