Decision trees(basics)

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Description

Diagramming technique which uses :

- Decision points – points in time when decisions are made, squares called nodes
- Decision alternatives – branches of the tree off the decision nodes
- Chance events – events that could affect a decision, branches or arrows leaving circular chance nodes
- Outcomes – each possible alternative listed

DT diagrams

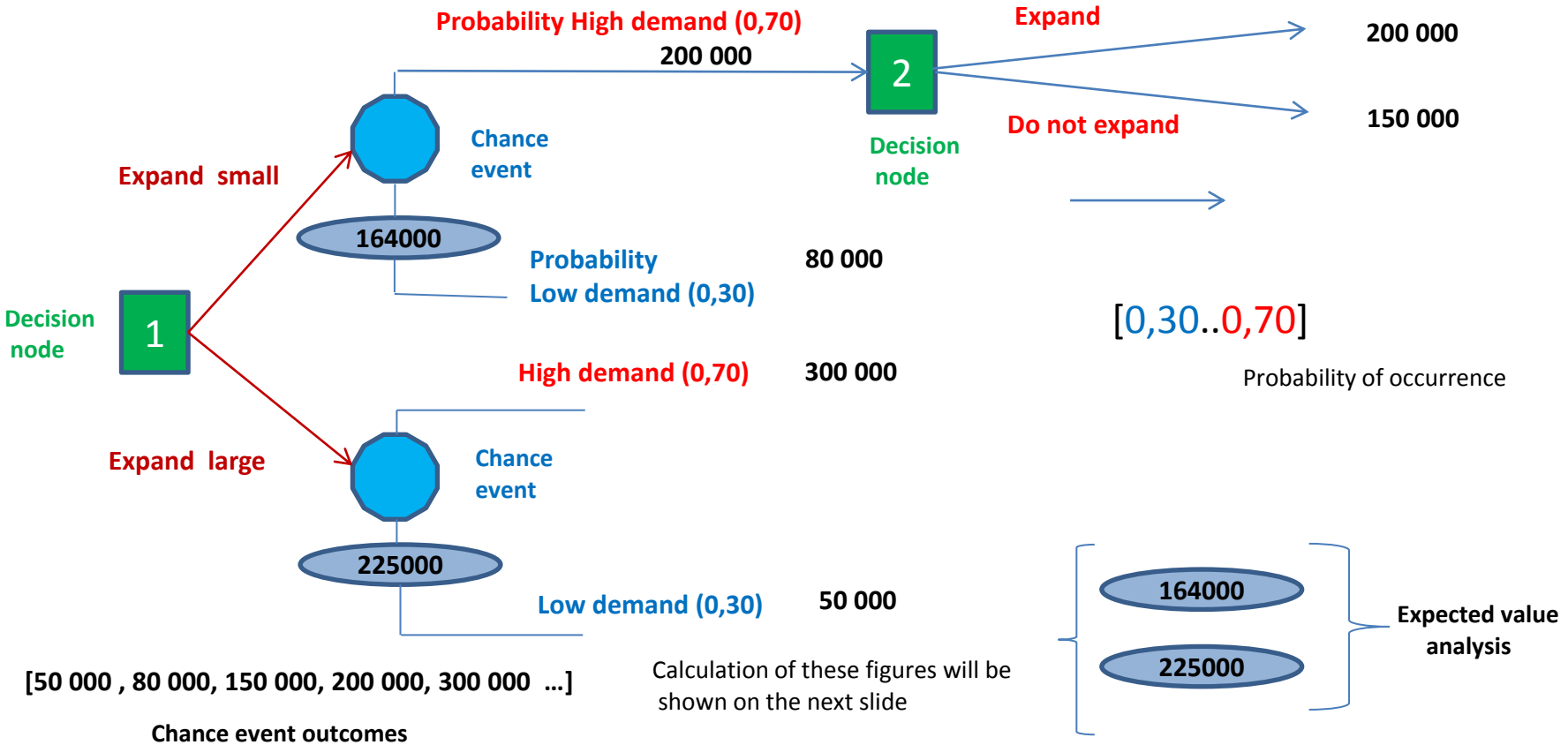
Decision trees developed by

- Drawing from left to right
- Use squares to indicate decision points 

- Use circles to indicate chance events 
- Write the probability of each chance by the chance (sum of associated chances = 100%)
- Write each alternative outcome in the right margin

