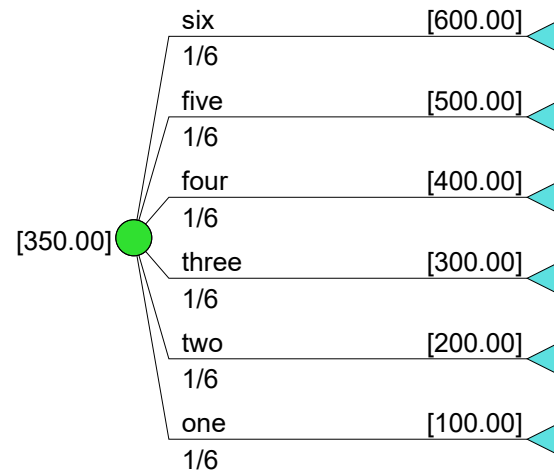


TIE4203 Decision Analysis in Industrial Operations and Management Solutions to Tutorial #10

Question 1 (P11.1)

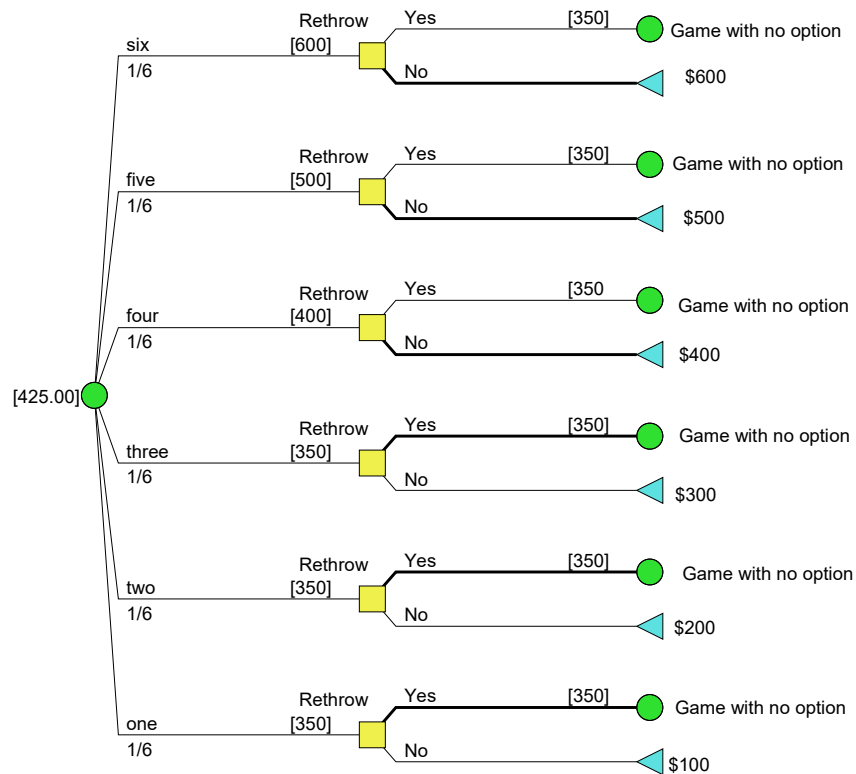
(a) Ella is risk neutral.

- The probability tree for the basic game:



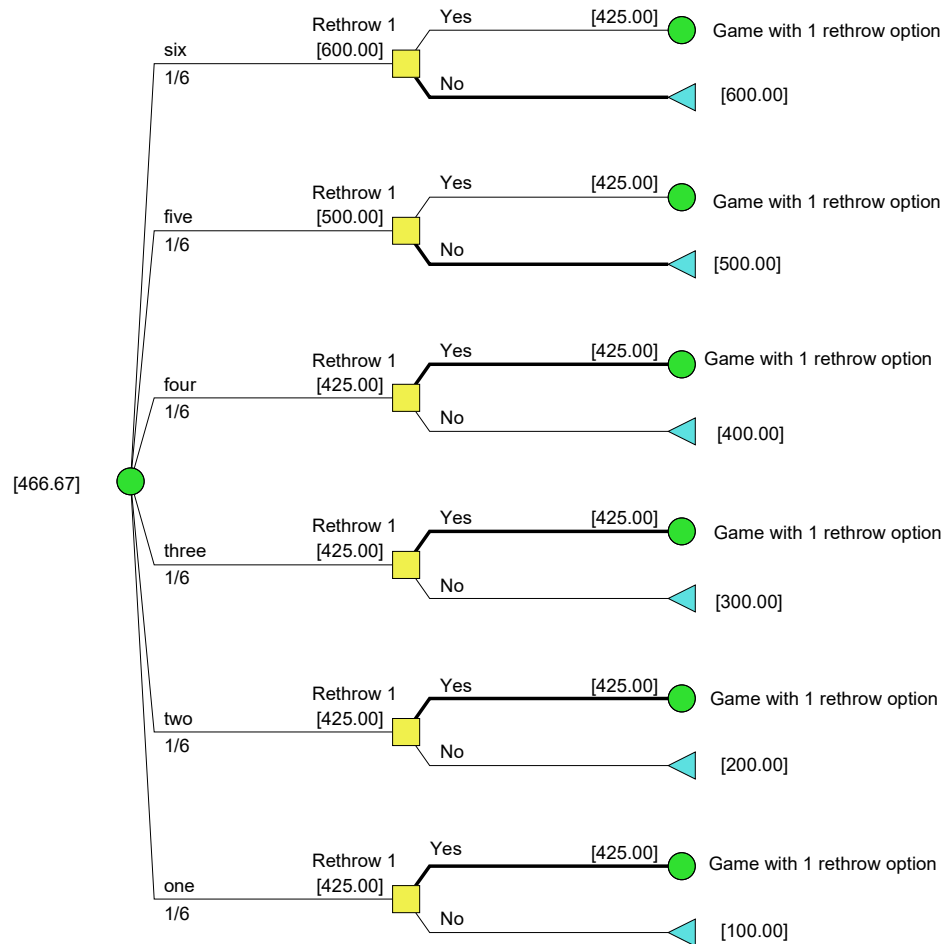
- Ella's personal indifferent buying price for the game = \$ **350.00**

(b) Decision Tree with one-rethrow option:



- If the option is exercised, the problem reduces to the basic (one-throw) game with an expected value of \$350.
- The option is exercised the outcome is 3 or below.
- Expected value with one-rethrow option = \$ **425.00**
- Ella's personal indifferent buying price for this game = \$ **425.00**
- Value of Option for one-rethrow = $425.00 - 350.00 = \$$ **75.00**

(c) Decision tree with two-rethrow option:

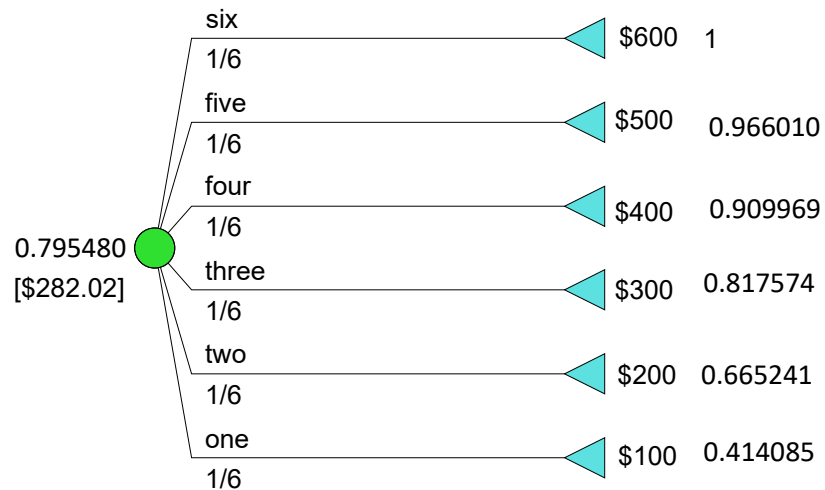


- If first rethrow option is exercised, the problem reduces the basic game with no option with an expected value of \$ 425.
- The first rethrow option is exercised when the first outcome is 4 or below.
- The second rethrow option is exercised the second outcome is 3 or below (see decision tree in part (b)).
- Expected value with two-rethrow options
 = personal indifferent buying price for this game
 = \$ 466.67
- Value of Option for two-rethrow = $466.67 - 350.00 = \$ \underline{117.67}$

