

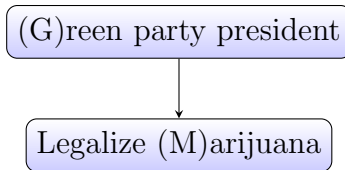
Student(s):

Nov. 12, 2015

Bayes Nets

1 Green Party

Its election season, and the chosen president may or may not be the Green Party candidate. Pundits believe that Green Party presidents are more likely to legalize marijuana than candidates from other parties, but legalization could occur under any administration. Armed with the power of probability, the analysts model the situation with the Bayes Net below.



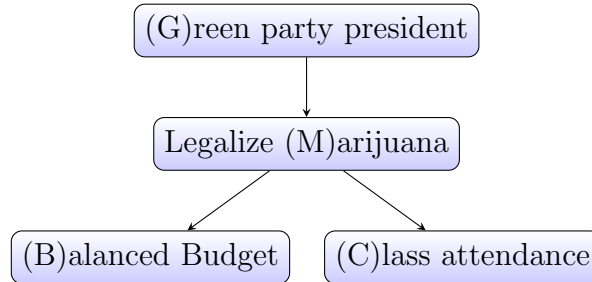
	+g	-g
P(g)	0.25	0.75

	$P(+m g)$	$P(-m g)$
+g	0.8	0.2
-g	0.1	0.9

1. What is the marginal probability that marijuana is legalized $P(+m)$?

2. News agencies air 24/7 coverage of the recent legalization of marijuana (+m), but you cant seem to find out who won the election. What is the conditional probability $P(+g|+m)$ that a Green Party president was elected?

We can make better inferences if we observe more evidence. Now we are going to expand on the model (Bayes net) by introducing two new random variables: whether the budget is balanced (B), and whether class attendance increases (C). The expanded Bayes net and conditional distributions are shown below.



	$P(+b m)$	$P(-b m)$		$P(+c m)$	$P(-c m)$
+m	0.3	0.7		0.2	0.8
-m	0.2	0.8		0.5	0.5

3. Compute the full joint distribution table below:

G	M	B	C	$P(G, M, B, C)$
+	+	+	+	
+	+	+	-	
+	+	-	+	
+	+	-	-	
+	-	+	+	
+	-	+	-	
+	-	-	+	
+	-	-	-	
-	+	+	+	
-	+	+	-	
-	+	-	+	
-	+	-	-	
-	-	+	+	
-	-	+	-	
-	-	-	+	
-	-	-	-	

4. Compute the following values:

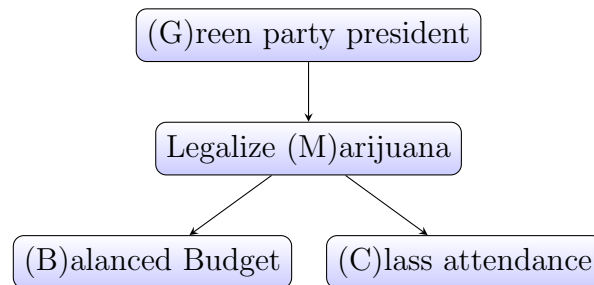
a. $P(+b | +m, +g)$

b. $P(+b)$

c. $P(+c | +b)$

d. $P(+b | +m)$

5. Now, add a node S to the Bayes net that reflects the possibility that a new scientific study could influence the probability that marijuana is legalized. Assume that the study does not directly influence B or C . Draw the new Bayes net below. Which CPT or CPTs need to be modified?



6. Consider your augmented model. Just based on the structure, which of the following are guaranteed to be true, and which are guaranteed to be false?

a. $B \perp\!\!\!\perp G$

b. $B \perp\!\!\!\perp C$

c. $C \perp\!\!\!\perp G | M$

d. $B \perp\!\!\!\perp C | G$

e. $G \perp\!\!\!\perp S$