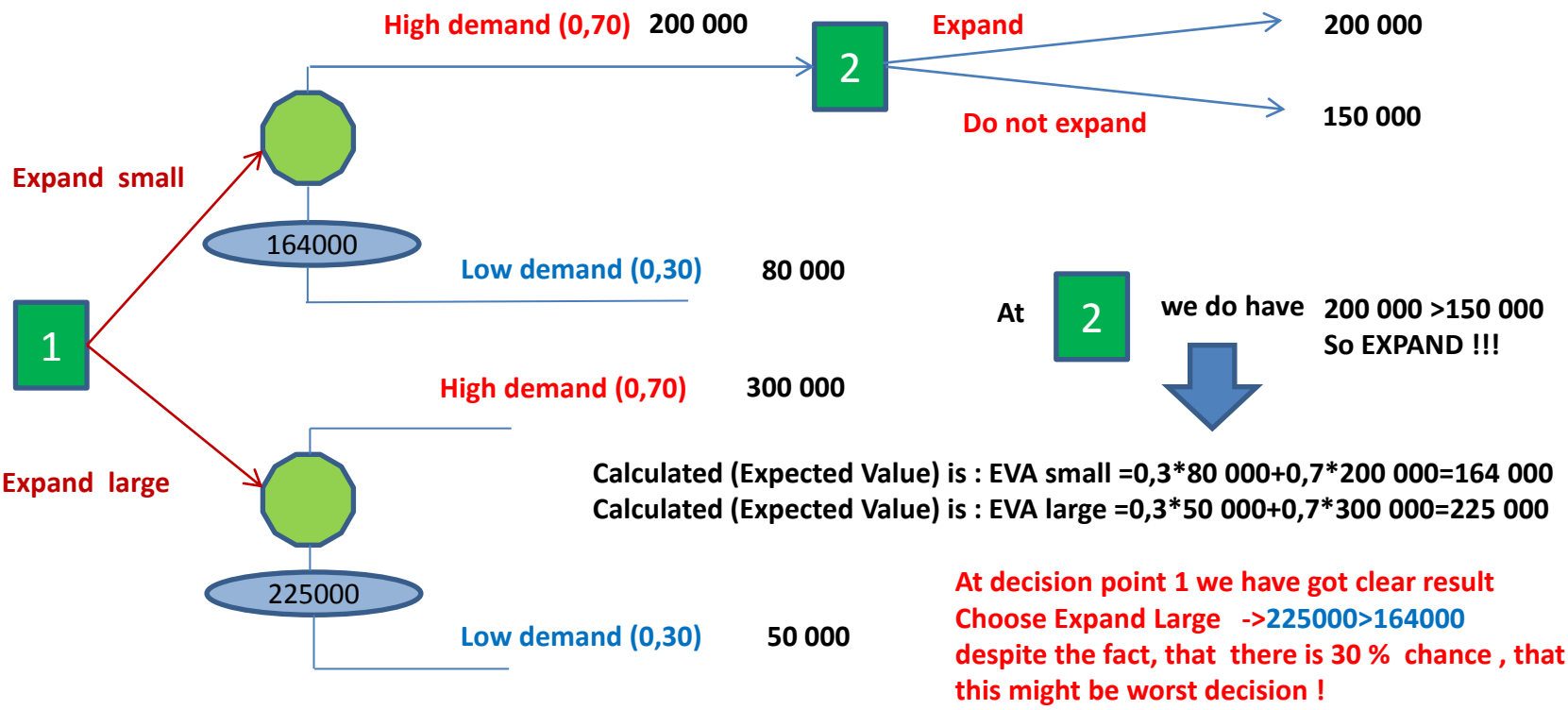
DT-Example I

- A restaurant owner has determined, that he needs to expand his facility. He has two alternatives. One is one large expand now and risk smaller demand later or the second alternative is to expand on a smaller scale now knowing, that he might need to expand again in three years. Which alternative would be most attractive?



