Rutgers University
CS440: Introduction to Artificial Intelligence, Spring 2017
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Homework 3: James Carroll and Joel Carrillo

Bayesian Inference, Temporal State Estimation and Decision Making under Uncertainty

1. Question 1
   (a) a)
      i. $P(A, B, C, D, E) =$
      ii. $P(A)P(B)P(C)P(D|A, B)P(E|B, C) =$
      iii. $(0.2)(0.5)(0.8)(0.1)(0.3) = 0.0024$
   (b) b)
      i. $P(\neg A)P(\neg B)P(\neg C)P(\neg D)P(\neg E) =$
      ii. $P(\neg A)P(\neg B)P(\neg C)P(\neg D|\neg A, \neg B)P(\neg E|\neg B, \neg C) =$
      iii. $(1 - 0.2)(1 - 0.5)(1 - 0.8)(1 - 0.9)(1 - 0.2) =$
      iv. $(0.8)(0.5)(0.2)(0.1)(0.8) = 0.0064$
   (c) c)
      i. $P(\neg A|B, C, D, E) = \frac{P(\neg A,B,C,D,E)}{P(\neg A,B,C,D,E)+P(A,B,C,D,E)}$
      ii. $P(\neg A, B, C, D, E) = P(\neg A)P(B)P(C)P(D|\neg A, B)P(E|B, C) =$
      iii. $(0.8)(0.5)(0.8)(0.6)(0.3) = 0.0576$
      iv. $\frac{0.0576}{0.0576+0.0024} = 0.96$
2. Question 2
3. Question 3
   (a) a)
      i. By definition: $P(X|MB(X)) = P(X|Parents, Children, PofC)$
      ii. FJPD for parents: $P(Y_i, ..., Y_n) = \prod i = 1^n P(Y_i|Z_i 1)$
      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