CSCI 3202 - Introduction to Artificial Intelligence
Instructor: Hoenigman
Assignment 7
Due Wednesday, November 4 by 4pm

For each of the following problems, you are asked to calculate the exact probabilities and approximations of the probabilities using sampling. For the sampling calculations, write a Python script to perform the calculations. For the exact calculations, you can either write these out by hand or code them into your script. Your assignment submission needs to include the output of your calculations and a printout of your code. Turn in your assignment at the beginning of class on Wednesday, November 4.

Using the Bayes net shown here, perform the following calculations using Prior and Rejection sampling. The samples are provided for you.

P(C) = 0.5

C	P(S)
t	0.10
f	0.50
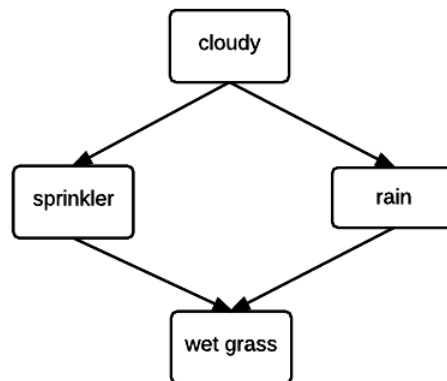
C	P(R)
t	0.80
f	0.20

S	R	P(W)
t	t	0.99
t	f	0.90
f	t	0.90
f	f	0.00

Use the following 100 samples for your calculations:

[0.82, 0.56, 0.08, 0.81, 0.34, 0.22, 0.37, 0.99, 0.55, 0.61, 0.31, 0.66, 0.28, 1.0, 0.95, 0.71, 0.14, 0.1, 1.0, 0.71, 0.1, 0.6, 0.64, 0.73, 0.39, 0.03, 0.99, 1.0, 0.97, 0.54, 0.8, 0.97, 0.07, 0.69, 0.43, 0.29, 0.61, 0.03, 0.13, 0.14, 0.13, 0.4, 0.94, 0.19, 0.6, 0.68, 0.36, 0.67, 0.12, 0.38, 0.42, 0.81, 0.0, 0.2, 0.85, 0.01, 0.55, 0.3, 0.3, 0.11, 0.83, 0.96, 0.41, 0.65, 0.29, 0.4, 0.54, 0.23, 0.74, 0.65, 0.38, 0.41, 0.82, 0.08, 0.39, 0.97, 0.95, 0.01, 0.62, 0.32,

0.56, 0.68, 0.32, 0.27, 0.77, 0.74, 0.79, 0.11, 0.29, 0.69, 0.99, 0.79, 0.21, 0.2, 0.43, 0.81, 0.9, 0.0, 0.91, 0.01]

Problems:
1. Use Prior sampling to calculate
   a. P(c = true)
   b. P(c = true | rain = true)
   c. P(s = true | w = true)
   d. P(s = true | c = true, w = true)

2. Calculate the exact value for the probabilities in Problem 1 and comment on the error between the exact and approximate calculations.

3. Use Rejection sampling to calculate

   a. P(c = true)
   b. P(c = true | rain = true)
   c. P(s = true | w = true)
   d. P(s = true | c = true, w = true)

4. Did Rejection sampling produce the same results as Prior sampling for each of the probabilities? If not, comment on the error rates for each of the calculations.

5. **This problem is optional.** For each of the probabilities given in the document for Assignment 6 and in the Assignment 6 writeup, calculate the value by hand. If you did not get assignment 6 to work fully, I will use your answers to this problem as partial credit for that assignment.