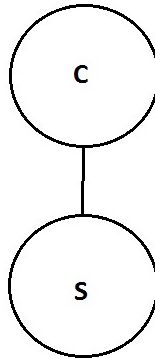


PROGRAMMING ASSIGNMENT

Inference with a Two Node Probabilistic Graphical Model

Probabilistic Graphical Models (PGM) can be handy for solving Bayesian Inference problems. For instance, suppose that we are interested in whether or not a patient has chicken pox. And suppose that, in order to make this determination, we can check whether or not the patient has spots. We might represent this problem using the following PGM:



To fully specify the PGM, we also need a node potential *for one node* in the graph and an edge potential *for each edge* in the graph.

Note: In this case, a node potential might be represented using a Python dictionary, such as `node_C = {'NOPOX': 0.9, 'POX': 0.1}`. Also, an edge potential might be represented using a Python dictionary of dictionaries, such as `edge_C_S = {'NOPOX': {'NOSPOTS': 0.999, 'SPOTS': 0.001}, 'POX': {'NOSPOTS': 0.2, 'SPOTS': 0.8}}`.

This assignment asks you to write code to carry out Bayesian Inference using a PGM with the same structure as the diagram above. This assignment requires you to work from the template code that I am providing. The template code defines a `PGM2()` class and four methods:

- `__init__()`
- `get_cell()`
- `update()`
- `marginalize()`

You need to complete these four functions. See the comments at the beginning of the functions for details about what the expected inputs and outputs are.

Note: In the Chicken Pox example, both random variables take on just two possible values. But your functions should place no restrictions on the number of possible values.

Note: In the template code, I give the probabilities in the "Expected Answer" rounded to 3 decimal places. But you are not required to round the probabilities when you write your functions.

Important: Please change the name of the file from `template_pgm_two.py` to just `pgm_two.py`. Also, the only part of the code that you need to fill in is the block denoted by "YOUR CODE GOES HERE". If you wish, you can create additional helper functions. You can also add code to the program to test your functions. But do not change the existing function definitions as they must remain consistent for grading!

Use "Assignments" in D2L to turn in your program. This assignment is due by 4pm on Wednesday, March 21. But please do try to get an early start. Also, remember to use good coding practices (include comments, use meaningful names for variables, etc.).

Please let me know if you have any questions.

HINTS

(1) This assignment is very similar to the previous programming assignment. It is also asking you to implement Bayesian Inference. It is just asking you to do it specifically by implementing the various steps of the Master Method. The `__init__()` function is Step 1. The `update()` function is Steps 2 and 3. And the `marginalize()` function is Step 4.

(2) You may want to make use of some of your code from the previous programming assignment when you write these functions.

(3) Remember that you can add (key, value) pairs to a Python dictionary (dict) using the following syntax: `dict[key] = value`

(4) You might want to test your functions using examples of probabilistic inference from the lectures.