

专业：人工智能

学号 + 姓名：

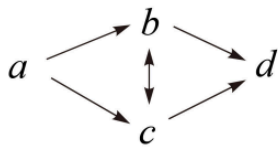
1. 请使用基于回答集编程的方法计算图中 3 个论辩框架的外延

- 分别写出三个论辩框架的回答集程序 P_{Nieves}^{pr} ;
 - (a)
 - $\text{def}(a) \vee \text{def}(b) \leftarrow$
 - $\text{def}(a) \vee \text{def}(c) \leftarrow$
 - $\text{def}(b) \vee \text{def}(c) \leftarrow$
 - $\text{def}(b) \vee \text{def}(d) \leftarrow$
 - $\text{def}(c) \vee \text{def}(d) \leftarrow$
 - $\text{def}(a) \leftarrow$
 - $\text{def}(b) \leftarrow \text{def}(b)$
 - $\text{def}(c) \leftarrow \text{def}(c)$
 - $\text{def}(d) \leftarrow \text{def}(c), \text{def}(b)$
 - (b)
 - $\text{def}(a) \vee \text{def}(b) \leftarrow$
 - $\text{def}(a) \vee \text{def}(c) \leftarrow$
 - $\text{def}(b) \vee \text{def}(c) \leftarrow$
 - $\text{def}(a) \vee \text{def}(d) \leftarrow$
 - $\text{def}(c) \vee \text{def}(e) \leftarrow$
 - $\text{def}(a) \leftarrow \text{def}(a), \text{def}(c)$
 - $\text{def}(b) \leftarrow \text{def}(b), \text{def}(d), \text{def}(a)$
 - $\text{def}(c) \leftarrow \text{def}(b), \text{def}(d)$
 - $\text{def}(d) \leftarrow \text{def}(b), \text{def}(d)$
 - $\text{def}(e) \leftarrow \text{def}(a)$
 - (c)
 - $\text{def}(a) \vee \text{def}(b) \leftarrow$
 - $\text{def}(a) \vee \text{def}(c) \leftarrow$
 - $\text{def}(b) \vee \text{def}(c) \leftarrow$
 - $\text{def}(a) \vee \text{def}(d) \leftarrow$
 - $\text{def}(c) \vee \text{def}(d) \leftarrow$
 - $\text{def}(b) \vee \text{def}(d) \leftarrow$
 - $\text{def}(a) \leftarrow \text{def}(c)$
 - $\text{def}(b) \leftarrow \text{def}(a)$
 - $\text{def}(c) \leftarrow \text{def}(b)$
 - $\text{def}(d) \leftarrow \text{def}(a), \text{def}(b), \text{def}(c)$
- 分别写出三个论辩框架的回答集程序 $P_{Wakaki}^{AF} \cup P_{Wakaki}^{co}$ 及 $P_{Wakaki}^{AF} \cup P_{Wakaki}^{st}$ 。
 - (a)
 - $P_{Wakaki}^{AF} \cup P_{Wakaki}^{co}$
 - $\text{arg}(a) \leftarrow$
 - $\text{arg}(b) \leftarrow$

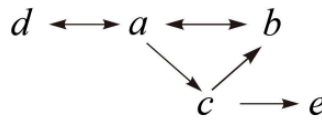
- $\text{arg}(c) \leftarrow$
- $\text{arg}(d) \leftarrow$
- $\text{att}(a, b) \leftarrow$
- $\text{att}(a, c) \leftarrow$
- $\text{att}(b, c) \leftarrow$
- $\text{att}(c, b) \leftarrow$
- $\text{att}(b, d) \leftarrow$
- $\text{att}(c, d) \leftarrow$
- $\text{in}(a) \leftarrow \text{arg}(a), \text{not ng}(a)$
- $\text{undec}(a) \leftarrow \text{arg}(a), \text{not in}(a), \text{not out}(a)$
- $\text{in}(b) \leftarrow \text{arg}(b), \text{not ng}(b)$
- $\text{ng}(b) \leftarrow \text{in}(a), \text{att}(a, b)$
- $\text{ng}(b) \leftarrow \text{undec}(a), \text{att}(a, b)$
- $\text{out}(b) \leftarrow \text{in}(a), \text{att}(a, b)$
- $\text{ng}(b) \leftarrow \text{in}(c), \text{att}(c, b)$
- $\text{ng}(b) \leftarrow \text{undec}(c), \text{att}(c, b)$
- $\text{out}(b) \leftarrow \text{in}(c), \text{att}(c, b)$
- $\text{undec}(b) \leftarrow \text{arg}(b), \text{not in}(b), \text{not out}(b)$
- $\text{in}(X) \leftarrow \text{arg}(X), \text{not ng}(X)$
- $\text{ng}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
- $\text{ng}(X) \leftarrow \text{undec}(Y), \text{att}(Y, X)$
- $\text{out}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
- $\text{undec}(X) \leftarrow \text{arg}(X), \text{not in}(Y), \text{not out}(X)$
- $P_{\text{Wakaki}}^{\text{AF}} \cup P_{\text{Wakaki}}^{\text{st}}$
 - $\text{arg}(a) \leftarrow .$
 - $\text{arg}(b) \leftarrow .$
 - $\text{arg}(c) \leftarrow .$
 - $\text{arg}(d) \leftarrow .$
 - $\text{att}(a, b) \leftarrow .$
 - $\text{att}(a, c) \leftarrow .$
 - $\text{att}(b, c) \leftarrow .$
 - $\text{att}(c, b) \leftarrow .$
 - $\text{att}(b, d) \leftarrow .$
 - $\text{att}(c, d) \leftarrow .$
 - $\text{in}(a) \leftarrow \text{arg}(a), \text{not ng}(a)$
 - $\text{undec}(a) \leftarrow \text{arg}(a), \text{not in}(a), \text{not out}(a)$
 - $\text{in}(b) \leftarrow \text{arg}(b), \text{not ng}(b)$
 - $\text{ng}(b) \leftarrow \text{in}(a), \text{att}(a, b)$
 - $\text{ng}(b) \leftarrow \text{undec}(a), \text{att}(a, b)$
 - $\text{out}(b) \leftarrow \text{in}(a), \text{att}(a, b)$
 - $\text{ng}(b) \leftarrow \text{in}(c), \text{att}(c, b)$
 - $\text{ng}(b) \leftarrow \text{undec}(c), \text{att}(c, b)$
 - $\text{out}(b) \leftarrow \text{in}(c), \text{att}(c, b)$
 - $\text{undec}(b) \leftarrow \text{arg}(b), \text{not in}(b), \text{not out}(b)$