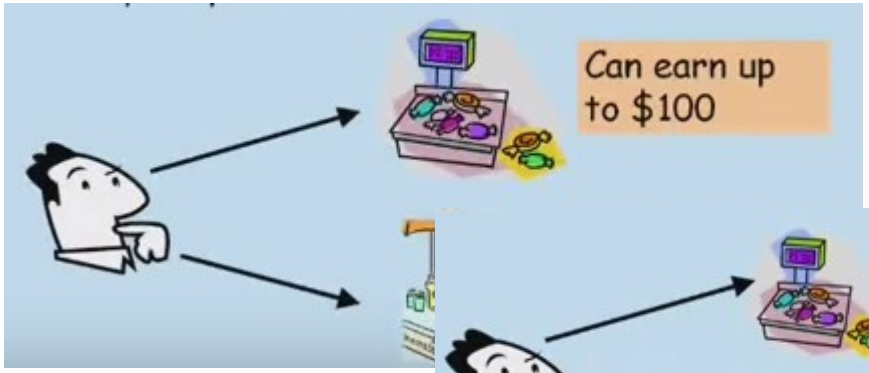
DT-Example I

- Decision tree analysis utilizes **E**xpected **V**alue **A**nalysis (EVA), which is a weighted average of the chance events :
  - **Probability of occurrence * chance event outcome**

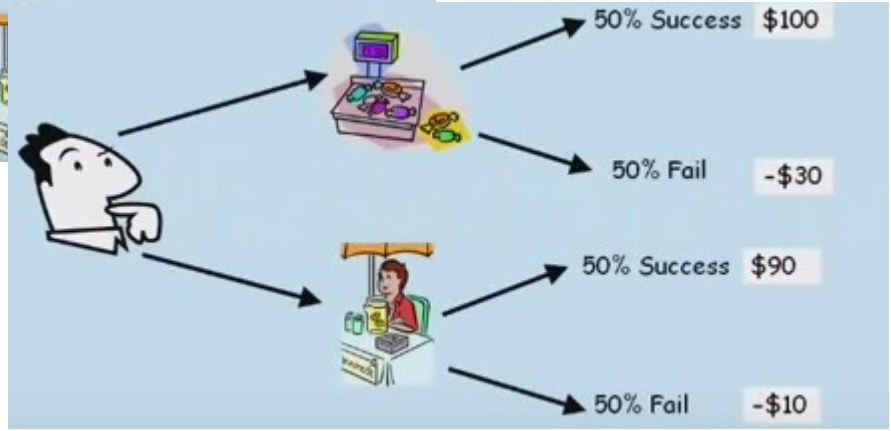


DT-Example II

- Project to sell candies or lemonade. At the first sight it is clear : Candy !!



0,5*100+ 0,5*(-30)=35 USD



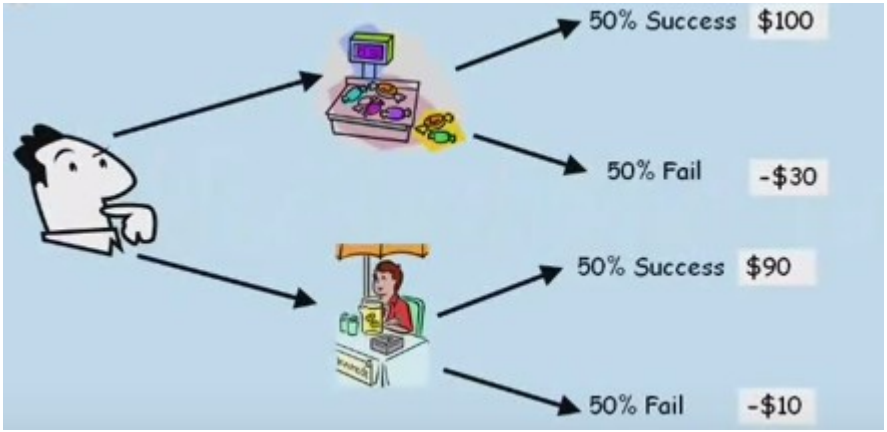
0,5*90+ 0,5*(-10)=40 USD

Resource: MBABullshit.com

DT-Example II

- So now it would be better to choose lemonade business ! So we have chosen bigger EVA. But..

0,5*100+ 0,5*(-30)=35 **0,5*90+ 0,5*(-10) = 40**



Decision based on EVA? Does this mean, that if you do Lemonade project, you will earn 40? **NO !**

If you did the IDENTICAL Lemonade project very many times (in exactly the same situation), then your **average** earnings will be **probably** 40 per time.

This means that you will not get 40 USD each time !!

Because $EVA(x) = \sum p(xi)xi$ for=1 to n,

Where Xi = outcome **i** and p(xi) is a probability of event outcome **i**

Resource: MBABullshit.com

Text related to the next example (sequential decision tree)

The Southern Textile company is considering two alternatives: to expand its existing production operation to manufacture a new line of lightweight material or to purchase land on which to construct a new facility in the future.

