Uncertainty Study Guide (AIMA 12)

Artificial Intelligence

1 Probability Theory

1. You have a fair 6-sided die whose outcome is given by the random variable D. What is the probability of the event $D < 4$?

2. You roll a weighted 4-sided die 20 times. Representing the number of times i is rolled by the number in the ith position of a vector of results, we have $\langle 10, 5, 3, 2 \rangle$. Using a similarly structured vector, what is the probability distribution over the number of times each number is rolled?

3. Given the following discrete probability distributions:

$P(X)$	$P(Y)$	$P(X \mid Y)$
		$P(x = T \mid y = A) = .8$
$P(x = T) = 0.8$	$P(y = A) = 0.6$	$P(x = F \mid y = A) = .2$
$P(x = F) = 0.2$	$P(y = B) = 0.4$	$P(x = T \mid y = B) = .8$
		$P(x = F \mid y = B) = .2$

What can you say about X and Y?

A. X and Y are independent.

B. X and Y are not independent.

2 Bayesian Reasoning

1. Most people don't like Mondays. It's so bad that the probability that a randomly chosen person has a full-blown case of The Mondays is $P(M = True) = 0.8$. The new temp is very concerned with cases of The Mondays, so she's constantly on the lookout. She is better than a coin flip at detecting The Mondays, so if you have The Mondays, she tells you so 60% of the time, $P(T = True \mid M = True) = 0.6$. She's very concerned about The Mondays, so gives many false positives, $P(T = True \mid M = False) = 0.3$. Given the prevalence of The Mondays and the temp's penchant for reporting cases of The Mondays, what is the probability that you have The Mondays if the temp sees you and declares: