Note Title

stochastic games

Review of <u>expected value</u> from basic probability:

Given some numerical outcomes and probabilities for those outcomes, the <u>expected value</u> is the sum of prob × outcome.

e.g. • one dice:

	1	2	3	4	5	6
prob	1/6	1/6	-	-	-	1/6

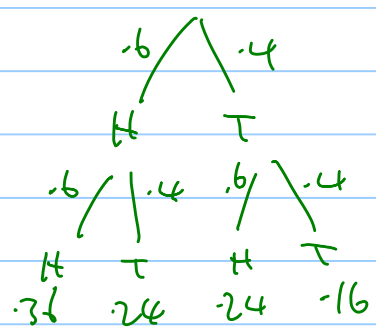
$$\text{exp. val.} = \left(\tfrac{1}{6}\times 1\right) + \left(\tfrac{1}{6}\times 2\right) + \dots + \left(\tfrac{1}{6}\times 6\right) = 3.5$$

• two dice:

2	3	4	....	11	12
1/36	2/36	3/36	...	2/36	1/36

$$\text{exp. val.} = \left(\tfrac{1}{36}\times 2\right) + \left(\tfrac{2}{36}\times 3\right) + \dots \left(\tfrac{1}{36}\times 12\right) = 7$$

Exercise: 2 biased coins. Chance of heads is 0.6 for each. Both are flipped, you win \$3 for each head showing. What are your expected winnings?



num heads	0	1	2
prob	.16	.48	.36
outcome	0	3	6

$$\text{exp. val.} = 0\times .16 + 3\times .48 + 6\times .36$$
$$= 3.6$$

Solving a stochastic game:

① Use chance nodes (as well as MAX, MIN)

② Use minimax, but compute expected value of minimax at chance nodes

e.g. Russell slide 26, Try it with biased coin.
and see formal algorithm on p148.

③ Can cut off and evaluate if desired.

Notes:
- complexity is horrible: $O(b^m n^m)$ — number of distinct chance outcomes
- pruning like α-β is possible but tricky — see homework exercise 5.16.
- can instead evaluate using Monte Carlo simulation...

Monte Carlo simulation

Basic idea: at chance node, do not evaluate all possibilities. Instead, pick a random sample of the outcome, compute minimax for each, and return the average. See p180 and p184 for a few more details.

Final note: The ideas in this lecture contain some promising material for the final project of the course.