1.

a. $P(A \cap B) = P(A) \cdot P(B)$

$P(A) = 0.5 = 0.05$

$P(B) = 0.1$

$P(A \cap B) = 0.01 + 0.01 = 0.05$

Therefore, (A,B) are independent

$P(A \cap C) = P(A) \cdot P(C)$

$P(A \cap C) = 0.36 + 0.04 = 0.4$

$P(A) = 0.5 \quad P(C) = 0.75$

$0.05 \cdot 0.75 \neq 0.4$

(A,C) are not independent

$P(B \cap C) = P(B) \cdot P(C)$

$P(B \cap C) = 0.04 + 0.035 = 0.075$

$P(B) \cdot P(C) = 0.1 \cdot 0.75 = 0.075$

So (B,C) are independent

B. Cannot be factored in Nice structure because dependsonpa

A,B are independent, C is not conditionally independent from both A and B

$P(C) \neq P(C|A)$

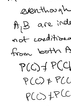
$P(C) \neq P(C|B)$

$P(C) \neq P(C|A,B)$

Violating conditional independence assumption

c. graph representation has 6 free parameters

D.




factored

$P(A,B,C) = P(A) \cdot P(B) \cdot P(C|A^{\sim})$

marginal distributions for A

conditional probabilities $P(B|A)$ or $P(C|A)$ or $P(B \cap C|A)$

$P(A) = 0.5 \quad P(A^{\sim}) = 0.5$ (1 free)

$P(B) = 0.1 \quad P(B^{\sim}) = 0.9$ (1 free)

$P(C|A) = 0.80 \quad P(C^{\sim}|A) = 0.20$ (2 free)

$P(C|A^{\sim}) = 0.70 \quad P(C^{\sim}|A^{\sim}) = 0.3$

4 free parameter

E. $2 \cdot 2 \cdot 2 = 8 - 1 = 7$ free parameter

$7 - 4 = 3$ parameters saved

2.a. $E \perp\!\!\!\perp S$ : False (ECS)

b. $L \perp\!\!\!\perp E \mid F, I$ : True

c. $I \perp\!\!\!\perp E \mid A, C$ : True

d. $L \perp\!\!\!\perp C \mid B, F, S$ : False (LBAREC)

e. $V \perp\!\!\!\perp L \mid B, D, E$ : False (VECSBADL)

f. $D \perp\!\!\!\perp C \mid E, F, S, V$ : True

g. If there is a break in and web-servers is compromised, then vulnerability is high and we need analysis on if intrusion detection can change vulnerability. The probability of an attacker being active effects the probability of intrusion detection. So, intrusion detection effects active attackers, which effects server accessibility. So, at server access, it gives a probability to complexity, which influence the probability of vulnerability. As a result, detection influences probability of vulnerability.

3a.

b. $\begin{matrix} \text{bull} \\ \text{bear} \end{matrix} \begin{pmatrix} 1.0 \\ 0.0 \end{pmatrix} \rightarrow \begin{pmatrix} 0.4 \\ 0.6 \end{pmatrix} \rightarrow \begin{pmatrix} 0.28 \\ 0.72 \end{pmatrix} \rightarrow \begin{pmatrix} 0.256 \\ 0.744 \end{pmatrix}$

$P(S_1) \quad P(S_2) \quad P(S_3) \quad P(S_4)$

$P(S_2) = P(\text{bull}|\text{bull})P(\text{bull}) + P(\text{bull}|\text{bear})P(\text{bear})$

$= 0.4 \rightarrow \text{bull}$

$P(S_3) = 0.4^2 + (0.6)(0.2) = 0.28 \rightarrow \text{bull}$

$P(S_4) = 0.4(0.28) + (0.2)(0.72) = 0.256 \rightarrow \text{bull}$

$1 - \text{bulls} = \text{bear}$

c. $P_{bull}(\text{bull}) = P(\text{bull}|\text{bull})P_{bull}(\text{bull}) + P(\text{bull}|\text{bear})P_{bear}(\text{bear})$

