Decision trees(basics)

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Description

Diagramming technique which uses :

- Decision points – points in time when decisions are made, squares called nodes (rozhodovací uzly) 1

- Decision alternatives – branches of the tree off the decision nodes (alternativy řešení)

- Chance events – events that could affect a decision, branches or arrows leaving circular chance nodes- (co může rozhodnutí ovlivnit)

- Outcomes – each possible alternativ sted (výstupy, výsledky, závěry,…)

- Payoff- (prospěch, výhoda výnos – využití v posledním příkladu)

DT diagrams

Decision trees developed by
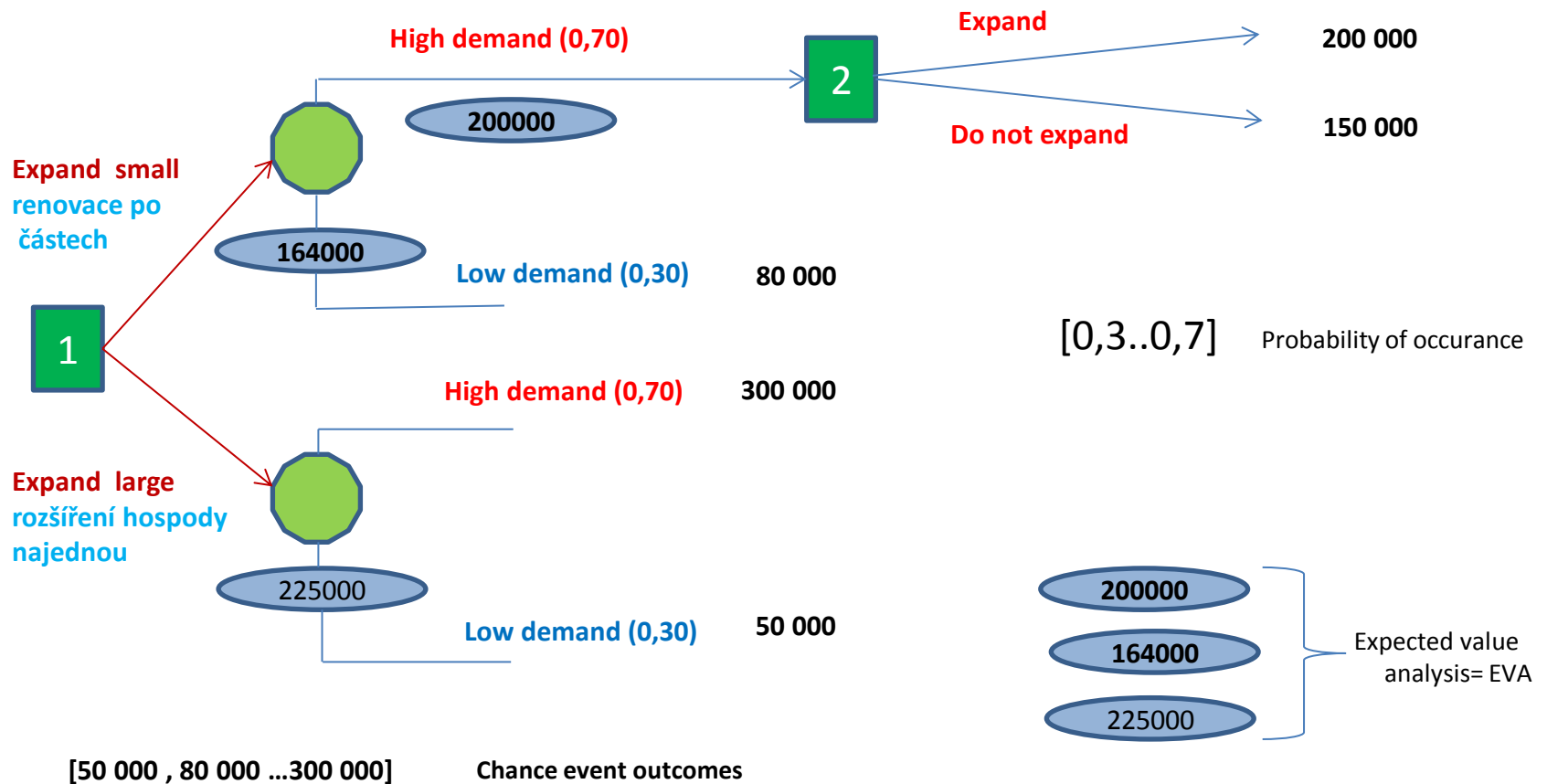
- – Drawing from left to right (kreslí se zleva doprava)
- – Use squares to indicate decision points
- – Use circles to indicate chance events
- – Write the probability of each chance by the chance (sum of associated chances = 100%) (součet pravděpodobností všech možností)
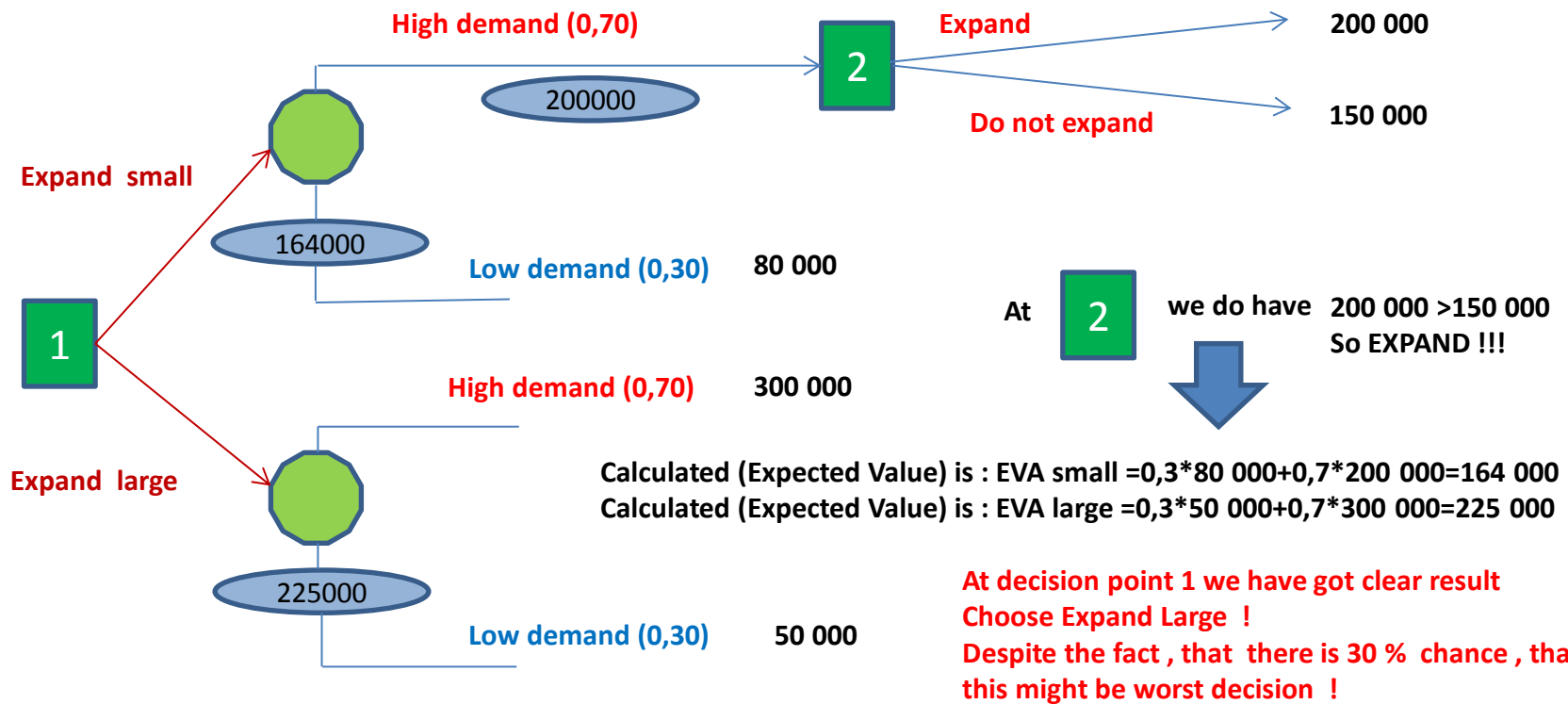- – Write each alternative outcome in the right margin

