"I pledge my honor that I have abided by the Stevens Honor System"

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8.1 The Parthenon Laboratory is planning to invest $650,000 in a technology to produce a new medicine. The new drug should reduce significantly the amount of risk involved with certain types of flu. The technology will last for 20 years, however, there is some uncertainty in the size of the revenue and costs involved. Assume a MARR of 15%; The possible outcomes for revenue and costs are given

Initial Cost	$650,000				
p (probability)	0.25		0.6		0.15
Annual Revenue	$	500,000	$	800,000	$	1,200,000
Annual Costs	$	90,000	$	120,000	$	144,000

Determine the FW of the project [4 points]

$$FW_{0.25} = -650000(\tfrac{F}{P}, 15\%, 20) + 410000(\tfrac{F}{A}, 15\%, 20) = -650000(16.367) + 410000(102.444)$$
$$FW_{0.25} = \$31,363,490$$

$$FW_{0.60} = -650000(\tfrac{F}{P}, 15\%, 20) + 680000(\tfrac{F}{A}, 15\%, 20) = -650000(16.367) + 680000(102.444)$$
$$FW_{0.60} = \$59,023,370$$

$$FW_{0.15} = -650000(\tfrac{F}{P}, 15\%, 20) + 1056000(\tfrac{F}{A}, 15\%, 20) = -650000(16.367) + 1056000(102.444)$$
$$FW_{0.15} = \$97,542,314$$

$$FW = (0.25)(\$31,363,490) + (0.60)(\$59,023,370) + (0.15)(\$97,542,314)$$
$$FW = \$57,886,241.60$$

8.2 A team at the RATP, the Parisian state-owned public transport operator, must advise which of two subway car models should be purchased (only one can be selected). Since the projects involve new technology, the performance is uncertain and the revenue will be different under each scenario. Estimated probabilities for each type of performance associated with annual savings are given below. Assume a 12% MARR and 30-year project life.

Alternative	Initial Investment	Performance	Probability	Annual Savings
1	$1,800,000	Good	0.3	$350,000
		Average	0.5	$290,000
		Poor	0.2	$200,000
2	$1,300,000	Good	0.25	$290,000
		Average	0.4	$190,000
		Poor	0.35	$150,000

a) Draw the Decision Tree [4 points]
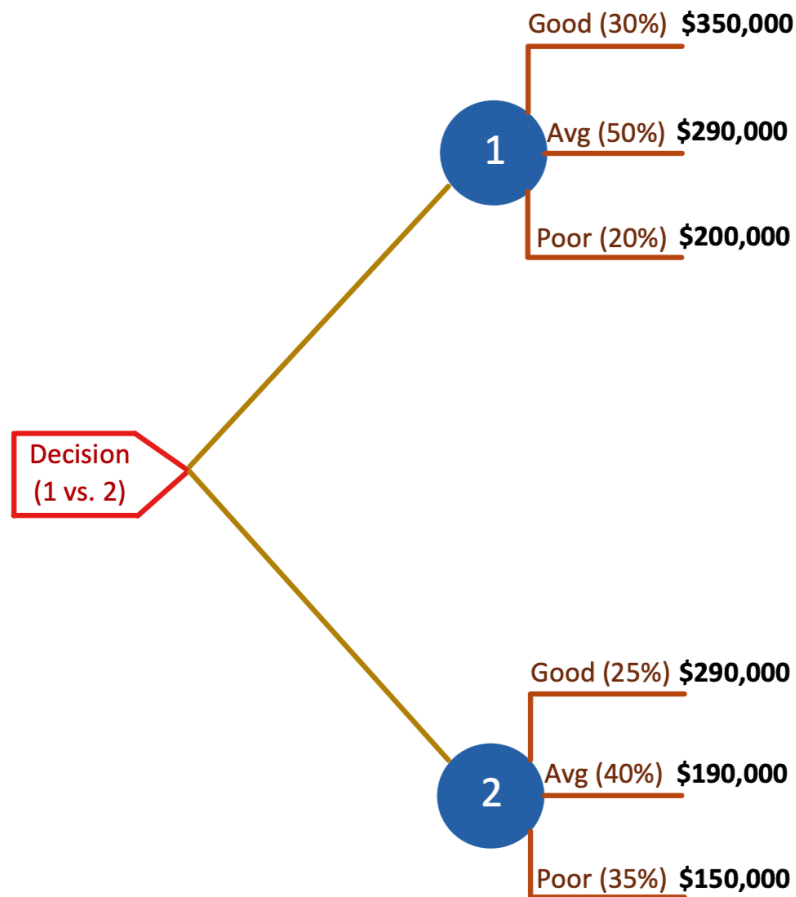
b) What is the expected value of annual revenue for each alternative? [4 points]

Alternative 1:

$EW = (0.3)(350000) + (0.5)(290000) + (0.2)(200000) = \$290,000$

Alternative 2:

$EW = (0.25)(290000) + (0.4)(190000) + (0.35)(150000) = \$201,000$

c) What is the expected annual worth for each alternative? [4 points]

Alternative 1:

$AW_{0.30} = -1,800,000(\frac{A}{P}, 12\%, 30) + 350,000 = \$126,620$

$AW_{0.50} = -1,800,000(\frac{A}{P}, 12\%, 30) + 290,000 = \$66,620$

$AW_{0.30} = -1,800,000(\frac{A}{P}, 12\%, 30) + 200,000 = -\$23,380$

$EW_1 = (0.3)(126620) + (0.5)(66620) + (0.2)(-23380) = \$66,620$

Alternative 2:

$AW_{0.25} = -1,300,000(\frac{A}{P}, 12\%, 30) + 290,000 = \$128,670$

$AW_{0.40} = -1,300,000(\frac{A}{P}, 12\%, 30) + 190,000 = \$28,670$

$AW_{0.35} = -1,300,000(\frac{A}{P}, 12\%, 30) + 150,000 = -\$11,330$

$EW_2 = (0.25)(128670) + (0.4)(28670) + (0.35)(-11330) = \$39,670$

d) Which alternative do you recommend and why? [2 points]

I would recommend Alternative #1, as it proposes a higher annual worth than Alternative #2 (Almost double the amount) over the 30 year time period.