- $\text{in}(X) \leftarrow \text{arg}(X), \text{not ng}(X)$
 - $\text{ng}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{ng}(X) \leftarrow \text{undec}(Y), \text{att}(Y, X)$
 - $\text{out}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{undec}(X) \leftarrow \text{arg}(X), \text{not in}(Y), \text{not out}(X)$
- (b)
- $P_{\text{Wakaki}}^{\text{AF}} \cup P_{\text{Wakaki}}^{\text{co}}$
 - $\text{arg}(a) \leftarrow .$
 - $\text{arg}(b) \leftarrow .$
 - $\text{arg}(c) \leftarrow .$
 - $\text{arg}(d) \leftarrow .$
 - $\text{arg}(e) \leftarrow .$
 - $\text{att}(a, b) \leftarrow .$
 - $\text{att}(b, a) \leftarrow .$
 - $\text{att}(a, d) \leftarrow .$
 - $\text{att}(d, a) \leftarrow .$
 - $\text{att}(a, c) \leftarrow .$
 - $\text{att}(c, b) \leftarrow .$
 - $\text{att}(c, e) \leftarrow .$
 - $\text{in}(X) \leftarrow \text{arg}(X), \text{not ng}(X)$
 - $\text{ng}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{ng}(X) \leftarrow \text{undec}(Y), \text{att}(Y, X)$
 - $\text{out}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{undec}(X) \leftarrow \text{arg}(X), \text{not in}(Y), \text{not out}(X)$
 - $P_{\text{Wakaki}}^{\text{AF}} \cup P_{\text{Wakaki}}^{\text{st}}$
 - $\text{arg}(a) \leftarrow .$
 - $\text{arg}(b) \leftarrow .$
 - $\text{arg}(c) \leftarrow .$
 - $\text{arg}(d) \leftarrow .$
 - $\text{arg}(e) \leftarrow .$
 - $\text{att}(a, b) \leftarrow .$
 - $\text{att}(b, a) \leftarrow .$
 - $\text{att}(a, d) \leftarrow .$
 - $\text{att}(d, a) \leftarrow .$
 - $\text{att}(a, c) \leftarrow .$
 - $\text{att}(c, b) \leftarrow .$
 - $\text{att}(c, e) \leftarrow .$
 - $\text{in}(X) \leftarrow \text{arg}(X), \text{not ng}(X)$
 - $\text{ng}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{ng}(X) \leftarrow \text{undec}(Y), \text{att}(Y, X)$
 - $\text{out}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{undec}(X) \leftarrow \text{arg}(X), \text{not in}(Y), \text{not out}(X)$
- (c)
- $P_{\text{Wakaki}}^{\text{AF}} \cup P_{\text{Wakaki}}^{\text{co}}$