$P_{bear}(\text{bear}) = P(\text{bear}|\text{bull})P_{bull}(\text{bull}) + P(\text{bear}|\text{bear})P_{bear}(\text{bear})$

$P_{bull}(\text{bull}) = 0.4P_{bull}(\text{bull}) + 0.2P_{bull}(\text{bear})$

$P_{bear}(\text{bear}) = 0.6P_{bull}(\text{bull}) + 0.8P_{bull}(\text{bear})$

$0.6P_{bull}(\text{bull}) = 0.2P_{bull}(\text{bear})$

$P_{bull}(\text{bull}) = 0.33P_{bull}(\text{bear})$

$0.2P_{bull}(\text{bear}) = 0.6P_{bull}(\text{bull})$

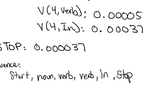
$P_{bull}(\text{bear}) = 3P_{bull}(\text{bull})$

$P_{bull}(\text{bull}) + P_{bull}(\text{bear}) = 1$

So $P_{bull}(\text{bull}) = 0.25 \quad P_{bull}(\text{bear}) = 0.75$

d. Event has no effect on accuracy of market predictions. This is because in the mini-forward algorithm takes the previous state distribution for all and each round. So since it already has previous market predictions, there's no effect on the accuracy.

4.




a. Fruit $V(1,\text{Noun})$: 0.28

Fruit $V(1,\text{Verb})$: 0.02

Fruit $V(1,\text{In})$: 0

Flies $V(2,\text{Noun})$: 0.0224

$V(2,\text{Verb})$: 0.0336

$V(2,\text{In})$: 0

Like $V(3,\text{Noun})$: 0.00168

$V(3,\text{Verb})$: 0.00252

$V(3,\text{In})$: 0.002016

Bananas $V(4,\text{Noun})$: 0.00014

$V(4,\text{Verb})$: 0.00005

$V(4,\text{In})$: 0.00037

STOP: 0.000037

b. sequence:

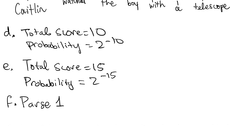
Start, noun, verb, verb, in, stop

5.

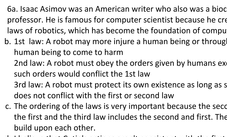
a.

| | | | | | | Score |
|---|---|---|---|---|---|---|
| S | ::= | NP | VP | | 1.000 | 0 |
| NP | ::= | NN | | | 0.250 | 2 |
| NP | ::= | NP | PP | | 0.250 | 2 |
| NP | ::= | NNP | | | 0.125 | 3 |
| NP | ::= | DT | NN | | 0.250 | 2 |
| NN | ::= | NNP | | | 0.125 | 3 |
| VP | ::= | VBD | NP | PP | 0.500 | 1 |
| VP | ::= | VBD | NP | | 0.250 | 2 |
| PP | ::= | IN | NP | | 0.250 | 2 |

b.




c.




d. Total score = 10

Probability ~ $2^{-10}$

e. Total score = 15

Probability = $2^{-15}$

f. Parse 1

6a. Isaac Asimov was an American writer who also was a biochemistry professor. He is famous for computer scientist because he created the three laws of robotics, which has become the foundation of computer science

b. 1st law: A robot may more injure a human being or through inaction, allow a human being to come to harm
2nd law: A robot must obey the orders given by humans except for when such orders would conflict the 1st law
3rd law: A robot must protect its own existence as long as such protection does not conflict with the first or second law

c. The ordering of the laws is very important because the second law includes the first and the third law includes the second and first. These set of laws build upon each other.

d. I believe that Cutie's actions aren't consistent with the first laws. When Cutie influences the robots to obey Cutie as the master instead of a human, violating the 2nd law.

e. I believe Cutie is conscious or sentient because even though the 2nd law is broken, the first and third law is still in place as the robots protect the humans and themselves. So Cutie actions are sentient, thinking of the robots and other humans but also conscious as he wants to be the leader.

f. I believe that it is not ethical because it talks about how robots should be treated with care, like pets and not objects. If the robots were able to improve and perform better instead of dismantle when inoperable, then it would be ethical.