

# Assignment 3: Bayesian Inference, Temporal State Estimation and Decision Making under Uncertainty

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## Problem 1:

**a**

The probability that all five of the Boolean variables are simultaneously true is:

$$P(A) = 0.2$$

$$P(B) = 0.5$$

$$P(C) = 0.8$$

$$P(D \mid A \wedge B) = 0.1$$

$$P(E \mid B \wedge C) = 0.3$$

$$P(A \wedge B) = 0.1$$

$$P(A \wedge B \wedge C) = 0.08$$

$$P(A \wedge B \wedge C) \times P(D \mid A \wedge B) = 0.008$$

$$P(A \wedge B \wedge C) \times P(D \mid A \wedge B) \times P(E \mid B \wedge C) = 0.0024$$

**b**

The probability that all five of the Boolean variables are simultaneously false is:

$$P(\neg A) = 0.8$$

$$P(\neg B) = 0.5$$

$$P(\neg C) = 0.2$$

$$P(\neg D \mid \neg A \wedge \neg B) = 0.1$$

$$P(\neg E \mid \neg B \wedge \neg C) = 0.8$$

$$P(\neg A \wedge \neg B) = 0.4$$

$$P(\neg A \wedge \neg B \wedge \neg C) = 0.08$$

$$P(\neg A \wedge \neg B \wedge \neg C) \times P(\neg D \mid \neg A \wedge \neg B) = 0.008$$

$$P(\neg A \wedge \neg B \wedge \neg C) \times P(\neg D \mid \neg A \wedge \neg B) \times P(\neg E \mid \neg B \wedge \neg C) = 0.0064$$

**c**

$$P(\neg A) = 0.8$$

$$P(D \wedge B) = 0.7$$

$$P(D \wedge B \mid \neg A) = 0.6$$

$$P(\neg A \mid D \wedge B) = \frac{0.8 * 0.6}{0.7} = 0.686$$

**Problem 2:**

a

b

c

**Problem 3:**

a

b

c

**Problem 4:**

a

b

c

d

**Problem 5 - Programming Component:**

a

b

c - Generating Ground Truth Data

d - Filtering and Viterbi Algorithms in Large Maps

e

f

g

h - Computational Approximations