

SurgeSafe, a company specializing in the production of electronic components, is currently seeking to choose a sole supplier for the raw materials that are utilized in the manufacturing of its primary product, the doublecap. The doublecap is a newly developed capacitor, which has been designed to safeguard microprocessors within cellular phones from voltage surges. CurrentCo has been identified as capable of providing the required materials.

CurrentCo is a small supplier of raw materials that has restricted production capacity and charges a lower price of \$1.50 per unit for its raw materials. However, its dependability in providing a stable supply of raw materials is uncertain. Due to its limited capacity, CurrentCo cannot guarantee supply to all of its customers all the time, resulting in potential order delays or cancellations. During a high-demand year, CurrentCo will have 90,000 units available for SurgeSafe, but during low-demand years, all products will be delivered.

If SurgeSafe does not get raw materials from suppliers, it needs to buy them on the spot market to supply its customers. SurgeSafe relies on one major cell phone manufacturer for the majority of its business. Failing to deliver could lead to losing this contract, essentially putting the firm at risk. Therefore, SurgeSafe will buy raw materials on the spot market to make up for any shortfall. Spot prices for single-lot purchases (such as SurgeSafe would need) are \$2.00.

Demand in the raw materials market has a 75 percent chance of being high each of the next two years. SurgeSafe sold 100,000 doublecaps last year (Period 0) and expects to sell 110,000 this year (Period 1). However, there is a 25 percent chance it will sell only 90,000. Next year, the demand has a 75 percent chance of rising 20 percent over this year and a 25 percent chance of falling 10 percent. SurgeSafe uses a discount rate of 20 percent. Consider that SurgeSafe will gain \$2.20 for each doublecap sale.

a. Draw a decision tree for a two-year time horizon ($T = 0, 1, 2$), which considers all above-mentioned binomial possibilities. (10 marks)

b. Calculate the expected NPV of

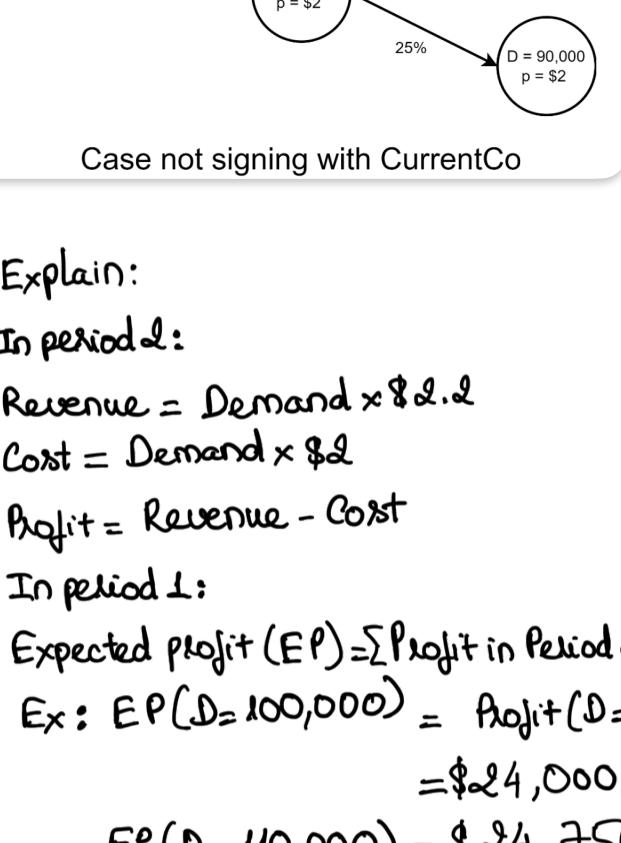
- the case not signing the contract with CurrentCo and obtain all raw materials on the spot market and;
- the case signing with CurrentCo and obtain the shortage raw materials on spot market.

Conclude whether SurgeSafe should sign a supply contract with CurrentCo or not. (Detailed calculation for first scenario of each case and each period shall be presented, others can be shown via a table, finalized cost shall be presented in the conclusion). (20 marks)

In question a, we have to draw the decision tree for this question, and from the given information, this question will lead to two cases:

- Case not signing contract with CurrentCo
- Case signing contract with CurrentCo

• Case 1: Case not signing contract with CurrentCo



The case not signing the contract with CurrentCo and obtain all raw materials on the spot market.

