Regular Discussion 5 Solutions

1 Probability

Use the probability table to calculate the following values:

X_1	X_2	X_3	$P(X_1, X_2, X_3)$
0	0	0	0.05
1	0	0	0.1
0	1	0	0.4
1	1	0	0.1
0	0	1	0.1
1	0	1	0.05
0	1	1	0.2
1	1	1	0.0

1. $P(X_1 = 1, X_2 = 0) = 0.15$
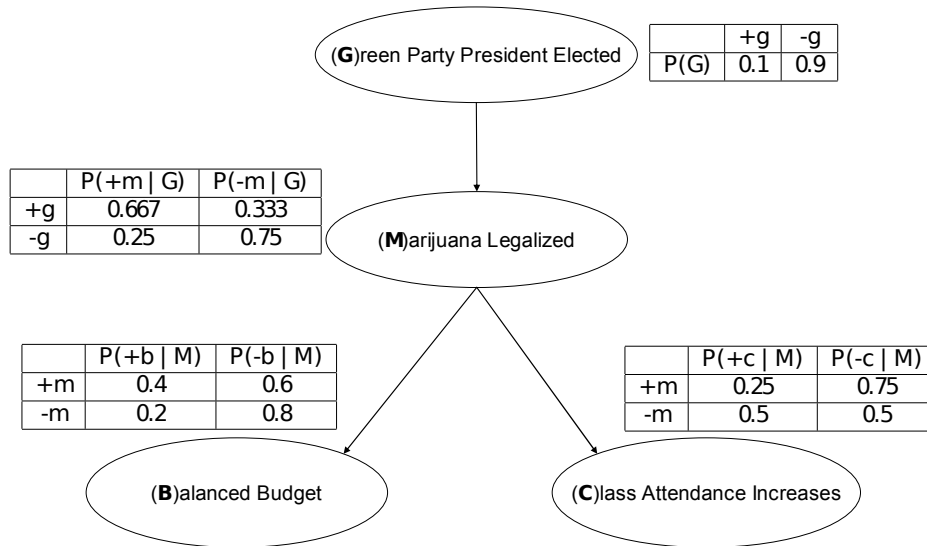
2. $P(X_3 = 0) = 0.65$

3. $P(X_2 = 1 | X_3 = 1) = 0.2/0.35$

4. $P(X_1 = 0 | X_2 = 1, X_3 = 1) = 1$

5. $P(X_1 = 0, X_2 = 1 | X_3 = 1) = 0.2/0.35$

Q2. Bayes Nets: Green Party President

In a parallel universe the Green Party is running for presidency. Whether a Green Party President is elected (G) will have an effect on whether marijuana is legalized (M), which then influences whether the budget is balanced (B), and whether class attendance increases (C). Armed with the power of probability, the analysts model the situation with the Bayes Net below.

	+g	-g
P(G)	0.1	0.9

(**G**)reen Party President Elected

	P(+m | G)	P(-m | G)
+g	0.667	0.333
-g	0.25	0.75

(**M**)arijuana Legalized

	P(+b | M)	P(-b | M)
+m	0.4	0.6
-m	0.2	0.8

	P(+c | M)	P(-c | M)
+m	0.25	0.75
-m	0.5	0.5

(**B**)alanced Budget

(**C**)lass Attendance Increases

1. The full joint distribution is given below. Fill in the missing values.

G	M	B	C	$P(G, M, B, C)$	G	M	B	C	$P(G, M, B, C)$
+	+	+	+	1/150	-	+	+	+	9/400
+	+	+	-	1/50	-	+	+	-	27/400
+	+	-	+	1/100	-	+	-	+	27/800
+	+	-	-	3/100	-	+	-	-	81/800
+	-	+	+	1/300	-	-	+	+	27/400
+	-	+	-	1/300	-	-	+	-	27/400
+	-	-	+	1/75	-	-	-	+	27/100
+	-	-	-	1/75	-	-	-	-	27/100

2. 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 CPT's need to be modified?

$P(M|G)$ will become $P(M|G, S)$, and will contain 8 entries instead of 4.

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        (S)tudy results          (G)reen Party President Elected


                    (M)arijuana Legalized


        (B)alanced Budget              (C)lass Attendance Increases
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