CECS 451
Assignment 6
Total: 50 Points

General Instruction

- Submit **uncompressed** file(s) in the Assignment folder via Canvas (Not email)
- Use **Python 3**, any other programming language is not acceptable
- You can import modules in the **Python Standard Library** (please check the full list here)

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1. Consider Figure 1, and implement a program to answer the query ***P****(C|¬s, w)* by using MCMC sampling. The program should generate 1,000,000 samples to estimate the probability. To answer (a) and (b), you can prepare the answers with scratch paper and print-out them (hard coding is fine). However, you are asked to implement a simulation program to answer (c). Submit **`mcmc.ipynb`** (including the output)
   a. (10 points) Show ***P****(C|¬s, r)*, ***P****(C|¬s, ¬r)*, ***P****(R|c, ¬s, w)*, ***P****(R|¬c, ¬s, w)*
   b. (20 points) Show the transition probability matrix $Q \in \mathbb{R}^{4\times4}$ where

      q_{ij} = transition probability from S_i to S_j in Figure 2

   c. (20 points) Show the probability of the query ***P****(C|¬s, w)*

      Please follow the output format. (Fix precisions using `"{:.4f}".format`)

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Part A. The sampling probabilities
P(C|-s,r) = <..., ...>
P(C|-s,-r) = <..., ...>
P(R|c,-s,w) = <..., ...>
P(R|-c,-s,w) = <..., ...>

Part B. The transition probability matrix
       S1      S2      S3      S4
S1      .       .       .       .
S2      .       .       .       .
S3      .       .       .       .
S4      .       .       .       .

Part C. The probability for the query
P(C|-s,w) = <..., ...>
```

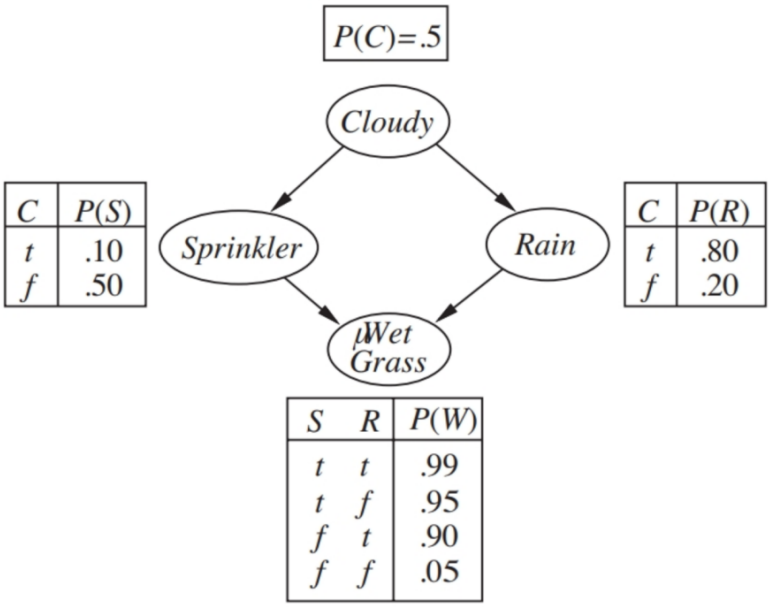

Figure 1: A multiply connected network with conditional probability tables. Note that the probabilities are slightly different than the lecture notes and the text book example.

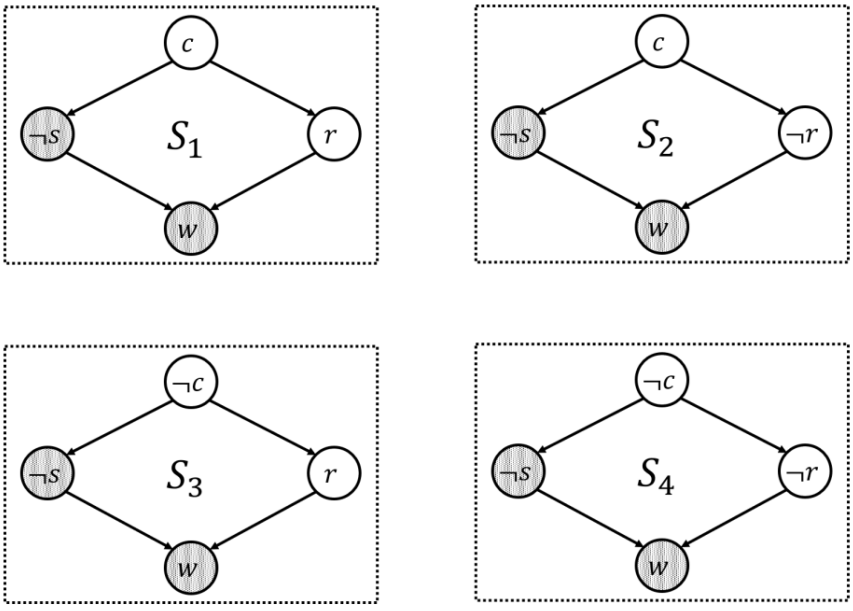

Figure 2: Possible states diagram