HW 11 Another Extensive Form Game Against Nature

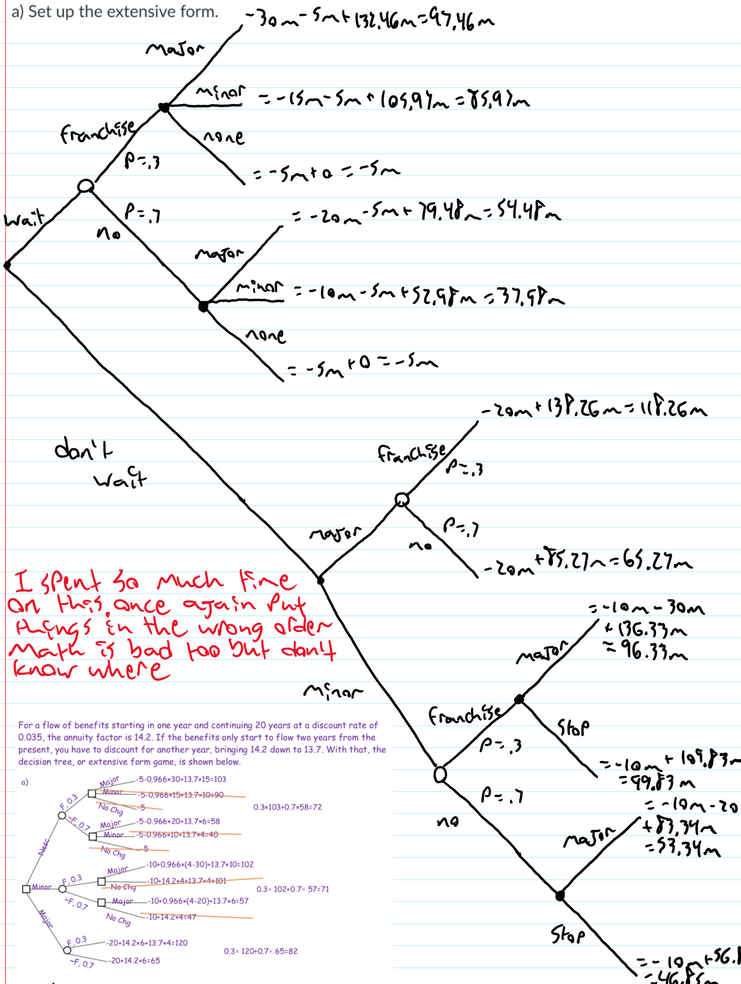
Thursday, November 26, 2020 1:05 PM

Passed solution review

A city is in the running for a major sports franchise, with a 30% chance (officials think) of being selected. They will not know for 1 year. A road not far from the stadium cite is in need of repair following flooding from ruptured water pipelines. The road was in need of upgrades anyway, and will need improvement more urgently if the franchise is awarded.

- Benefits accrue for 20 years beginning one year from incurring the cost of improvements.
- The horizon value is 0.
- The real discount rate is 0.035.
- The cost of a minor upgrade is $10M and benefits are $4M/year if the franchise has not been awarded. If and after the franchise is awarded, the cost is $15M (more traffic disruption) and benefits are $8M/year.
- The cost of a major upgrade is $20M and benefits are $6M/year if the franchise has not yet been awarded. If and after the franchise is awarded, the cost is $30M (more traffic disruption) and benefits are $10M/year.
- The city could implement minimum necessary repairs for $5M now and delay deciding on improvements. Benefits are $0/year. (This restores the status quo level of service.)
- The city could undertake the minor improvement now and the major improvement later.

a) Set up the extensive form.



I spent so much time on this, once again put things in the wrong order math is bad too but don't know where

For a flow of benefits starting in one year and continuing 20 years at a discount rate of 0.035, the annuity factor is 14.2. If the benefits only start to flow two years from the present, you have to discount for another year, bringing 14.2 down to 13.7. With that, the decision tree, or extensive form game, is shown below.

a)

I've been working on this for an hour, I know I didn't calculate benefits, but I'm moving on.

b) Find the solution with the highest ENPV.

Assuming time to build improvements is ≤1 year
Assume doing major after minor as soon as they find out about the franchise
Assume major after minor incurs full costs
Assume benefits end at year 20 even if they waited or upgraded

Not waiting, doing the major upgrade, then getting the franchise has the highest ENPV

c) What are the best and worst case scenarios for the option with the highest ENPV?

Ugh. I did this wrong and I'm in too deep.

Worst case = no franchise = 65.27m =65m
Best case = 118.26m =120m
EV's = 82m

Wait. This is right!

d) What is the value of perfect information on whether the franchise will be awarded?

118.26m - (-5m) = 123.26m

Even perfect information has no impact because BR is always build no matter what

(definitely wrong)

Year	Wait, Franchise, Major	Wait, Franchise, Minor	Wait, Franchise, None	Wait, No Franchise, Major	Wait, No Franchise, Minor	Wait, No Franchise, None	No Wait, Major, Franchise	No Wait, Major, No Franchise	No Wait, Major, Franchise, Major	No Wait, Major, Franchise, Stop	No Wait, Minor, No Franchise, Major	No Wait, Minor, No Franchise, Stop
1	0	0	0	0	0	0	5.80	5.80	3.86	3.86	3.86	3.86
2	9.34	7.47	0	5.60	3.73	0	9.34	5.60	9.34	7.47	5.60	3.73
3	9.02	7.22	0	5.41	3.61	0	9.02	5.41	9.02	7.22	5.41	3.61
4	8.71	6.97	0	5.23	3.49	0	8.71	5.23	8.71	6.97	5.23	3.49
5	8.42	6.74	0	5.05	3.37	0	8.42	5.05	8.42	6.74	5.05	3.37
6	8.14	6.51	0	4.88	3.25	0	8.14	4.88	8.14	6.51	4.88	3.25
7	7.86	6.29	0	4.72	3.14	0	7.86	4.72	7.86	6.29	4.72	3.14
8	7.59	6.08	0	4.56	3.04	0	7.59	4.56	7.59	6.08	4.56	3.04
9	7.34	5.87	0	4.40	2.93	0	7.34	4.40	7.34	5.87	4.40	2.93
10	7.09	5.67	0	4.25	2.84	0	7.09	4.25	7.09	5.67	4.25	2.84
11	6.85	5.48	0	4.11	2.74	0	6.85	4.11	6.85	5.48	4.11	2.74
12	6.62	5.29	0	3.97	2.65	0	6.62	3.97	6.62	5.29	3.97	2.65
13	6.39	5.12	0	3.84	2.56	0	6.39	3.84	6.39	5.12	3.84	2.56
14	6.18	4.94	0	3.71	2.47	0	6.18	3.71	6.18	4.94	3.71	2.47
15	5.97	4.78	0	3.58	2.39	0	5.97	3.58	5.97	4.78	3.58	2.39
16	5.77	4.61	0	3.46	2.31	0	5.77	3.46	5.77	4.61	3.46	2.31
17	5.57	4.46	0	3.34	2.23	0	5.57	3.34	5.57	4.46	3.34	2.23
18	5.38	4.31	0	3.23	2.15	0	5.38	3.23	5.38	4.31	3.23	2.15
19	5.20	4.16	0	3.12	2.08	0	5.20	3.12	5.20	4.16	3.12	2.08
20	5.03	4.02	0	3.02	2.01	0	5.03	3.02	5.03	4.02	3.02	2.01
Total B	132.46	105.97	0	79.48	52.98	0	138.26	85.27	136.33	109.83	83.34	56.85
NB	97.46	85.97	-5	54.48	37.98	-5	118.26	65.27	96.33	99.83	53.34	46.85
NB with Bad P	29.24	25.79	-1.50	38.13	26.59	-3.50	35.48	45.69	28.90	29.95	37.34	32.79