Question 2 (P11.2)

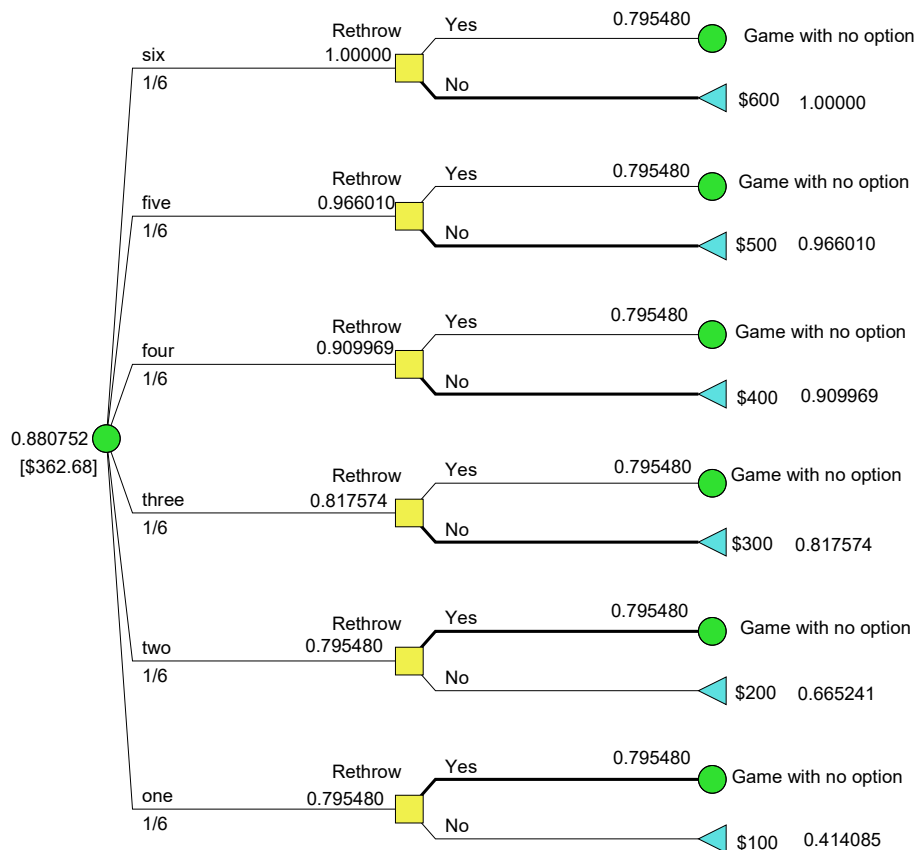
(a)

- Ella has delta property with Risk Tolerance = \$200.
- Let $u(\$600) = 1$ and $u(\$0) = 0$, then Ella's utility function is $u(x) = 1.0523957(1 - e^{-x/200})$
- The probability tree for the game:



