

Name Jaren, Can

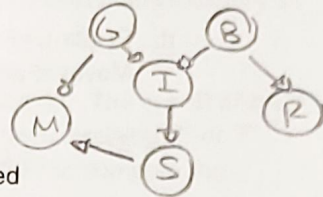
ITCS 3153: Introduction to Artificial Intelligence

In-class assignment

Bayesian Networks

- Construct a Bayesian Network to describe a car's starting system. Use all the variables below, but don't use any other variables. Each node should have **at most 2** parents.

- Starts - If the car successfully starts
- Radio - If the car radio works
- Gas - If the car has gas
- Battery - If the car battery works
- Ignition - If the ignition works
- Moves - If the car moves when the accelerator is pushed



- Add reasonable CPTs for each event in the network.

$$P(G) = .98$$

$$P(B) = .95$$

$$P(R | \neg B) = .001$$

$$P(R | B) = .99$$

$$P(I | \neg G, \neg B) = 0$$

$$P(I | G, \neg B) = .001$$

$$P(I | \neg G, B) = .3$$

$$P(I | G, B) = .99$$

$$P(S | I) = .98$$

$$P(S | \neg I) = .001$$

$$P(M | \neg G, \neg S) = 0$$

$$P(M | \neg G, S) = .01$$

$$P(M | G, \neg S) = .001$$

$$P(M | G, S) = .99$$

- Given the network you created, show the equations to compute the following queries:

- $P(\text{Starts}=\text{True}, \text{Radio}=\text{True}, \text{Gas}=\text{True}, \text{Battery}=\text{True}, \text{Ignition}=\text{True}, \text{Moves}=\text{True})$

$$= P(B) P(G) P(I | G, B) P(S | I) P(M | G, S) P(R | B)$$

- $P(\text{Starts}=\text{False}, \text{Radio}=\text{True}, \text{Gas}=\text{True}, \text{Battery}=\text{True}, \text{Ignition}=\text{True}, \text{Moves}=\text{False})$

$$= P(G) P(B) P(I | G, B) P(R | B) P(\neg S | I) P(\neg M | G, \neg S)$$

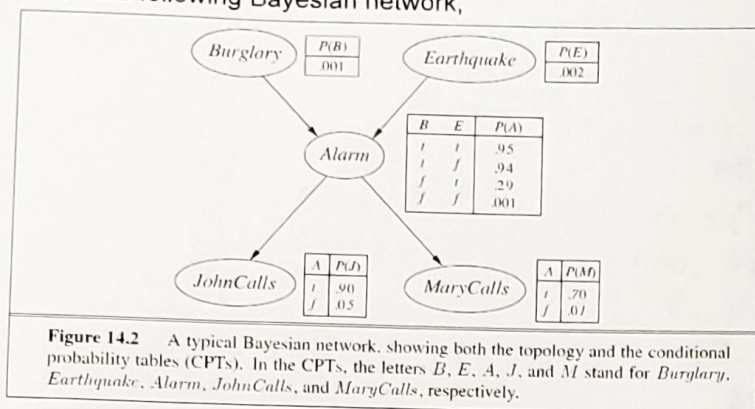
- c. $P(\text{Starts}=\text{True}, \text{Radio}=\text{True}, \text{Gas}=\text{True}, \text{Battery}=\text{True}, \text{Ignition}=\text{True}, \text{Moves}=\text{False})$

$$= P(B) P(G) P(R|B) P(I|B, G) P(S|I) P(\neg M|G, S)$$

- d. $P(\text{Starts}=\text{False}, \text{Radio}=\text{True}, \text{Gas}=\text{False}, \text{Battery}=\text{True}, \text{Ignition}=\text{True}, \text{Moves}=\text{False})$

$$= P(\neg G) P(B) P(I|\neg G, B) P(\neg S|I) P(\neg M|\neg S, \neg G) P(R|B)$$

4. Given the following Bayesian network,



- a) What nodes are in the Markov blanket of node Burglary?

Alarm, Earthquake

- b) What nodes are in the Markov blanket of JohnCalls?

Alarm

- c) What nodes are in the Markov blanket of Alarm?

Burglary, Earthquake, JohnCalls, MaryCalls

- d) Given Alarm=True, are JohnCalls and MaryCalls conditionally independent? Why or why not?

Yes. They are not a part of each others Markov blankets