Each of these decision has outcomes based on product market growth in the future that results in another set of decisions (during a 10-Years planning horizon as shown in the following figure of the sequential decision tree.

Nodes represent decisions, and the circle nodes reflect the different status of nature and their probabilities.

So the first decision facing the company is whether to expand or buy land.

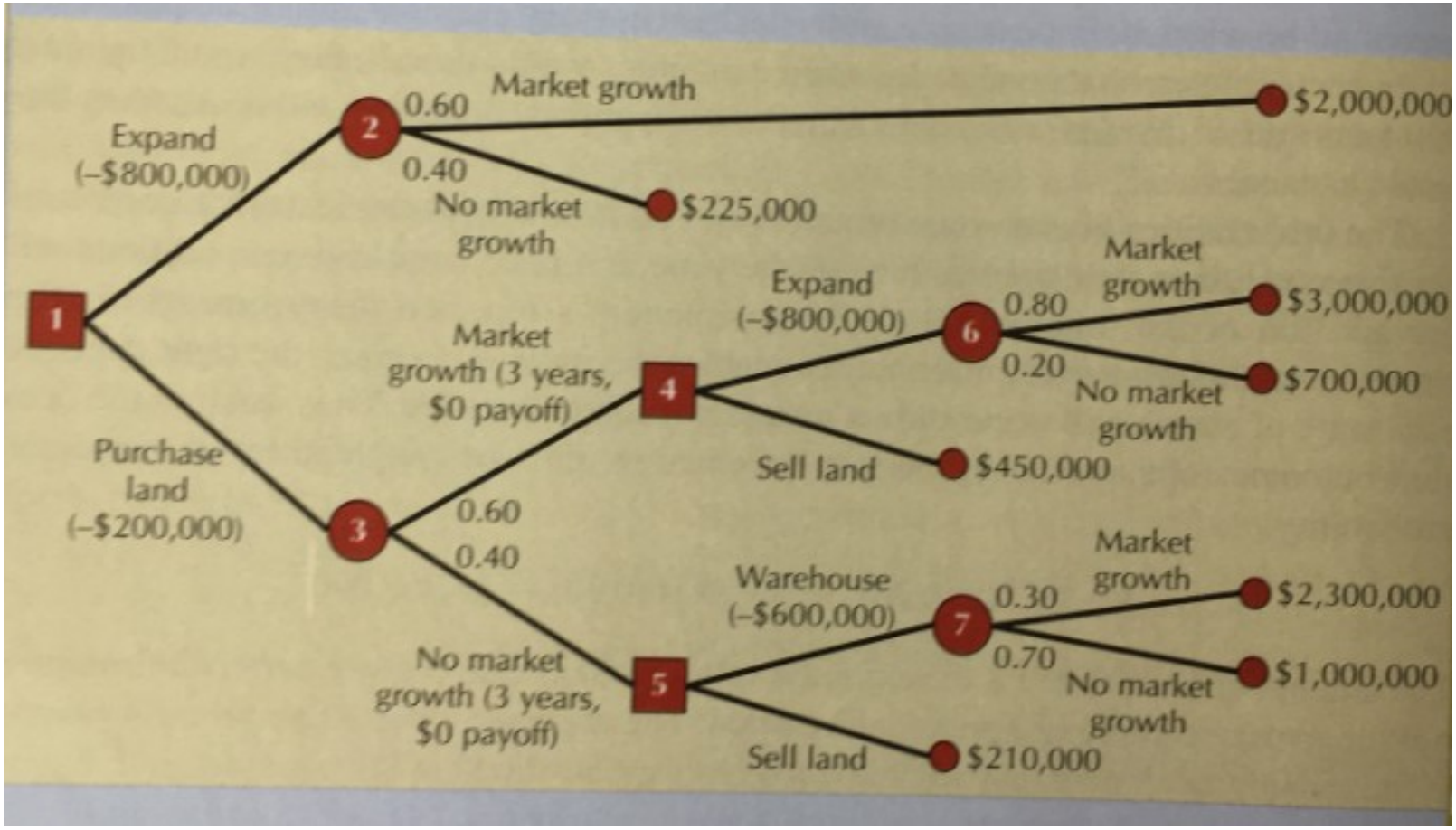
Resource: Russel and Taylor Operation management pages 66-67

DT-Example III

(see Excel file with calculations !!!!!)