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 expand on a smaller scale now knowing, that he might need to expand again in three years. Which alternative would be most attractive?

High demand (0,70)

Expand 200 000

2

200000

Do not expand 150 000

Expand small
renovace po
částech

164000

Low demand (0,30) 80 000

[0,3..0,7] Probability of occurance

1

High demand (0,70) 300 000

Expand large
rozšíření hospody
najednou

225000

Low demand (0,30) 50 000

200000

164000

225000

Expected value
analysis= EVA

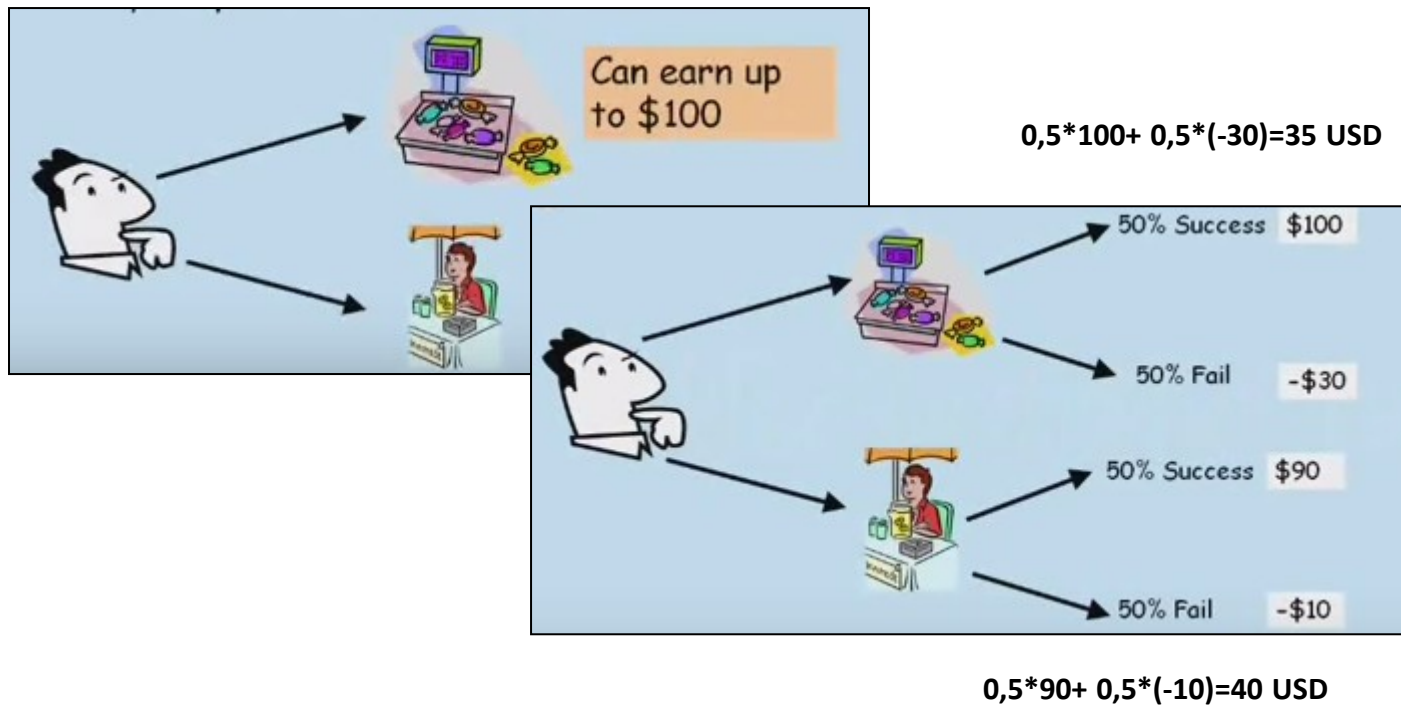[50 000 , 80 000 ...300 000] Chance event outcomes