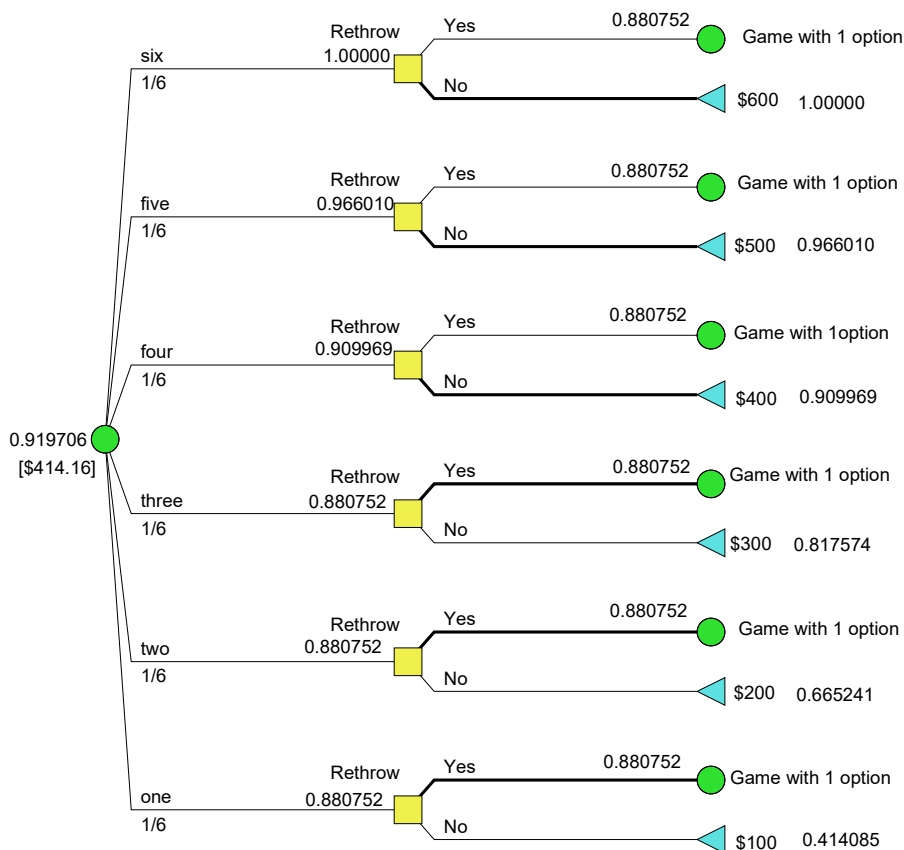
- Expected utility of game = 0.795480
- CE of game = \$ 282.02
- Ella's personal indifferent buying price for the game = \$ 282.02

(b) Decision Tree with one-rethrow option:



- If the rethrow option is exercised, the problem reduces to the basic game with Expected utility = 0.795480 and CE = \$282.02.
- The option is exercised when the first outcome is 2 or below.
- Expected utility with one rethrow option = 0.880752
- CE with one-rethrow option = \$362.86
- Ella's personal indifferent buying price for this game = **\$ 362.86**
- Value of Option for one-rethrow = $362.86 - 282.02 = \text{\$ } 80.84$

(c) Decision tree with two-rethrow options:



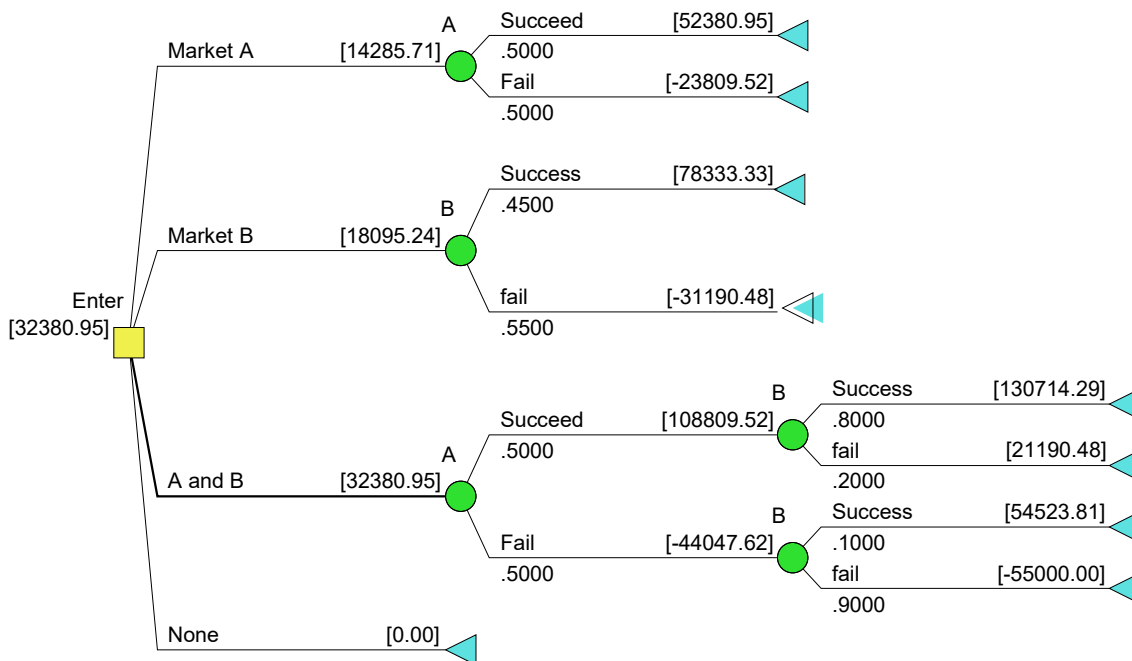
- If throw option after the first throw is exercised, the problem reduces to a game with one rethrow option with expected utility = 0.880752 and CE = \$362.68.
- The first rethrow option is exercised when the outcome is 3 or below.
- Expected utility with two rethrow options = 0.919706
- CE with two-rethrow options = personal indifferent buying price for game = **\$ 414.16**
- Value of Option for two-rethrow options = $414.16 - 282.02 = \mathbf{\$ 132.14}$

