

Adversarial Search - Bayesian Networks

Assignment 3

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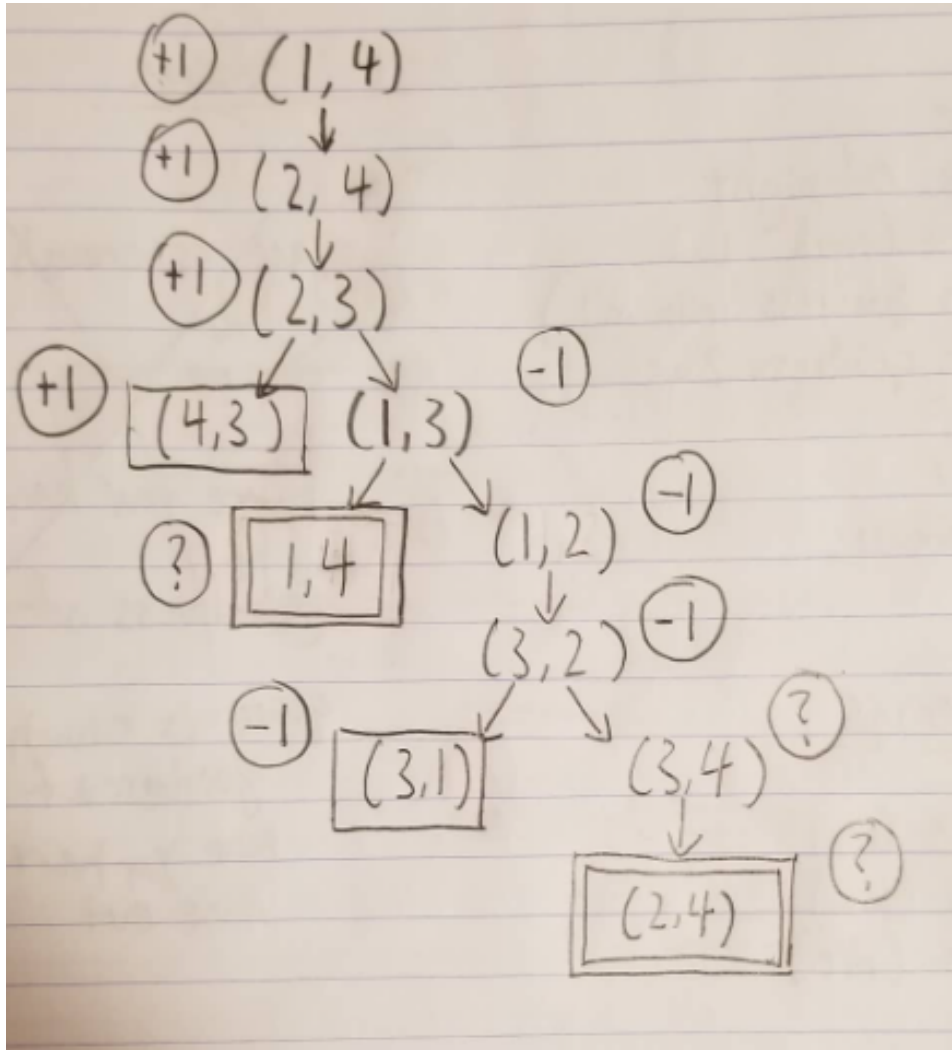
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Problem 1



"?" values are used to annotate loop states. When an agent has to choose between a +1 value and a "?" value (+1,?) the max player will always choose +1 while the min player will choose ?, and vice versa for (-1,?), with the min player choosing -1 and the max player choosing "?". Since the game value of a loop state is unknown, it is best for a max/min player to choose the corresponding max/min value if it is available, however if that value is not available the "?" state is a viable option to explore as it cannot be worse than an immediate loss. If all the successors of a state have a "?" value, the backed-up value is also "?".

Problem 2

- (a) Computing the joint probability distribution:

$$P(a, b, c, d, e) = P(a) * P(b) * P(c) * P(d|a, b) * P(e|b, c)$$

$$P(a, b, c, d, e) = 0.2 * 0.5 * 0.8 * 0.1 * 0.3$$

$$P(a, b, c, d, e) = 0.0024$$

- (b) Computing the joint probability distribution:

$$P(\neg a, \neg b, \neg c, \neg d, \neg e) = P(\neg a) * P(\neg b) * P(\neg c) * P(\neg d|\neg a, \neg b) * P(\neg e|\neg b, \neg c)$$

$$P(\neg a, \neg b, \neg c, \neg d, \neg e) = 0.8 * 0.5 * 0.2 * 0.1 * 0.8$$

$$P(\neg a, \neg b, \neg c, \neg d, \neg e) = 0.0064$$

- (c) Using the conditional probability rule $P(A|B) = \frac{P(A \cap B)}{P(B)}$

$$P(\neg a|b, c, d, e) = \frac{P(\neg a, b, c, d, e)}{P(b, c, d, e)}$$

$$P(\neg a|b, c, d, e) = \frac{P(\neg a, b, c, d, e)}{P(a, b, c, d, e) + P(\neg a, b, c, d, e)}$$

$$P(\neg a|b, c, d, e) = \frac{P(\neg a) * P(b) * P(c) * P(d|\neg a, b) * P(e|b, c)}{0.0024 + P(\neg a) * P(b) * P(c) * P(d|\neg a, b) * P(e|b, c)}$$

$$P(\neg a|b, c, d, e) = \frac{0.8 * 0.5 * 0.8 * 0.6 * 0.3}{0.0024 + 0.8 * 0.5 * 0.8 * 0.6 * 0.3}$$

$$P(\neg a|b, c, d, e) = \frac{0.0576}{0.0024 + 0.0576}$$

$$P(\neg a|b, c, d, e) = 0.96$$

Problem 3

- (a)

- (b)

Problem 4

- (a)

- (b)