DT-Example I

- Decision tree analysis utilizes Expected Value Analysis (EVA), which is a weighted average of the chance events :

  - **Probability of occurrence * chance event outcome**

High demand (0,70)   **Expand** → 200 000

200000

2   **Do not expand** → 150 000

Expand small

164000

Low demand (0,30)   **80 000**

At **2** we do have 200 000 >150 000
So EXPAND !!!

1

High demand (0,70)   **300 000**

Expand large

Calculated (Expected Value) is : EVA small =0,3*80 000+0,7*200 000=164 000
Calculated (Expected Value) is : EVA large =0,3*50 000+0,7*300 000=225 000

225000

Low demand (0,30)   **50 000**

At decision point 1 we have got clear result
Choose Expand Large !
Despite the fact , that there is 30 % chance , that
this might be worst decision !

DT-Example II

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

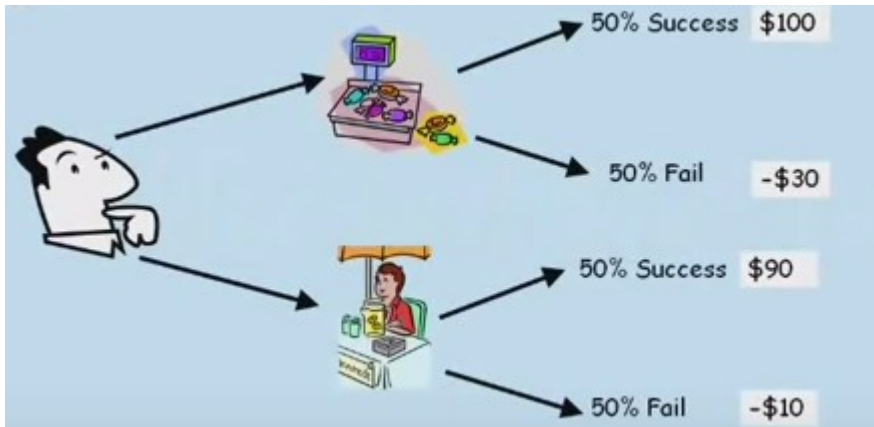0,5*100+ 0,5*(-30)=35 USD

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

DT-Example II

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

$$0,5*100+ 0,5*(-30)=35 \qquad 0,5*90+ 0,5*(-10) = \boxed{40}$$

50% Success $100

50% Fail -$30

50% Success $90

50% Fail -$10

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 **probabl**y 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 outcome i

Example III

- The first decision facing the company is whether to expand or buy land. If the company expands, two states of nature is possible. Either the market will grow (probability 0,6) or it will not grow (probability 0,4).

- Either state of nature will result in a payoff. On the other hand, if company chooses to purchase land, three years in the future another decision will have to be made regarding the development of the land

