

4. AlwaysRain Irrigation, Inc., would like to determine capacity requirements for the next four years. Currently two production lines are in place for making bronze and plastic sprinklers. Three types of sprinklers are available in both bronze and plastic: 90-degree nozzle sprinklers, 180-degree nozzle sprinklers, and 360-degree nozzle sprinklers. Management has forecast demand for the next four years as follows:

	YEARLY DEMAND			
	1 (IN 000S)	2 (IN 000S)	3 (IN 000S)	4 (IN 000S)
Plastic 90	32	44	55	56
Plastic 180	15	16	17	18
Plastic 360	50	55	64	67
Bronze 90	7	8	9	10
Bronze 180	3	4	5	6
Bronze 360	11	12	15	18

Both production lines can produce all the different types of nozzles. The bronze machines needed for the bronze sprinklers require two operators and can produce up to 12,000 sprinklers. The plastic injection molding machine needed for the plastic sprinklers requires four

operators and can produce up to 200,000 sprinklers. Three bronze machines and only one injection molding machine are available. What are the capacity requirements for the next four years? (Assume that there is no learning.)

<b>Plastic</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
<i>Demand for plastic sprinklers</i>	97	115	136	141
<i>Percentage of capacity used</i>	48.5%	57.5%	68.0%	70.5%
<i>Machine requirements</i>	.485	.575	.680	.705
<i>Labor requirements</i>	1.94	2.30	2.72	2.82
<b>Bronze</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
<i>Demand for bronze sprinklers</i>	21	24	29	34
<i>Percentage of capacity used</i>	58.3%	66.7%	80.6%	94.4%
<i>Machine requirements</i>	1.75	2.00	2.42	2.83
<i>Labor requirements</i>	3.50	4.00	4.83	5.66

*There is sufficient capacity to meet expected demand over the 4-year planning horizon. The only concern might be year 4 on the bronze line. Capacity is approaching 100% in that year and forecast error might lead to an over-capacity situation. It is probably not a large concern now, but management should pay special attention to that point in time as forecasts are updated in the future.*

9. A builder has located a piece of property that she would like to buy and eventually build on. The land is currently zoned for four homes per acre, but she is planning to request new zoning. What she builds depends on approval of zoning requests and your analysis of this problem to advise her. With her input and your help, the decision process has been reduced to the following costs, alternatives, and probabilities:

Cost of land: \$2 million.

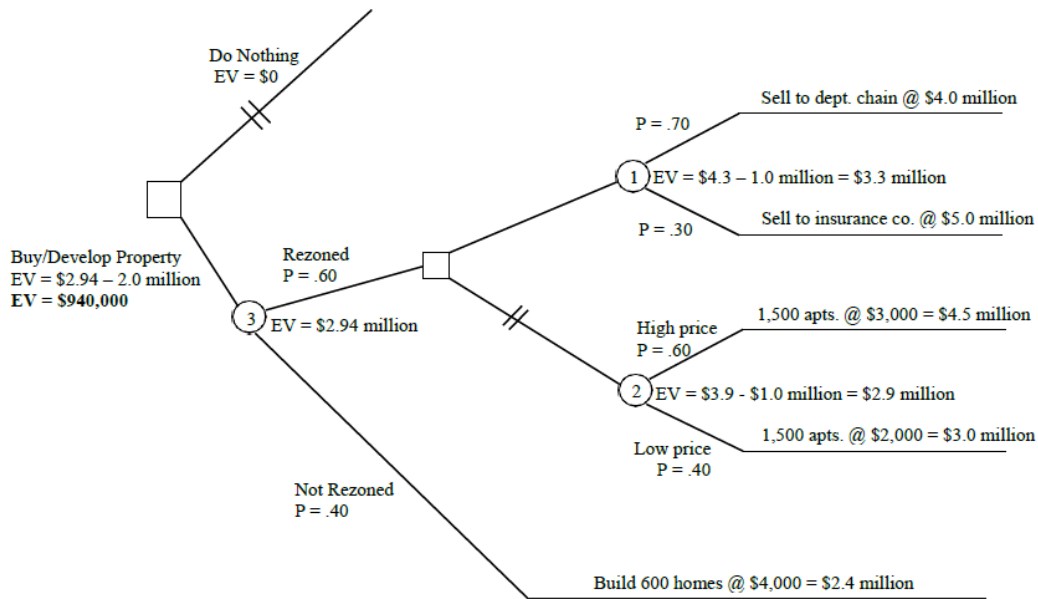
Probability of rezoning: .60.

If the land is rezoned, there will be additional costs for new roads, lighting, and so on, of \$1 million.

If the land is rezoned, the contractor must decide whether to build a shopping center or 1,500 apartments that the tentative plan shows would be possible. If she builds a shopping center, there is a 70 percent chance that she can sell the shopping center to a large department store chain for \$4 million over her construction cost, which excludes the land; and there is a 30 percent chance that she can sell it to an insurance company for \$5 million over her construction cost (also excluding the land). If, instead of the shopping center, she decides to build the 1,500 apartments, she places probabilities on the profits as follows: There is a 60 percent chance that she can sell the apartments to a real estate investment corporation for \$3,000 each over her construction cost; there is a 40 percent chance that she can get only \$2,000 each over her construction cost. (Both exclude the land cost.)

If the land is not rezoned, she will comply with the existing zoning restrictions and simply build 600 homes, on which she expects to make \$4,000 over the construction cost on each one (excluding the cost of land).

Draw a decision tree of the problem and determine the best solution and the expected net profit.



The "Do Nothing" option is included here for completeness.

## 110-1 OM chapter 4 Homework

*Rezoned shopping center (includes \$1.0 rezoning costs):*

$$\text{Point 1: Expected value} = .70(\$4 \text{ Million}) + .30(\$5 \text{ Million}) - \$1.0 \text{ million} = \$3.3 \text{ Million}$$

*Rezoned apartments:*

$$\text{Point 2: Expected value} = .60(\$4.5 \text{ Million}) + .40(\$3 \text{ Million}) - \$1.0 \text{ million} = \$2.9 \text{ Million}$$

*Since a shopping center has more value, prune the apartment choice. In other words, if rezoned, build a shopping center with a revenue of \$4.3 Million - \$1 Million = \$3.3 Million. (The purchase cost could be included here if desired but would need to be included in the calculations for all development options. This solution shows it at the leftmost part of the tree.)*

*If not rezoned the revenue will be \$2.4 million from building homes:*

$$\text{Point 3: Expected value of developing the land is } .6 * (\$3.3 \text{ million}) + .4 * (\$2.4 \text{ million}) = \$2.94 \text{ million.}$$

*Expected profit of buying and developing the land is \$2.94 million - \$2 million purchase cost = \$940,000. Since this is a positive expected value, prune the option of doing nothing.*