

Intelligent Autonomous Agents and Cognitive Robotics

Exercise Sheet 7

1. Give a DBN example with CPTs that show how transient failure of measurement devices can be handled. Use CPTs of size 3x3 and write down an expression that shows the effect of your design.
2. Describe the main steps of particle filtering. Also, compare particle filtering with Likelihood weighting.
3. What would happen if resampling is skipped in particle filtering?
4. Given the following possible gambles. What is the relationship between the gambles in terms of dominance?

Dominance is defined as follows :

Random variable **A** has stochastic dominance over random variable **B**

if for any outcome x , **A** gives at least as high a probability of receiving at least x as does **B**, and for some x , **A** gives a higher probability of receiving at least x .

$\Pr(A \geq x) \geq \Pr(B \geq x)$ for all x , and for some x . $\Pr(A \geq x) > \Pr(B \geq x)$

| State (die result) | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------------|---|---|---|---|---|---|
| Gamble A wins \$ | 1 | 1 | 2 | 2 | 2 | 2 |
| Gamble B wins \$ | 1 | 1 | 1 | 2 | 2 | 2 |
| Gamble C wins \$ | 3 | 3 | 3 | 1 | 1 | 1 |

5. Show that the judgments $B > A$ and $C > D$ in the Allais paradox of the lecture violate the axiom of substitutability.