CS1571
Fall 2019
11/6 In-Class Worksheet

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Where were you sitting in class today: Back left

A. Pre-Reflection
On a scale of 1-5, with 5 being most confident, how well do you think you could execute
these learning objectives:
18.1 Describe Bayes Rule _____
18.2 Represent knowledge as a Bayes Net _____
18.3 Identify independence relationships within a Bayes Net _____
18.4 Demonstrate how a Bayes Net can be used to make an inference
about the probability of a variable. _____
18.5 Explain the complexity of inference by enumeration
using Bayes Nets _____

B. Bayes Nets

1. Use Bayes Rule to solve the following problem. In a particular pain clinic, 10% of
patients are prescribed narcotic pain killers. Overall, five percent of the clinic's patients
are addicted to narcotics (including pain killers and illegal substances). Out of all the
people prescribed pain pills, 8% are addicts. *If a patient is an addict, what is the
probability that they will be prescribed pain pills?*

P(addict) = .05 P(prescribed) = .10 P(prescribed|addict) = .8
P(Addict | Prescribed) = P(.01*.08)/.05

2. Given the following conditional probabilities, what is P(Cancer=True | Result =
positive)?

Cancer	No Cancer
0.01	0.99

	Positive	Negative
Cancer	.9	.1
No Cancer	0.08	0.92

(.9 * .1) / (.9 * .1) + (.08 * .99) = .1

3. Given the following Bayes Net, are these statements true or false:
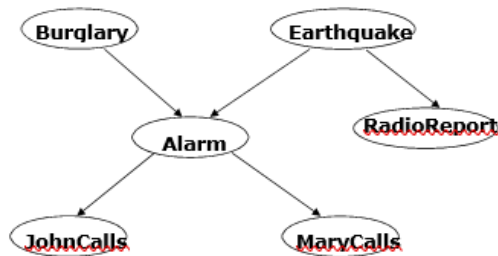
Earthquake and Burglary are independent, given MaryCalls   _F_____

Burglary and MaryCalls are independent, given Alarm   _T_____

Burglary and RadioReport are independent, given Earthquake   __T____

Burglary and RadioReport are independent, given MaryCalls   _F_____

4. Given the chain rule and the above independence relationships, what is a good way to calculate P(B=T,E=T,A=T,J=T,M=F). Assume the following Bayes Net:
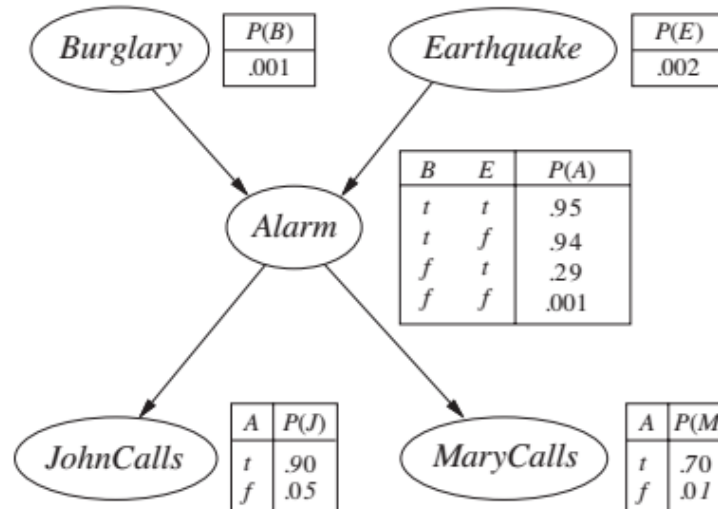

B	E	P(A)
t	t	.95
t	f	.94
f	t	.29
f	f	.001

A	P(J)
t	.90
f	.05

A	P(M)
t	.70
f	.01

Figure 14.2   A typical Bayesian network, showing both the topology and the conditional probability tables (CPTs). In the CPTs, the letters B, E, A, J, and M stand for *Burglary, Earthquake, Alarm, JohnCalls*, and *MaryCalls*, respectively.

P(Alarm | John) = .90 *
P(Alarm | Burglary & Earthquake) = .95 *
P(Alarm | ~M) = .01 *
P(Burglary) = .001 *
P(Earthquake) = .002

5. For the above scenario (in question 4), how many parameters do we need to define the full joint distribution? What about the Bayes Net?

Full joint distribution – 2^5 = 32 (true or false and 5 random variables)
Bayes Net – 5 * 2 + the graph

6. Using the Bayes Net formulation, how many additions do you have to do and how many products do you have to do to compute the probability that P(J=T)? I'll be using your solutions (possibly by name) to open the discussion next class.

C. Post Reflection

On a scale of 1-5, with 5 being most confident, how well do you think you could execute these learning objectives:

18.6   Describe Bayes Rule   _____

18.7   Represent knowledge as a Bayes Net   _____

18.8   Identify independence relationships within a Bayes Net   _____

18.9   Demonstrate how a Bayes Net can be used to make an inference
about the probability of a variable.   _____

18.10 Explain the complexity of inference by enumeration
using Bayes Nets   _____