

Homework 3: James Carroll and Joel Carrillo

Bayesian Inference, Temporal State Estimation and Decision Making under Uncertainty

1. Question 1

(a) a) $P(A, B, C, D, E) = P(A)P(B)P(C)P(D|A, B)P(E|B, C) = (0.2)(0.5)(0.8)(0.1)(0.3) = 0.0024$

(b) b) $P(\neg A)P(\neg B)P(\neg C)P(\neg D)P(\neg E) = P(\neg A)P(\neg B)P(\neg C)P(\neg D|\neg A, \neg B)P(\neg E|\neg B, \neg C) = (1 - 0.2)(1 - 0.5)(1 - 0.8)(1 - 0.9)(1 - 0.2) = (0.8)(0.5)(0.2)(0.1)(0.8) = 0.0064$

(c) c) $P(\neg A|B, C, D, E) = \frac{P(\neg A, B, C, D, E)}{P(\neg A, B, C, D, E) + P(A, B, C, D, E)} P(\neg A, B, C, D, E) = \frac{P(\neg A)P(B)P(C)P(D|\neg A, B)P(E|B, C)}{(0.8)(0.5)(0.8)(0.6)(0.3)} = \frac{0.0576}{0.0576 + 0.0024} = 0.96$

2. Question 2

3. Question 3

- (a) a)
- i. By definition: $P(X|MB(X)) = P(X|Parents, Children, PofC)$
 - ii. FJPD for parents: $P(Y_i, \dots, Y_n) = \prod_i P(Y_i|Z_i)$
 - iii. All together:
- (b) b)
- (c) c)

4. Question 4

5. Question 5a

6. Question 5b

7. Question 5c

8. Question 5d

9. Question 5e

10. Question 5f

11. Question 5h