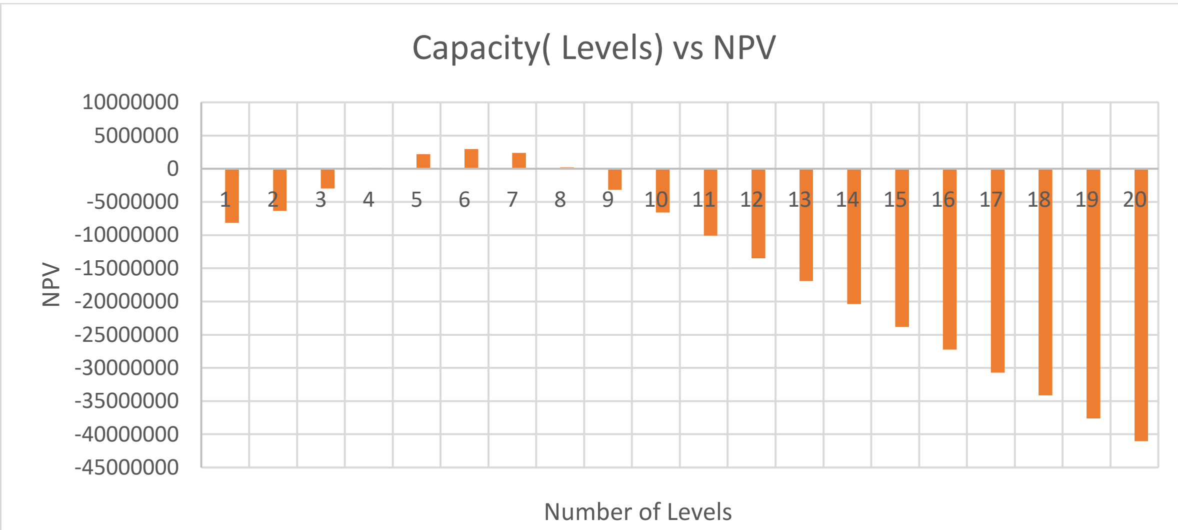
Problem 1

(1) An NPV calculation using the "sure demand" profile given by the function Demand(k) is given. What no. of levels would you recommend on this basis?

