CS 4100/5100: Foundations of Artificial Intelligence (Fall 2015) Robert Platt
Student(s): Oct. 1, 2015

Alpha-Beta Pruning – Probability

1 Alpha-Beta Pruning

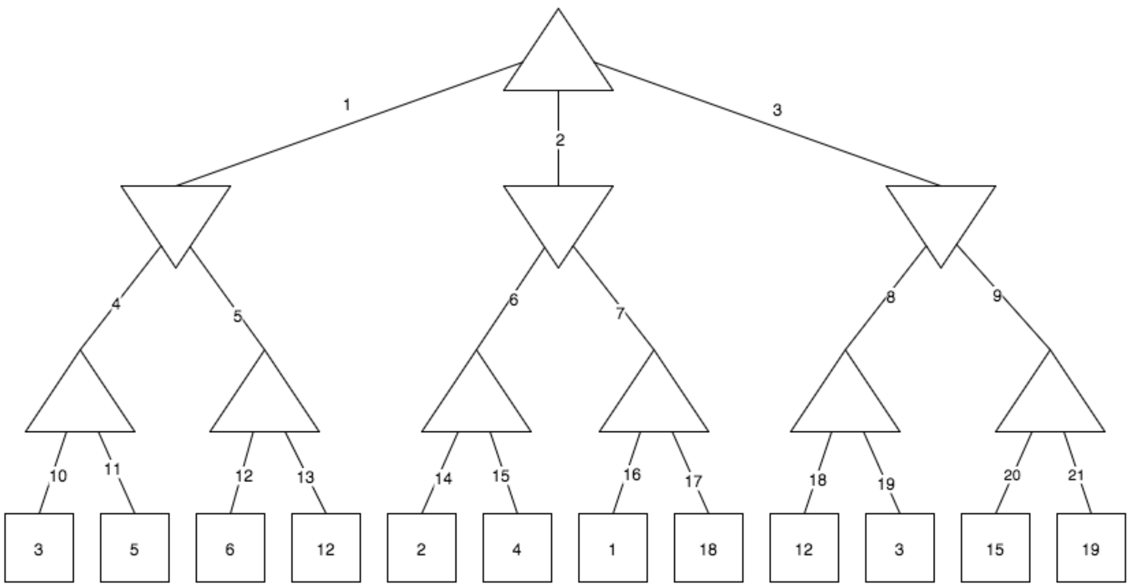

Figure 1: Alpha-Beta Pruning

1. Please fill in the state's utility values for the game tree above using alpha-beta pruning, cross the pruned edges and write down the Alpha Beta value from the parent state to the child state. You don't need to write Alpah-Beta values for the edges that have been pruned and the utility values for the pruned states.

	Alpha	Beta
1	$-\infty$	$+\infty$
2		
3		
4		
5		
6		
7		
8		
9		
10		

	Alpha	Beta
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		

2 Probability

Find the value of $P(X|Y=-y)$ using normalization.

X	Y	P
+x	+y	0.2
+x	-y	0.3
-x	+y	0.4
-x	-y	0.1

3 Bayes' rule

Suppose a woman in her 40s, decides to have a medical test for breast cancer called a mammogram. If the test is positive, what is the probability that she has cancer? That obviously depends on how reliable the test is. Suppose she is told that the test has a sensitivity of 80%, which means, if she has cancer, the test will be positive with probability 0.8. In other words,

$p(x=1|y=1)=0.8$

Where $x=1$ is the event the mammogram is positive, and $y=1$ is the event she has breast cancer. Many people conclude that she is 80% likely to has cancer, but this is false! They fall for the base rate fallacy. Show why they are wrong, and calculate the actual chance that she has cancer[1]. You may need these: $p(y=1)=0.004$ and $p(x=1|y=0)=0.1$.

[1] Based on this analysis, the US government decided not to recommend annual mammogram screening to women in their 40s because the number of false alarms would cause needless worry and stress among women, and result in unnecessary, expensive, and potentially harmful tests.