Comparison of results

	Risk Neutral	Risk averse RT=\$200
CE of Base game	\$ 350.00	\$ 282.02
CE of with option for one re-throw	\$ 425.00	\$ 362.86
Value of Option for one re-throw	\$ 75.00	\$ 80.84
CE of with option for two re-throws	\$ 467.67	\$ 414.16
Value of Option for two re-throws	\$ 117.67	\$ 132.14

Question 3 (P11.3)

(a) Decision for base model:



Computation of end-point NPVs

Enter Market A only now

$$\text{If product succeeds: } NPV = -100,000 + \frac{160,000}{(1+0.05)} = \$52,380.95$$

$$\text{If product fails: } NPV = -100,000 + \frac{80,000}{(1+0.05)} = -\$23,809.52$$

Enter Market B only now

$$\text{If product succeeds: } NPV = -55,000 + \frac{140,000}{(1+0.05)} = \$78,333.33$$

$$\text{If product fails: } NPV = -55,000 + \frac{25,000}{(1+0.05)} = -\$31,190.48$$

Enter Market A and B now:

$$\text{If A succeeds, B succeeds: } \$52,380.95 + \$78,333.33 = \$130,714.29$$

$$\text{If A succeeds, B fails: } \$52,380.95 - \$31,190.48 = \$21,190.48$$

$$\text{If A fails, B succeeds: } -\$23,809.52 + \$78,333.33 = \$54,523.81$$

$$\text{If A fails, B fails: } -\$23,809.52 - \$31,190.48 = -\$55,000.00$$

Enter None:

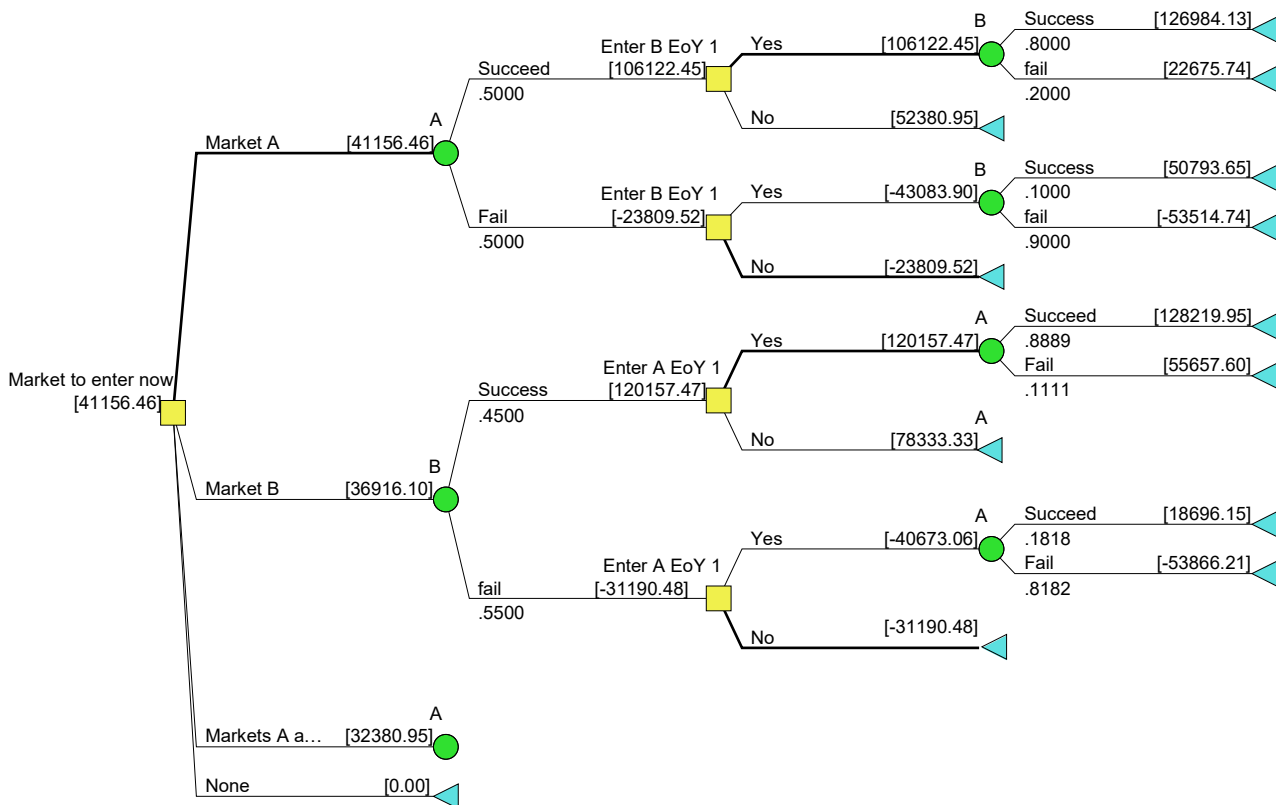
$$NPV = 0$$

The best decision is to enter both markets now.

Expected NPV = **\$32,380.95**

(b)

Decision tree with option to delay one market by a year.



Computation of additional end-point NPVs

Enter Market A and Market B one year later:

$$\text{If A succeeds, B succeeds: } NPV = 52,380.95 + \frac{78,333.33}{(1 + 0.05)} = \$126,984.13$$

$$\text{If A succeeds, B fails: } NPV = 52,380.95 + \frac{-31,190.48}{(1 + 0.05)} = \$22,675.74$$

$$\text{If A fails, B succeeds: } NPV = -23,809.52 + \frac{78,333.33}{(1 + 0.05)} = \$50,793.65$$

$$\text{If A fails, B fails: } NPV = -23,809.52 + \frac{-31,190.48}{(1 + 0.05)} = -\$53,514.74$$

Enter Market B now and Market A one year later

$$\text{If B succeed, A succeeds: } NPV = 78,333.33 + \frac{52,380.95}{(1+0.05)} = \$128,219.95$$

$$\text{If B succeed, A fails: } NPV = 78,333.33 + \frac{-2,3809.52}{(1+0.05)} = \$55,657.60$$

$$\text{If B fails, A succeeds: } NPV = -31,190.48 + \frac{52,380.95}{(1+0.05)} = \$18,696.15$$

$$\text{If B fails, A fails: } NPV = -31,190.48 + \frac{-2,3809.52}{(1+0.05)} = -\$53,866.21$$

Optimal Decision Policy:

Enter Market A now.

 If successful after one year, Enter Market B.

 Else do not enter Market B.

Expected NPV = \$ **41,156.46**

(c)

Present Equivalent Value of Option to Delay entering market

$$= \$41,156.46 - \$32,380.95$$

$$= \$ **8,775.51**$$