Assignment 4

Due Date: May 5, 2022, 11:59PM

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Collaboration Policy

This assignment should be done **alone. You may not, under any circumstances, submit any solution not written by yourself, look at a student's solution, and share your own work with others.**
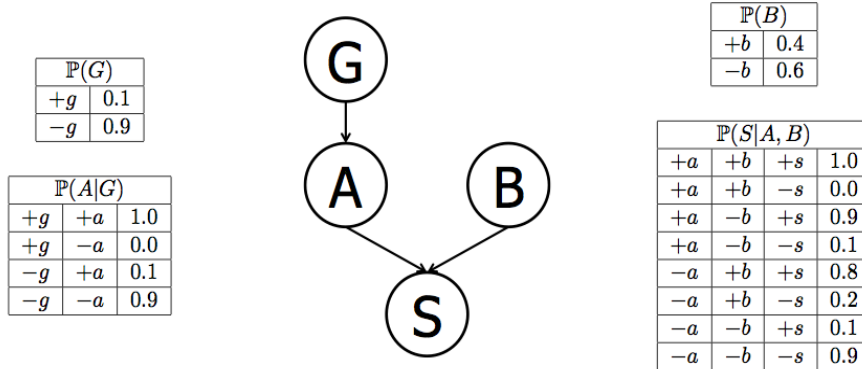
Submission via iLearn

Submit your answers via iLearn as a *single **pdf** file* with the name **csc665_assign4_lastname_sfsuid**. Write your name and SFSU ID at the top.

Academic Honesty

Plagiarism is a serious offense and will be dealt with harshly. I consider plagiarism to be the unattributed use of an external source (e.g., another student, a web site, a book) in work for which a student takes credit, or the inappropriate use of an external source whether or not attribution is made. The seriousness of the offense depends on the extent to which the student relied upon the external source. All written responses must be your own. All work ideas and quotes that originate from elsewhere must be cited according to standard academic practice. Students caught cheating will automatically fail the course.

1 [20 points] Bayes Net Inference

$\mathbb{P}(G)$	
$+g$	0.1
$-g$	0.9

$\mathbb{P}(A\mid G)$		
$+g$	$+a$	1.0
$+g$	$-a$	0.0
$-g$	$+a$	0.1
$-g$	$-a$	0.9

$\mathbb{P}(B)$	
$+b$	0.4
$-b$	0.6

$\mathbb{P}(S\mid A, B)$			
$+a$	$+b$	$+s$	1.0
$+a$	$+b$	$-s$	0.0
$+a$	$-b$	$+s$	0.9
$+a$	$-b$	$-s$	0.1
$-a$	$+b$	$+s$	0.8
$-a$	$+b$	$-s$	0.2
$-a$	$-b$	$+s$	0.1
$-a$	$-b$	$-s$	0.9

Compute the values of the following probabilities:

1. [3 points] $P(+g, +a, +b, +s) =$ P(+g) * P(+a|+g) * P(+b|+g,+a) * P(+s|+a,+b,+g)
   P(+g) * P(+g,+a) * P(+b) * P(+a,+b,+s)
   0.1 * 1.0 * 0.4 * 1.0 = 0.04

2. [3 points] $P(+a) =$ P(+a)
   P(+g) * P(+g,+a) + P(-g) * P(-g,+a)
   0.1 * 1.0 + 0.9 * 0.1 = 0.19

3. [3 points] $P(+a \mid +b) =$ P(+a|+b)
   P(+a)
   P(+g) * P(+g,+a) + P(-g) * P(-g,+a)
   0.1 * 1.0 + 0.9 * 0.1 = 0.19

4. [5 points] $P(+a \mid +s, +b) =$ P(+a|+s,+b)
   P(+a) / P(+s,+b)
   P(+a) / (P(+a) * P(+a,+b,+s) + P(-a) * P(-a,+b,+s))
   0.19/ (0.19 * 1.0 + 0.81 * 0.8) = 0.227

5. [3 points] $P(+g \mid a) =$ P(+g|+a)
   P(+g) / P(+a)
   P(+g) / (P(+g) * P(+g|+a) + P(-g) * P(-g|+a))
   0.1/ (0.1 * 1.0 + 0.9 * 0.1) = 0.526

6. [3 points] $P(+g \mid b) =$ P(+g|+b)
   P(+g) = 0.1