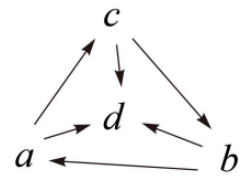
- $\text{arg}(a) \leftarrow .$
 - $\text{arg}(b) \leftarrow .$
 - $\text{arg}(c) \leftarrow .$
 - $\text{arg}(d) \leftarrow .$
 - $\text{att}(a, c) \leftarrow .$
 - $\text{att}(b, a) \leftarrow .$
 - $\text{att}(c, b) \leftarrow .$
 - $\text{att}(a, d) \leftarrow .$
 - $\text{att}(b, d) \leftarrow .$
 - $\text{att}(c, d) \leftarrow .$
 - $\text{in}(X) \leftarrow \text{arg}(X), \text{not ng}(X)$
 - $\text{ng}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{ng}(X) \leftarrow \text{undec}(Y), \text{att}(Y, X)$
 - $\text{out}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{undec}(X) \leftarrow \text{arg}(X), \text{not in}(Y), \text{not out}(X)$
- $P_{\text{Wakaki}}^{\text{AF}} \cup P_{\text{Wakaki}}^{\text{st}}$
- $\text{arg}(a) \leftarrow .$
 - $\text{arg}(b) \leftarrow .$
 - $\text{arg}(c) \leftarrow .$
 - $\text{arg}(d) \leftarrow .$
 - $\text{att}(a, c) \leftarrow .$
 - $\text{att}(b, a) \leftarrow .$
 - $\text{att}(c, b) \leftarrow .$
 - $\text{att}(a, d) \leftarrow .$
 - $\text{att}(b, d) \leftarrow .$
 - $\text{att}(c, d) \leftarrow .$
 - $\text{in}(X) \leftarrow \text{arg}(X), \text{not ng}(X)$
 - $\text{ng}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{ng}(X) \leftarrow \text{undec}(Y), \text{att}(Y, X)$
 - $\text{out}(X) \leftarrow \text{in}(Y), \text{att}(Y, X)$
 - $\text{undec}(X) \leftarrow \text{arg}(X), \text{not in}(Y), \text{not out}(X)$



(a)



(b)



(c)

1. 考虑如下例子：脑转移瘤可能是脑瘤的一个可能原因，也是血清总钙升高的一个解释。反过来，这两者中的任何一种都可能导致患者偶尔陷入昏迷。严重的头痛也可以用脑瘤来解释。在贝叶斯网络中表示这些因果联系。设 a 代表“转移性癌症”，b 代表“血清总钙含量增加”，c 代表“脑瘤”，d 代表“偶尔昏迷”，e 代表“严重头痛”。

- 给出这个网络中隐含的一个独立性假设的例子。

- 假设给定以下概率：

- $P(a) = 0.2$
- $P(b | a) = 0.8, P(b | \bar{a}) = 0.2$
- $P(c | a) = 0.2, P(c | \bar{a}) = 0.05$
- $P(e | c) = 0.8, P(e | \bar{c}) = 0.6$
- $P(d | b, c) = 0.8, P(d | \bar{b}, c) = 0.8$
- $P(d | b, \bar{c}) = 0.8, P(d | \bar{b}, \bar{c}) = 0.05$

假设还给出了某个病人患有严重头痛但尚未陷入昏迷。计算剩下的八种可能性（即，根据 a、b 和 c 发生还是未发生）的联合概率。

$$P(a = 1, b = 1, c = 1, d = 0, e = 1) = 0.2 \times 0.8 \times 0.2 \times 0.2 \times 0.8 = 0.00512$$

$$P(a = 1, b = 1, c = 0, d = 0, e = 1) = 0.2 \times 0.8 \times 0.8 \times 0.2 \times 0.6 = 0.01536$$

$$P(a = 1, b = 0, c = 1, d = 0, e = 1) = 0.2 \times 0.2 \times 0.2 \times 0.2 \times 0.8 = 0.00128$$

$$P(a = 1, b = 0, c = 0, d = 0, e = 1) = 0.2 \times 0.2 \times 0.8 \times 0.95 \times 0.6 = 0.01824$$

$$P(a = 0, b = 1, c = 1, d = 0, e = 1) = 0.8 \times 0.2 \times 0.05 \times 0.2 \times 0.8 = 0.00128$$

$$P(a = 0, b = 1, c = 0, d = 0, e = 1) = 0.8 \times 0.2 \times 0.95 \times 0.2 \times 0.6 = 0.01824$$

$$P(a = 0, b = 0, c = 1, d = 0, e = 1) = 0.8 \times 0.8 \times 0.05 \times 0.2 \times 0.8 = 0.00512$$

$$P(a = 0, b = 0, c = 0, d = 0, e = 1) = 0.8 \times 0.8 \times 0.95 \times 0.95 \times 0.6 = 0.34656$$

求和即得到联合概率 $P(d = 0, e = 1) = 0.4112$

- 根据给出的数字，病人患有转移性癌症的先验概率是 0.2。鉴于病人患有严重头痛但尚未陷入昏迷，我们现在是否更倾向于认为病人患有癌症？请解释。

$$\text{▸ } P(a = 1 | d = 0, e = 1) = \frac{0.00512 + 0.01536 + 0.00128 + 0.01824}{0.4112} = \frac{0.04}{0.004112} < 0.2$$

- 我们不倾向于认为病人患有癌症。未昏迷的结果更符合 b 或 c 不存在的场景，而癌症作为它们的共同原因，其概率被削弱