1 **Decision point**

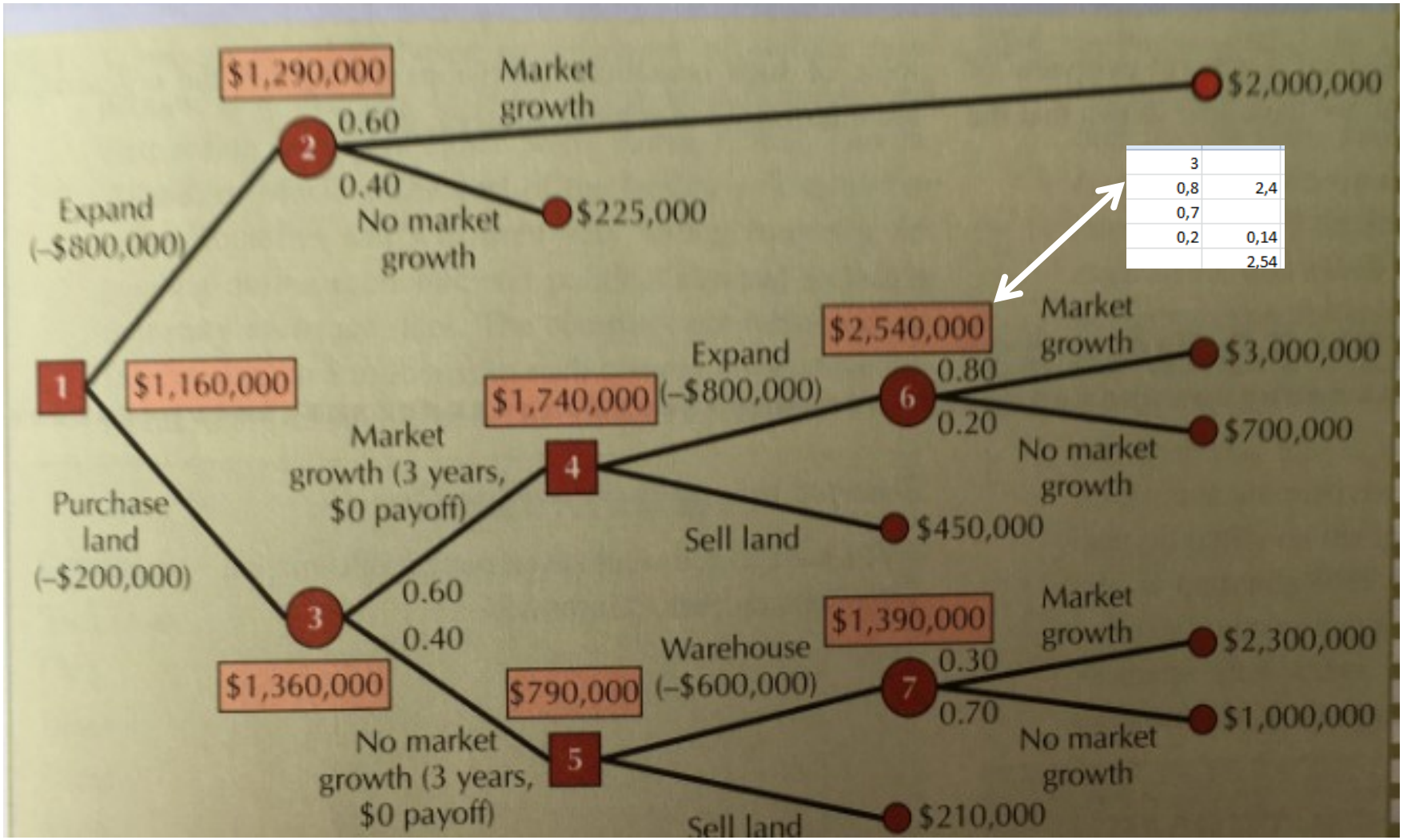
Chance event



Payoff= contribution-benefit ->not in parentheses and sign is plus

The Cost of ventures is -USD 200 000 and so on are in parentheses- cost are represented by minus sign

DT-Example III



Purchase land decision is the winner

Decision tree calculation

Outcome	Probability	EVA	Expand
3 000 000,00	0,80		
700 000,00	0,20	2 540 000,00	
2 540 000,00		1 740 000,00	-800 000,00
1 740 000,00	0,60		
790 000,00	0,40	1 360 000,00	
1 360 000,00		1 160 000,00	-200 000,00
1 290 000,00		490 000,00	-800 000,00