

Homework #6: Chapters 13-16

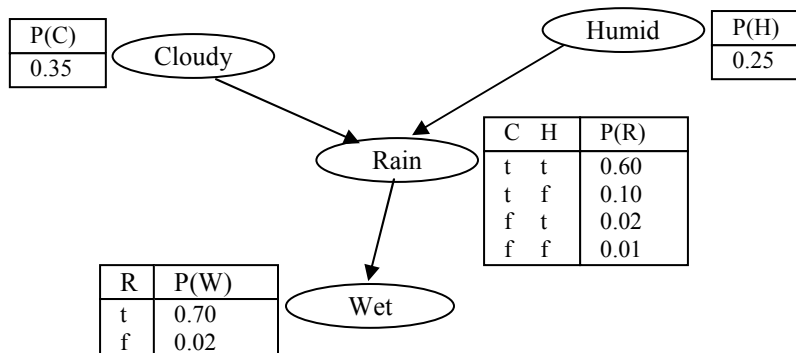
The following exercises are due at the beginning of class on Wednesday, April 16. Note, this homework is continued on the reverse side of the paper.

1. [25 points] A full joint distribution for the Boolean random variables A , B , and C is specified below. Assume that the true value of a random variable is the corresponding lower case letter (e.g., $P(b)$ means $P(B=true)$).

	b		$\neg b$	
	c	$\neg c$	c	$\neg c$
a	0.01	0.20	0.10	0.25
$\neg a$	0.04	0.05	0.15	0.20

Use the distribution to compute the following probabilities and probability distribution. Show your work.

- $P(\neg a)$
 - $P(C)$
 - $P(a \wedge \neg b)$
 - $P(c \vee \neg a)$
 - $P(a \mid \neg b \wedge c)$
2. [30 points total] Use the Bayesian network and conditional probability tables shown below to compute the following probabilities and probability distributions. All random variables are Boolean, and you should use a <true,false> ordering for probability distributions. You must give computed numeric answers and show all of your work.



- [5 pts] $P(w \wedge \neg r \wedge \neg c \wedge h)$
 - [10 pts] $P(h \wedge r \wedge \neg w)$
 - [15 pts] $P(C \mid w)$
3. [20 pts.] Do exercise 14.2 (a-d) from the book (p. 533).
4. [25 pts.] Consider the following variation of the Wumpus World agent. The agent has determined the probabilities of the outcomes of three different action sequences: A, B and C. The outcomes are defined by two Boolean propositions: *Gold* and *Die*. *Gold* is true if the agent gets the gold. *Die* is true if the agent loses its life (e.g., by stepping into a pit or encountering the Wumpus). The agent's utility is -100 if the agent dies, 50 if the agent gets

the gold and lives, and 10 if the agent lives but does not get the gold. The probability of the various outcomes are given by the table below:

Action Sequence	Gold		¬Gold	
	Die	¬Die	Die	¬Die
A	0.6	0.05	0.2	0.15
B	0.05	0.1	0.05	0.8
C	0.25	0.6	0.1	0.05

What is the expected utility of each action sequence? To maximize the chance for partial credit, be sure to show your work. If the agent follows the principle of maximum expected utility, which action sequence will it choose?