Period 2

D	p	Revenue	Cost	Profit
120,000	\$2	\$264,000	\$240,000	\$24,000
90,000	\$2	\$198,000	\$180,000	\$18,000
132,000	\$2	\$290,400	\$264,000	\$26,400
99,000	\$2	\$217,800	\$198,000	\$19,800

Period 1

D	p	EP	PVEP	Revenue	Cost	Profit
100,000	\$2	\$22,500	\$18,750	\$220,000	\$200,000	\$38,750
110,000	\$2	\$24,750	\$20,625	\$242,000	\$220,000	\$42,625

Period 0

D	p	EP	PVEP	Revenue	Cost	Profit
100,000	\$2	\$41,656	\$34,714	\$220,000	\$200,000	\$54,713

Explain:

- In period 2:

$$\text{Revenue} = \text{Demand} \times \$2.20$$

$$\text{Cost} = \text{Demand} \times \$2$$

$$\text{Profit} = \text{Revenue} - \text{Cost}$$

- In period 1:

• Expected profit (EP) = $\sum \text{Profit in Period } k \times \text{Probability}$

$$\text{Ex: EP}(D=100,000) = \text{Profit}(D=120,000) \times 75\% + \text{Profit}(D=90,000) \times 25\%$$

$$= \$24,000 \times 75\% + \$18,000 \times 25\% = \$22,500$$

$$\text{EP}(D=110,000) = \$24,750$$

• Present Value of the Expected Profit (PVEP) = $\text{EP} / (1+k)$

$$\text{Ex: PVEP}(D=100,000) = \text{EP}(100,000) / (1+20\%) = 22,500 / (1+20\%) = \$18,750$$

$$\text{PVEP}(D=110,000) = \$20,625$$

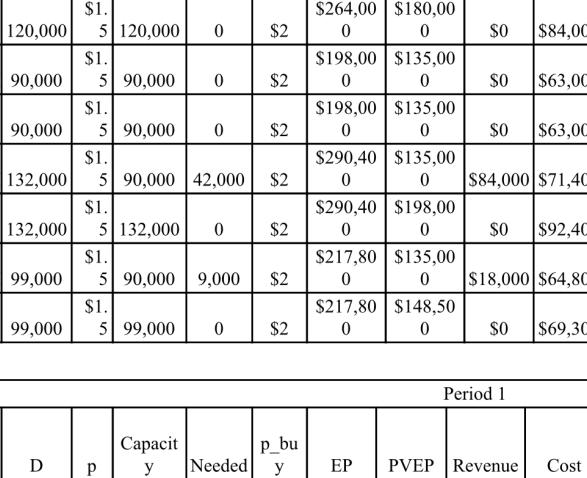
$$\text{Revenue} = \text{Demand} \times \$2.20$$

$$\text{Cost} = \text{Demand} \times \$2$$

$$\text{Profit} = \text{Revenue} - \text{Cost} + \text{PVEP}$$

- In Period 0: Do similarly period 1

• Case 2: Case signing contract with CurrentCo



Explain:

In this case, the material that SurgeSafe required will be mainly supplied by CurrentCo. However, CurrentCo can fully supply only on low-demand year. Therefore, beside the change in demand period-by-period, we will consider if that period is high-or low-demand period.

Notation: HIGH : High-demand period

LOW : Low-demand period

In high-demand period, any unsatisfied material that CurrentCo cannot guarantee will be bought from spot market.

- In period 2:

H: High-demand period

L: Low-demand period

D: Demand

p: material price in contact with CurrentCo, in this case, $p = \$1.5$

Capacity: the maximum material CurrentCo can supplied; capacity in H = 90,000

Capacity in L = Unlimited

Needed = $\max\{D - \text{Capacity}, 0\}$

p-buy: material cost on spot market (\$2)

Revenue = Demand $\times \$2.20$

Cost = Capacity $\times \$1.5$

Cost_b = Needed $\times \$2$

Profit = Revenue - Cost - Cost_b

Demand rate & high-low demand: given in question

Finalized: the probability for the scenario

= Demand rate \times High-low demand

Hint: $\sum \text{Finalized} = 100\%$ in each branch of tree

- In period 1:

EP: Expected profit

= $\sum \text{Profit in next Period} \times \text{Finalized}$

PVEP: The present value of the Expected Profit

= $\text{EP} / (1+k)$

Profit = Revenue - Cost - Cost_b + PVEP

- In period 0: Similar to period 1.

⇒ Conclusion: By comparing the profit in period 0 from the two cases, we can suggest SurgeSafe sign supply contract with CurrentCo.