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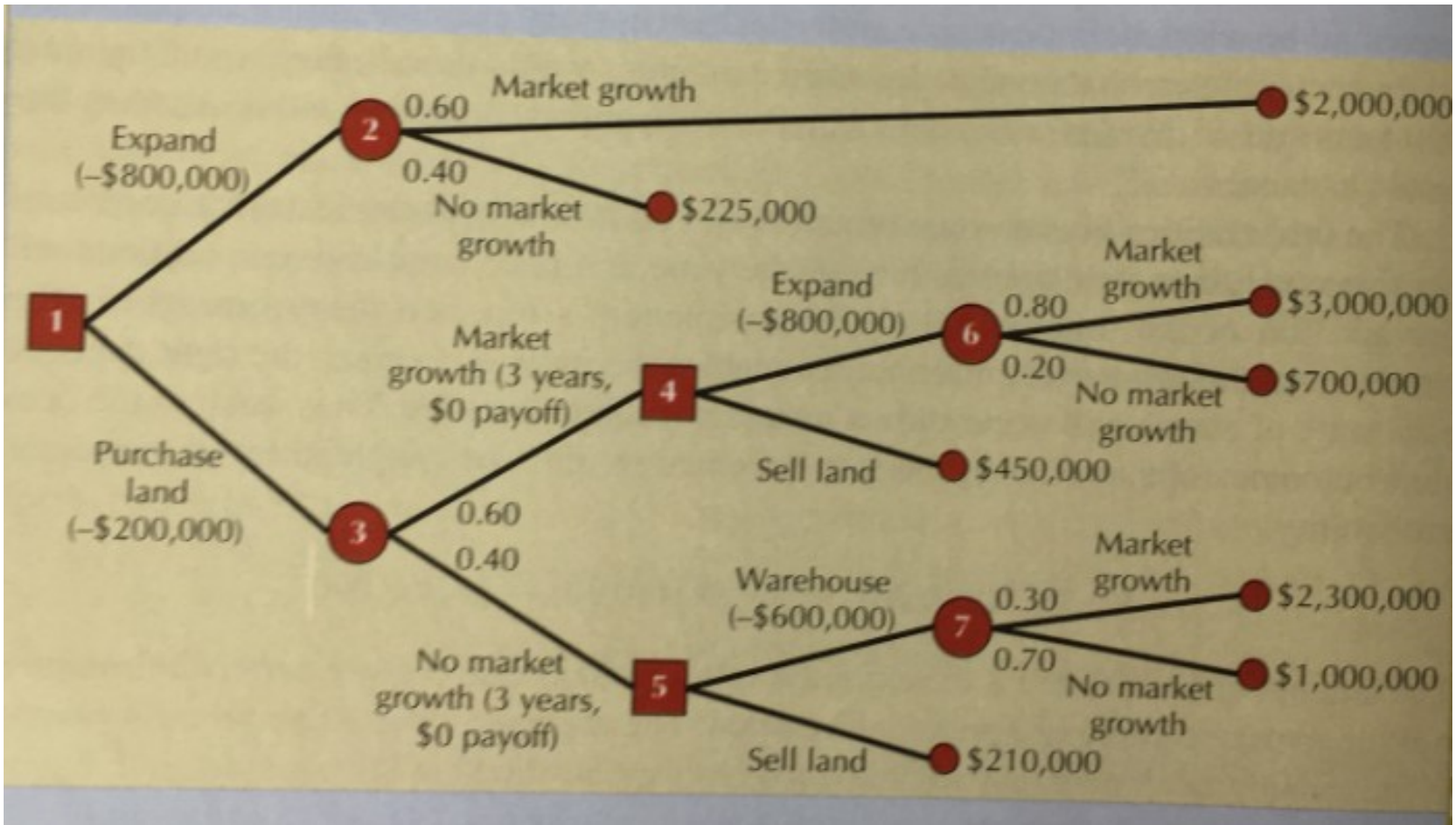
DT-Example III
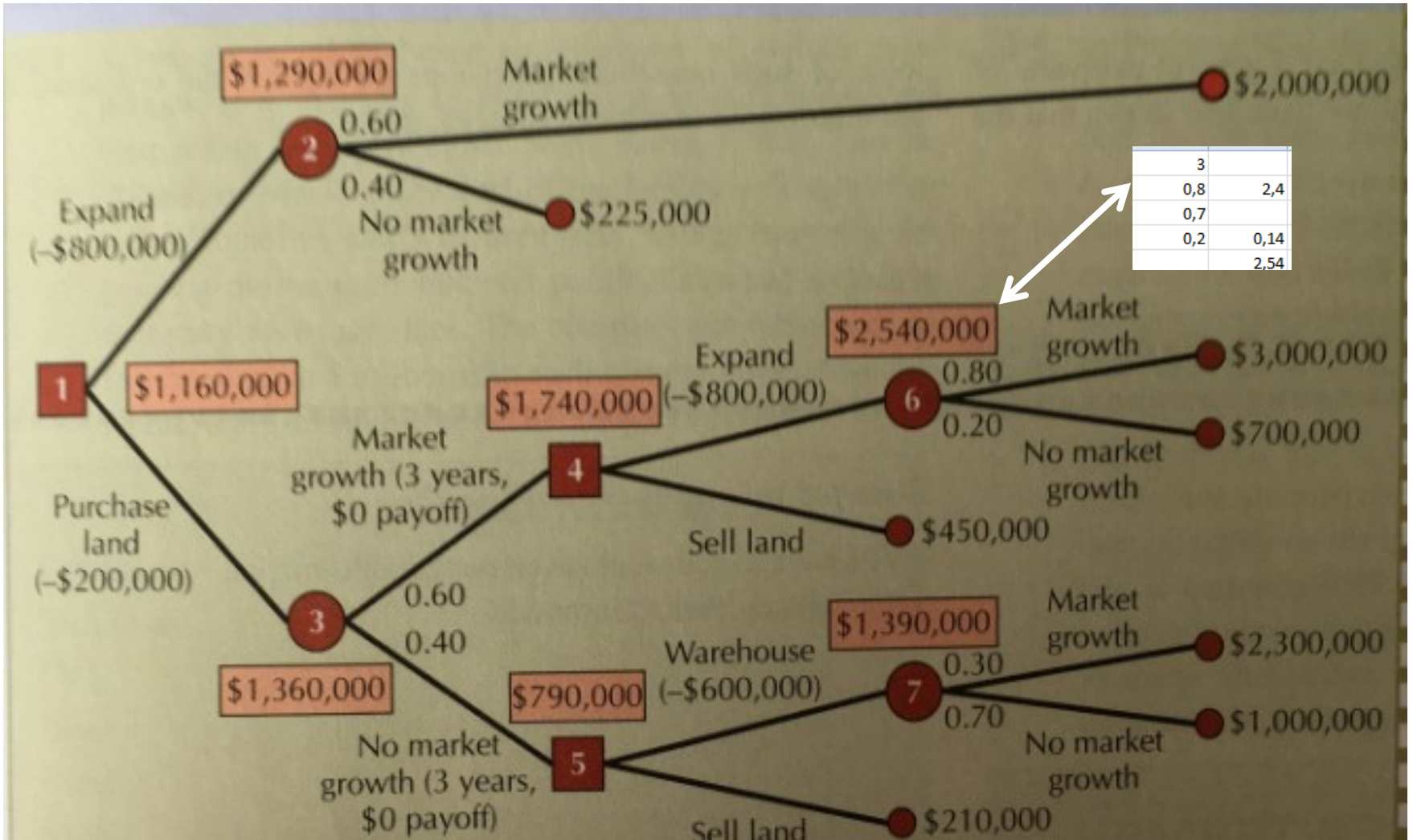
Decision tree calculation				
Outcome	Probability	EVA	Expand	
3 000 000,00	0,80			
700 000,00	0,20	2 540 000,00		
2 540 000,00		1 740 000,00	-800 000,00	
1 740 000,00	0,60			
790 000,00	0,40	1 360 000,00		
1 360 000,00		1 160 000,00	-200 000,00	
1 290 000,00		490 000,00	-800 000,00	

3 000 0000 * 0,8 + 700 000 *0,2=2 540 000
2 540 000 – 800 000 =1 740 000
1 740 000*0,6 + 790 000*0,4=1 360 000
1 360 000-200 000= 1 160 000
1 290 000-800 000=490 000

Final decision

- Expand : 129 000-800 000= 490 000
- Land :   1 360 000-200 000 = 1 160 000
- Payoff of purchasing land is 1,16 milions