



► Introduction

▼ 1. Probability and Inference

Introduction to Probability (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST



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.

| | | I | | Y | |
|-----|-------|-----|-----|-------|------|
| | | 1 | 0 | 1 | 0 |
| W | sunny | 1/2 | 0 | sunny | 1/4 |
| | rainy | 0 | 1/6 | rainy | 1/12 |
| | snowy | 0 | 1/3 | snowy | 1/6 |

- 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}


Homework 1 (Week 2)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 **Independence Structure (Week 3)**Exercises due Oct 06, 2016 at 02:30 IST **Homework 2 (Week 3)**Homework due Oct 06, 2016 at 02:30 IST **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 **Measuring Randomness (Week 4)**Exercises due Oct 13, 2016 at 02:30 IST 

- Express the probability table for random variable Y as a Python dictionary (the keys should be the Python integers 0 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 decimal places.)

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

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

- 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?☒ Yes ☐ No

?

Do I and Y have the same distribution?☒ Yes ☐ No

?

Towards Infinity in Modeling Uncertainty (Week 4)

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 ✓

?

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 $p_{X,Y}$, we sum across the columns in the table shown for $p_{X,Y}$:

$$\begin{aligned}\mathbb{P}(\text{sunny}) &= 1/4 + 1/4 = 1/2, \\ \mathbb{P}(\text{rainy}) &= 1/12 + 1/12 = 1/6, \\ \mathbb{P}(\text{snowy}) &= 1/6 + 1/6 = 1/3.\end{aligned}$$

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

- Express the probability table for random variable 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}**

- 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 $p_{W,I}$:

$$\mathbb{P}(\text{sunny}) = 1/2 + 0 = 1/2,$$

$$\mathbb{P}(\text{rainy}) = 0 + 1/6 = 1/6,$$

$$\mathbb{P}(\text{snowy}) = 0 + 1/3 = 1/3.$$

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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