

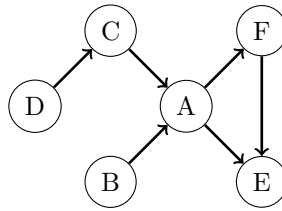
ASEN 5519-002 Decision Making under Uncertainty

Quiz 3: Bayesian Networks and Games

Show all work and justify and box answers.

You may consult any source, but you may NOT communicate with any person except the instructor.

Question 1. (40 pts) Consider the following Bayesian network structure:



- True or Inconclusive given structure: $E \perp C \mid F$? Justify your answer.
- True or Inconclusive given structure: $E \perp C \mid A$? Justify your answer.
- Suppose that all random variables in the network are binary. Given the following conditional distributions and evidence values, infer the probability of $C = 1$.
 - $P(C = 1 \mid D = 1) = 0.8$
 - $P(A = 1 \mid C = 1) = 0.7$
 - $P(A = 1 \mid C = 0) = 0.4$
 - Evidence: $D = 1, A = 0$
- Suppose that $P(E = 0 \mid C = 0, A = 1, F = 1) = 0.4$. What is $P(E = 1 \mid C = 1, A = 1, F = 1)$? Justify your answer.

Question 2. (30 pts) Answer the following questions about simple games:

- a) Does the following game have a Nash equilibrium? Justify your answer.

		Player 2	
		a	b
Player 1	a	1,2	2,1
	b	2,1	1,2

- b) Consider the following incomplete game matrix:

		Player 2	
		a	b
Player 1	a	10,10	3,5
	b	5,3	x,y

Choose x and y so that the game has two pure Nash equilibria.

- c) In the incomplete game matrix above, choose x and y so that the game has a single dominant strategy equilibrium.

Question 3. (30 pts) Consider a turn taking game where Player 1 (the maximizing player) chooses a number between 1 and 3 (i.e. 1, 2, or 3) then, after seeing Player 1's number, Player 2 also chooses a number between 1 and 3. If *both* the sum of the two numbers *and* the product of the two numbers are even, Player 2 wins, otherwise, Player 1 wins.

- Draw a minimax tree depicting this game labeled with payoffs.
- Use minimax backup to calculate the values at each node and indicate them on the tree.
- Which player has the advantage?
- What number should Player 1 choose?