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

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Exercise: Marginalization for Many Random Variables

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Exercise: Marginalization for Many Random Variables

4 points possible (graded)

Suppose that we have the joint probability table $p_{V,W,X,Y,Z}$ where random variable V takes on k values (i.e., the alphabet for V has k elements in it), W takes on ℓ values, X takes on m values, Y takes on n values, and Z takes on o values.

- How many entries are in the joint probability table $p_{V,W,X,Y,Z}$?

  In this part, please provide your answer as a mathematical formula (and not as Python code). Use ^ for exponentiation, e.g., x^2 denotes x^2. Explicitly include multiplication using *, e.g. x*y is xy.

  [   ]　　**Answer:** k*l*m*n*o

  [   ]

- If we marginalize out X and Z, the resulting joint probability table is for which random variables? (You can select multiple options.)

  ☐ V

☐ W

☐ X

☐ Y

☐ Z

- If we marginalize out V, Y, and Z, the resulting joint probability table has how many entries?

  In this part, please provide your answer as a mathematical formula (and not as Python code). Use ^ for exponentiation, e.g., x^2 denotes x^2. Explicitly include multiplication using *, e.g. x*y is xy.

  Answer: l*m

Now suppose that we have the joint probability table $p_{X,Y,Z}$ for three random variables X, Y, and Z. We want to compute the probability table p_X for random variable X.

- True or false: If we marginalize out Z first and then Y, or if we marginalize out Y first and then Z, we get the same answer for the probability table p_X. In other words, we have

$$p_X(x) = \sum_y \left(\sum_z p_{X,Y,Z}(x, y, z) \right) = \sum_z \left(\sum_y p_{X,Y,Z}(x, y, z) \right).$$

(If it helps, look at what happens in the example we had of weather, temperature, and humidity, and think about whether that example generalizes.)

○ True

○ False

Solution:

- How many entries are in the joint probability table $p_{V,W,X,Y,Z}$?

    Solution: When we have two variables, the number of entries in their joint probability table is the number of rows multipled by the number of columns. With three variables, we further multiply by the number of possible values along the third dimension. In general, the number of entries is the product of the number of possible values along each dimension.

    So specifically for $p_{V,W,X,Y,Z}$, we would have $k \times \ell \times m \times n \times o$, which you would input into the answer box as **k*l*m*n*o**.

- If we marginalize out X and Z, the resulting joint probability table is for which random variables? (You can select multiple options.)

Solution: If we marginalize out X and Z, then we are left with V, W, and Y so the resulting joint probability table is for V, W, and Y.

- If we marginalize out V, Y, and Z, the resulting joint probability table has how many entries?

    Solution: If we marginalize out V, Y, and Z, then we are left with X and W, so the resulting joint probability table has number of entries given by the number of values for X multiplied b y the number of values for W: $\ell \times m$, which you would input into the answer box as **l*m**.

Now suppose that we have the joint probability table $p_{X,Y,Z}$ for three random variables X, Y, and Z that have alphabets of sizes m, n, and o respectively. We want to compute the probability table p_X for random variable X.

- True or false: If we marginalize out Z first and then Y, or if we marginalize out Y first and then Z, we get the same answer for the probability table p_X. In other words, we have

$$p_X(x) = \sum_y \left(\sum_z p_{X,Y,Z}(x,y,z) \right) = \sum_z \left(\sum_y p_{X,Y,Z}(x,y,z) \right).$$

    Solution: True. For each specific value of x, we are summing out $n \times o$ different terms in the joint probability table. The ordering in which we sum these $n \times o$ different terms does not matter! Thus, we can interchange the ordering of the summations.

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Discussion

Topic: Jointly Distributed Random Variables / Exercise: Marginalization for Many Random Variables

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Thank you for course notes

discussion posted 2 months ago by **ashikyan**

Just wanted to thank you for course notes under videos. Those are extremely helpful and much easier to search through. Wish every EDX course...

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Not able to submit - Submit button is missing for me

discussion posted 2 months ago by **shivack**

I see only show answer button in spite of filling all the answers and I don't see submit button. I still have time until 2-30 pm IST but not...

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Problem with the grader

discussion posted 2 months ago by **nandhamarobar**

I gave the correct answer but the grader does not grade it as correct. kindly please avoid such errors with the grader in future. I hope many...

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very poorly explained

discussion posted 2 months ago by anonymous

very poor instruction here... one should tell what is coming next instead of genera, instructions and the exercise is different

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Still unable to submit any of my answers

discussion posted 2 months ago by anonymous

it seems like it has been five days and still I am unable to submit any of the four answers , as the answer to question One is still rejected. This...

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o not permitted in answer

discussion posted 2 months ago by **memresener**

Grader doesn't like the character "o" included in the answers, is that on purpose? I can't really answer it without the letter o in the formulae....

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n not permitted in answer

discussion posted 2 months ago by **Asaelis**

I'm getting Error: Invalid input: n not permitted in answer.

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a sugestion

discussion posted 2 months ago by **zafar-hussain**

@georgehc

i suggest several small tiny practical queries as exercises would help us really solidify our intuition about the topic

for example:

consider...

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