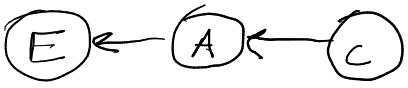
32:00

Question 1

$G = \{F\}$

a) paths



not d-separated by G

since there is a path that is not d-separated by G, we cannot conclude that $E \perp C \mid F$ based on the structure.

Inconclusive

b) $G = \{A\}$

paths

d-separated by G (rule 1)

d-separated by G

Since all paths are d-separated, we can conclude that $C \perp E \mid A$

True

c) $P(C=1 \mid A=0, D=1) = \dfrac{P(C=1, A=0, D=1)}{P(A=0, D=1)}$

$P(C=1, A=0, D=1) = P(D=1)\,P(C=1 \mid D=1)\,P(A=0 \mid C=1)$

$= 0.24 \cdot P(D=1)$ (0.8 and 0.3)

$P(A=0, D=1) = \sum_c P(C=c, A=0, D=1)$

$= \sum_c P(D=1)\,P(C=c \mid D=1)\,P(A=0 \mid C=c)$

$= P(D=1)\,(P(C=0 \mid D=1)P(A=0 \mid C=0) + P(C=1 \mid D=1)P(A=0 \mid C=1))$

$= P(D=1)\,(0.2 \cdot 0.6 + 0.8 \cdot 0.3) = 0.36 \cdot P(D=1)$

$P(C=1 \mid A=0, D=1) = \dfrac{0.24\,P(D=1)}{0.36\,P(D=1)} = \boxed{\frac{2}{3}}$

d) Hypothesis: $E \perp C \mid A, F$

$C = \{A, F\}$

paths

d-separated (rule 1)

d-separated (rule 1)

Since all paths are d-separated we know that $E \perp C \mid A, F$. Therefore

$$P(E \mid C, A, F) = P(E \mid A, F)$$

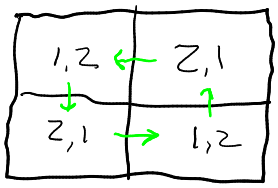
Since $P(E=0 \mid A=1, F=1) = 0.4$ we have

$$\boxed{P(E=1 \mid A=1, F=1) = 0.6}$$

Question 2

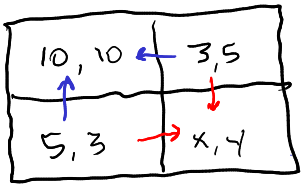
9:00

a)



There are no pure Nash equilibria, but every game has at least one Nash equilibrium. Hence, this game must have a mixed Nash equilibrium.

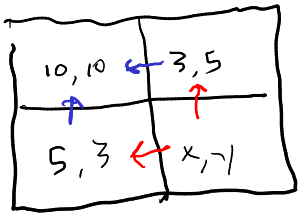
b)



We will have two Nash equilibria if we can induce the red arrows

$x = 6, y = 6$ will accomplish this

c)

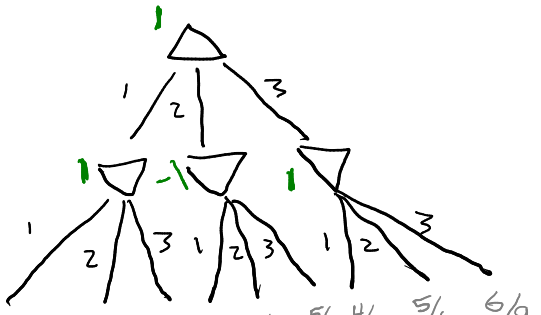


If we can induce the red arrows, a will be a dominant strategy for both players,

$x = 2, y = 2$ will accomplish this.

Question 3

a)



b) Values indicated above in green.

c) Player 1, the maximizing player, has the advantage because the value at the root node is 1.

d) Player 1 should choose either 1 or 3 because the value of those actions is +1. If Player 1 chooses 2, they will lose because the value is -1.