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## 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
$W$	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.)

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

### Week 3: Inference with Bayes' Theorem for Random Variables

due Oct 6, 2016 02:30 IST



### Week 3: Independence Structure

due Oct 6, 2016 02:30 IST



### Week 3: Homework 2

due Oct 6, 2016 02:30 IST



### Notation Summary Up Through Week 3

### Weeks 3 and 4: Mini-project on Movie Recommendations

due Oct 21, 2016 02:30 IST



### Week 4: Decisions and Expectations

due Oct 13, 2016 02:30 IST



### Week 4: Measuring Randomness

due Oct 13, 2016 02:30 IST



### Week 4: Towards Infinity in Modeling Uncertainty

due Oct 13, 2016 02:30 IST



### Week 4: Homework 3

due Oct 13, 2016 02:30 IST



### ► Part 2: Inference in Graphical Models

- 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

- ▶ [Part 3: Learning Probabilistic Models](#)
- ▶ [Final Project](#)

- 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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You have used 0 of 5 attempts

## Discussion

**Topic:** Jointly Distributed Random Variables / Exercise: Marginalization

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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...

This post is visible to everyone.

**+ 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?

This post is visible to everyone.

**+ Expand discussion**

## 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 l: value of p('sunny', value of...

This post is visible to everyone.

**+ Expand discussion**

## 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.

**+ Expand discussion**

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