

# Homework 2

CS 3793/5233 – Fall 2016  
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assigned September 9, 2016  
due September 23, 2016

The first three items in this homework consider the unicorn world, in which the following statements are true.

If the unicorn is mythical, then it is immortal.

If the unicorn is not mythical, then it is a mortal mammal.

If the unicorn is immortal or a mammal or both, then it is horned.

The unicorn is magical if it is horned.

1. (10 pts.) Provide a list of propositional symbols for the unicorn world, and provide a list of the possible models (truth assignments to symbols) for the unicorn world. You should have 5 symbols and 3 models.
2. (20 pts.) Write the knowledge base for the unicorn world.
  - (a) Write each statement using an implication operator.
  - (b) Write the statements in conjunctive normal form. That is, each sentence in your knowledge base should be a disjunction (OR) of literals. A statement above might translate into multiple sentences in your knowledge base.
3. (10 pts.) Show the unicorn world as a CSP. This should look like figure 4.4 from section 4.5 in the book. Each of the five symbols should be a variable (true or false). Each sentence from your CNF representation should be a constraint. Show the result of applying arc consistency assuming that the unicorn is a mammal.

4. (20 pts.) For the following joint probability distribution, determine  $P(B | D)$ ,  $P(B | \neg D)$ ,  $P(\neg B | D)$ ,  $P(\neg B | \neg D)$ ,  $P(D | B)$ ,  $P(D | \neg B)$ ,  $P(\neg D | B)$ , and  $P(\neg D | \neg B)$ .

$\mathbf{P}(A, B, C, D)$				
<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>P</i>
<i>T</i>	<i>T</i>	<i>T</i>	<i>T</i>	0.040
<i>T</i>	<i>T</i>	<i>T</i>	<i>F</i>	0.040
<i>T</i>	<i>T</i>	<i>F</i>	<i>T</i>	0.256
<i>T</i>	<i>T</i>	<i>F</i>	<i>F</i>	0.064
<i>T</i>	<i>F</i>	<i>T</i>	<i>T</i>	0.016
<i>T</i>	<i>F</i>	<i>T</i>	<i>F</i>	0.064
<i>T</i>	<i>F</i>	<i>F</i>	<i>T</i>	0.128
<i>T</i>	<i>F</i>	<i>F</i>	<i>F</i>	0.192
<i>F</i>	<i>T</i>	<i>T</i>	<i>T</i>	0.010
<i>F</i>	<i>T</i>	<i>T</i>	<i>F</i>	0.010
<i>F</i>	<i>T</i>	<i>F</i>	<i>T</i>	0.016
<i>F</i>	<i>T</i>	<i>F</i>	<i>F</i>	0.004
<i>F</i>	<i>F</i>	<i>T</i>	<i>T</i>	0.016
<i>F</i>	<i>F</i>	<i>T</i>	<i>F</i>	0.064
<i>F</i>	<i>F</i>	<i>F</i>	<i>T</i>	0.032
<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>	0.048

5. Consider the Bayesian network in Exercise 6.6 in the textbook.
- (a) (20 pts.) Compute  $P(E = \text{true})$
- (b) (20 pts.) Compute  $P(E = \text{true} | F = \text{false})$ .