CS188: Exam Practice Session 6

Q1. Probabilities

(a) Fill in the circles of **all** expressions that are equal to **1**, **given no independence assumptions**:

- ◯ $\sum_a P(A = a \mid B)$
- ◯ $\sum_b P(A \mid B = b)$
- ◯ $\sum_a \sum_b P(A = a, B = b)$
- ◯ $\sum_a \sum_b P(A = a \mid B = b)$
- ◯ $\sum_a \sum_b P(A = a)\ P(B = b)$
- ◯ $\sum_a P(A = a)\ P(B = b)$
- ◯ None of the above.

(b) Fill in the circles of **all** expressions that are equal to $\mathbf{P}(\mathbf{A}, \mathbf{B}, \mathbf{C})$, **given no independence assumptions**:

- ◯ $P(A \mid B, C)\ P(B \mid C)\ P(C)$
- ◯ $P(C \mid A, B)\ P(A)\ P(B)$
- ◯ $P(A, B \mid C)\ P(C)$
- ◯ $P(C \mid A, B)\ P(A, B)$
- ◯ $P(A \mid B)\ P(B \mid C)\ P(C)$
- ◯ $P(A \mid B, C)\ P(B \mid A, C)\ P(C \mid A, B)$
- ◯ None of the above.

(c) Fill in the circles of **all** expressions that are equal to $\mathbf{P}(\mathbf{A} \mid \mathbf{B}, \mathbf{C})$, **given no independence assumptions**:

- ◯ $\frac{P(A,B,C)}{\sum_a P(A=a,B,C)}$
- ◯ $\frac{P(B,C|A)\ P(A)}{P(B,C)}$
- ◯ $\frac{P(B|A,C)\ P(A|C)}{P(B|C)}$
- ◯ $\frac{P(B|A,C)\ P(A|C)}{P(B,C)}$
- ◯ $\frac{P(B|A,C)\ P(C|A,B)}{P(B,C)}$
- ◯ $\frac{P(A,B|C)}{P(B|A,C)}$
- ◯ None of the above.

(d) Fill in the circles of **all** expressions that are equal to $\mathbf{P}(\mathbf{A} \mid \mathbf{B})$, **given that $\mathbf{A} \perp\!\!\!\perp \mathbf{B} \mid \mathbf{C}$**:

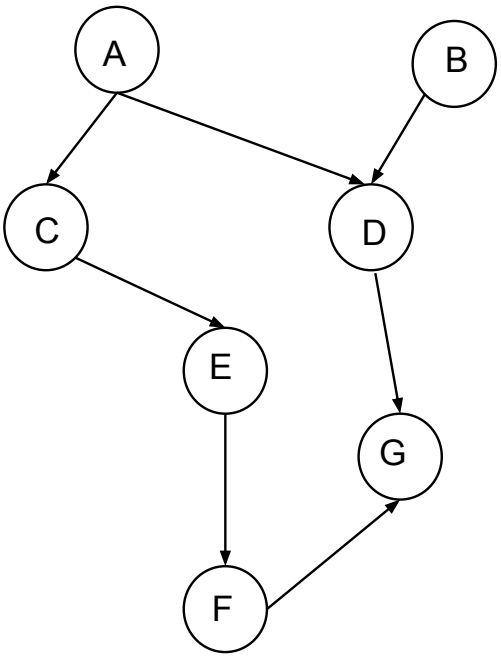
- ◯ $\frac{P(A|C)\ P(B|C)}{P(B)}$
- ◯ $\frac{P(A|C)\ P(B|C)}{P(B|C)}$
- ◯ $\frac{\sum_c P(A|C=c)\ P(B|C=c)\ P(C=c)}{\sum_{c'} P(B|C=c')\ P(C=c')}$
- ◯ $\frac{P(A|B,C)}{P(A|C)}$
- ◯ $\frac{\sum_c P(B|A,C=c)\ P(A,C=c)}{P(B)}$
- ◯ $\frac{\sum_c P(A,C=c)\ P(B|C=c)}{\sum_{c'} P(A,B,C=c')}$
- ◯ None of the above.

(e) Fill in the circles of **all** expressions that are equal to $\mathbf{P}(\mathbf{A}, \mathbf{B}, \mathbf{C})$, **given that $\mathbf{A} \perp\!\!\!\perp \mathbf{B} \mid \mathbf{C}$ and $\mathbf{A} \perp\!\!\!\perp \mathbf{C}$**:

- ◯ $P(A)\ P(B)\ P(C)$
- ◯ $P(A)\ P(B, C)$
- ◯ $P(A \mid B)\ P(B \mid C)\ P(C)$
- ◯ $P(A \mid B, C)\ P(B \mid A, C)\ P(C \mid A, B)$
- ◯ $P(A \mid C)\ P(B \mid C)\ P(C)$
- ◯ $P(A \mid C)\ P(B \mid C)$
- ◯ None of the above.

Q2. Bayes Nets: Independence

Consider a Bayes Net with the following graph:



Which of the following are guaranteed to be true without making any additional conditional independence assumptions, other than those implied by the graph? (Mark all true statements)

- ◯ $P(A \mid C, E) = P(A \mid C)$
- ◯ $P(A, E \mid G) = P(A \mid G) * P(E \mid G)$
- ◯ $P(A \mid B = b) = P(A)$
- ◯ $P(A \mid B, G) = P(A \mid G)$
- ◯ $P(E, G \mid D) = P(E \mid D) * P(G \mid D)$
- ◯ $P(A, B \mid F) = P(A \mid F) * P(B \mid F)$