edX　　**MITx:** 6.008.1x Computational Probability and Inference

Part 1: Probability and Inference > Week 2: Jointly Distributed Random Variables > Exercise: Marginalization

Exercise: Marginalization

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Exercise: Marginalization

5 points possible (graded)
Consider the following two joint probability tables.

		I				Y	
		1	0			1	0
	sunny	1/2	0		sunny	1/4	1/4
W	rainy	0	1/6	X	rainy	1/12	1/12
	snowy	0	1/3		snowy	1/6	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.)

　　　　　　　　　　　　　　　　Answer: {'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). (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.)

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

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

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

  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.

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Discussion
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Question 2

discussion posted 2 months ago by **nandhamarobar**

Am i getting the question wrong here {'sunny': value, 'rainy':value , 'snowy': value}
Kindly let me know the correct format or i should think...

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+ Expand discussion

formatting errors

discussion posted 2 months ago by **bhaskarv2758282**

I had formatting errors for the first two questions. Will this be marked correct?

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format of the dictionary

discussion posted 2 months ago by **ebadgen**

I'm using the same format as the one in the example but I keep getting error. for example: {'sunny': {value of I: value of p('sunny', value of...

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NUMPY library

discussion posted 2 months ago by **yasser-5**

Could anyone guys provide a link for numpy library and how to use its methods specially the ones relevant to our work.

I'm trying to understand...

This post is visible to everyone.

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