**CECS 451**
**Assignment 8**
**Total: 44 Points**

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General Instruction

- Submit unzipped files in the Dropbox folder via BeachBoard (Not email or in class).

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1. Consider Figure 1, and implement a program to answer the query $\vec{P}(C|\neg s, w)$ by using Gibbs (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 the them. However, you have to implement a simulation program to answer (c). Using `Jupyter notebook` and Submit both `html` and `ipynb`.
   (a) (8 points) Show $\vec{P}(C|\neg s, r), \vec{P}(C|\neg s, \neg r), \vec{P}(R|c, \neg s, w), \vec{P}(R|\neg c, \neg s, w)$.
   (b) (16 points) Show the transition probability matrix $Q \in \mathbb{R}^{4\times 4}$ where $q_{ij}$ = transition probability from $S_i$ to $S_j$ in Figure 2.
   (c) (20 points) Show the probability of the query $\vec{P}(C|\neg s, w)$
   (d) Please follow the output format. (Fix precisions using `"0:.nf".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) = <..., ...>
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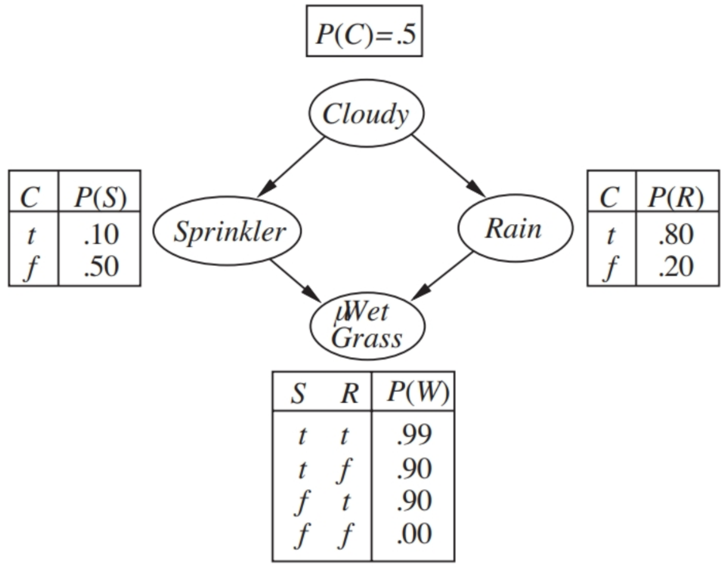


Figure 1: A multiply connected network with conditional probability tables

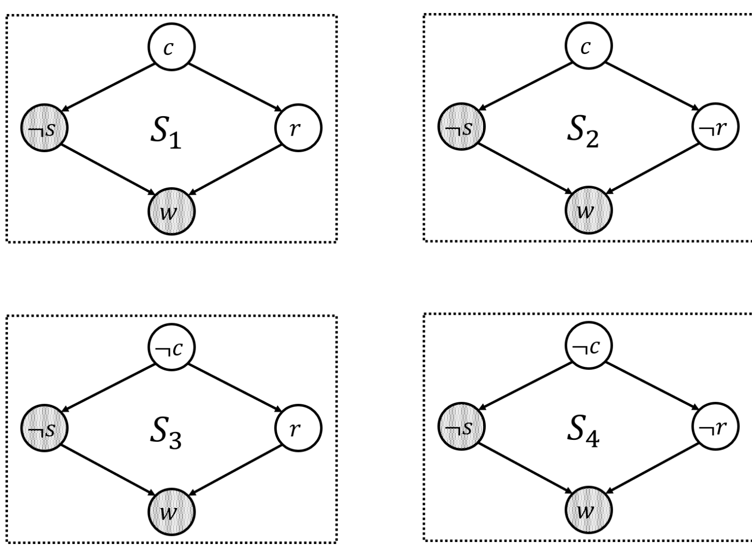


Figure 2: Possible states diagram