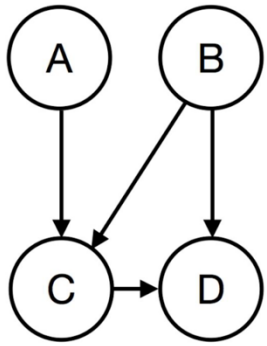
CIE6040 Homework 3

Part I: Programming [60 points]

Your task here is to implement Rejection Sampling to perform approximate inference on any given Bayes Net. An example Bayes Net is shown below:

P(A)	
+A	0.0
-A	1.0

P(B)	
+B	0.9
-B	0.1



P(C | A,B)			
+A	+B	+C	0.2
+A	+B	-C	0.8
+A	-B	+C	0.6
+A	-B	-C	0.4
-A	+B	+C	0.5
-A	+B	-C	0.5
-A	-B	+C	0.0
-A	-B	-C	1.0

P(D | B,C)			
+B	+C	+D	0.75
+B	+C	-D	0.25
+B	-C	+D	0.1
+B	-C	-D	0.9
-B	+C	+D	0.5
-B	+C	-D	0.5
-B	-C	+D	0.2
-B	-C	-D	0.8

You will develop codes to compute conditional probabilities, i.e., P(d|c) and P(d | −a, b), where d = (D=True) = (+D) in our convention.

We have given you the sample code (folder "bayesnet") for the example discussed in the course. And the code provides an example solution for Rejection Sampling. Please revise the code files accordingly based on the above Bayes Net (i.e., model.py and sample. py)

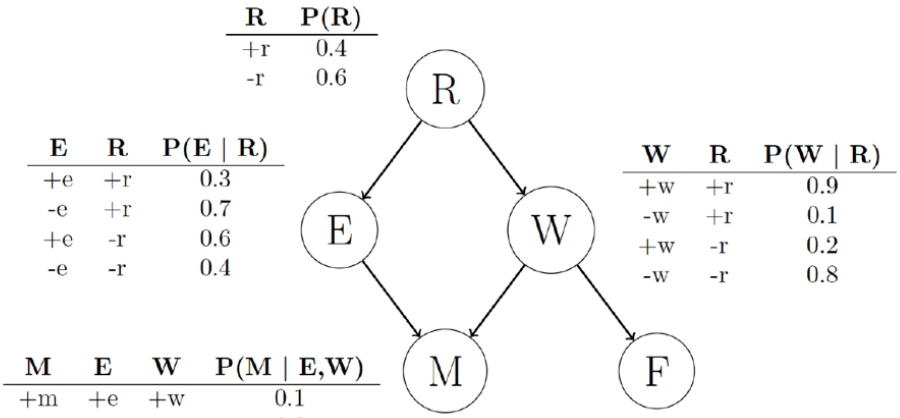
Once you've completed all the required documents, should be able to run python sample.py in the folder. And posted the screenshot solution below. The format should be like:
%Python sample.py
Observation: c or (-a, b)
Counter({'d'}: xxx, '-d': xxx)

Part II: Written Problem [16 points]

Q2. [10 pts] Consider the following Bayes Net and corresponding probability tables. Consider the case where we are sampling to approximate the query

P(R | +f, +m). Suppose we use Likelihood weighting technique, what are the weighting value "w" of the sample < +r,+e,-w,+m,+f > and < +r,-e,+w, +m,+f > , respectively.

For the sample < +r,+e,-w,+m,+f >, w = _____;
For the sample < +r,-e,+w,+m,+f > , w = _____.



R	P(R)
+r	0.4
-r	0.6

E	R	P(E | R)
+e	+r	0.3
-e	+r	0.7
+e	-r	0.6
-e	-r	0.4

W	R	P(W | R)
+w	+r	0.9
-w	+r	0.1
+w	-r	0.2
-w	-r	0.8

M	E	W	P(M | E,W)
+m	+e	+w	0.1
-m	+e	+w	0.9
+m	+e	-w	0.45
-m	+e	-w	0.55
+m	-e	+w	0.35
-m	-e	+w	0.65
+m	-e	-w	0.9
-m	-e	-w	0.1

F	W	P(F | W)
+f	+w	0.15
-f	+w	0.85
+f	-w	0.75
-f	-w	0.25

Q2. [6 pts] For each of the following data sets, is it appropriate to use HMM? Provide a one sentence explanation to your answer.

Users' movie review: for predicting about how much someone is going to enjoy a movie based on their and other users' movie preferences

Daily precipitation data in Shenzhen: for predicting the raining weather

Optical character recognition: for word recognition