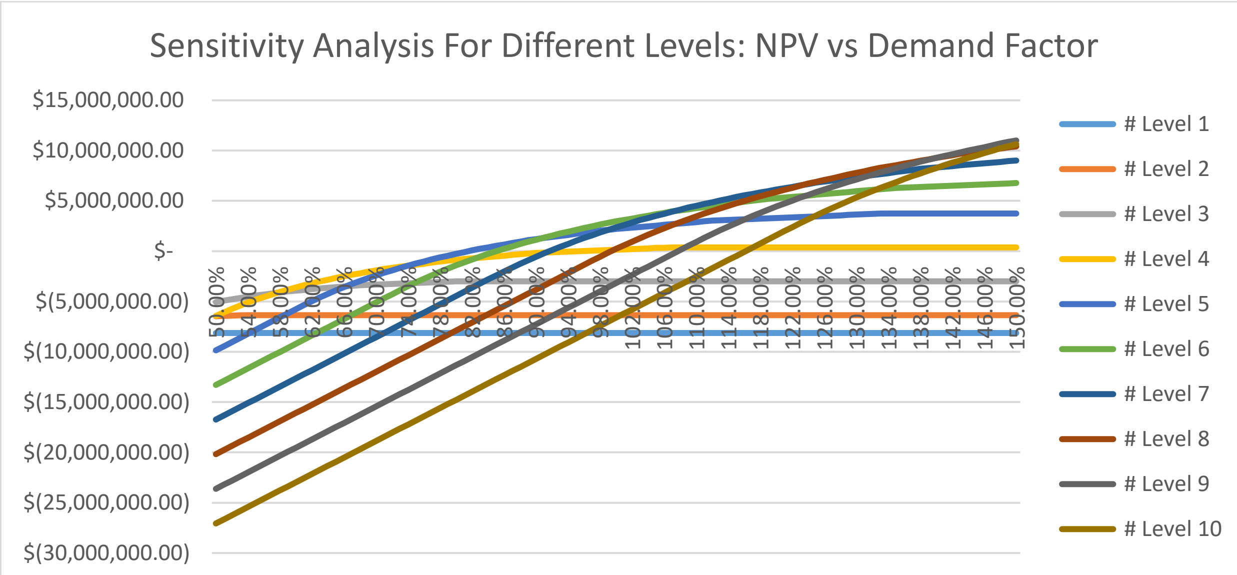
<u>Solution:</u>

I would recommend **6** number of levels with NPV: **$ 2,967,368.33**



Optimum Number of Levels	**6**
NPV	**$ 2,967,368.33**

(2) The consulting parking expert is, in fact, quite unsure about the actual demand given the long time horizon. His projections are only estimates. He believes that the initial demand, the additional demand in the next decade, and the final growth beyond that decade, could all be 50% or more off his projection, either way. This leaves, on the one hand, the possibility of erecting a white elephant. On the other hand, there may well be demand above expectation which CinPark does not want to leave untapped. The CEO requests that you do some sensitivity analysis to get a first understanding of the effect of uncertainty. Modify the model in A.i. as follows: Introduce a single parameter p%, called the Demand Factor, that will give demand in any year as p% of the "sure demand" value calculated in Model A.i. (This scales the sure demand curve up if p > 100 and down if p < 100.) Change the Demand Factor from 50% to 150%, by hand or in a data table, to get an idea of how sensitive value is to demand; display the results in a chart. Does your sensitivity analysis have any implications for your value estimate from Model A.i, or your recommendation based on that model?

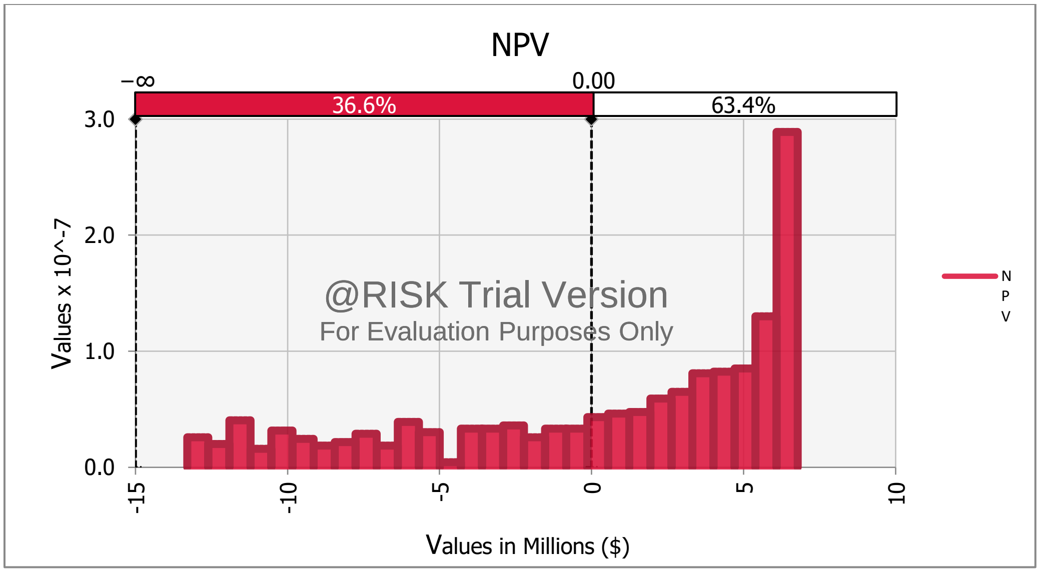


Max. Avg NPV is still obtained at Capacity (Number of Levels) = **6** and Avg. NPV is **$ 698,368.17**

Optimum Number of Levels	6
Expected NPV	$ 698,368.17

(3) CinPark understands the dangers of valuations that treat demand forecasts as certainties. Model C.i. Randomize your spreadsheet by making the Demand Factor a random variable that is uniformly distributed between 50% and 150%; either use RiskUniform(0.5, 1.5) or make use of rand() which gives a random number uniformly distributed between 0 and 1. Press F9 several times to get a feeling for the randomness. Now perform a Monte Carlo Simulation with @Risk for the number of levels recommended in Part A.i.

Questions:
--- Why is the average of the distribution of NPVs lower than the NPV in your original "Static NPV" worksheet? After all, the demand variations are symmetric around the projections.
--- What is the chance of losing money on the project?
--- Investigate the shape of the NPV distribution.
--- Is that what you would have expected? Or would you have expected another shape? Can you
explain the shape?



Optimum Number of Levels	6
Expected NPV	$576,489.33

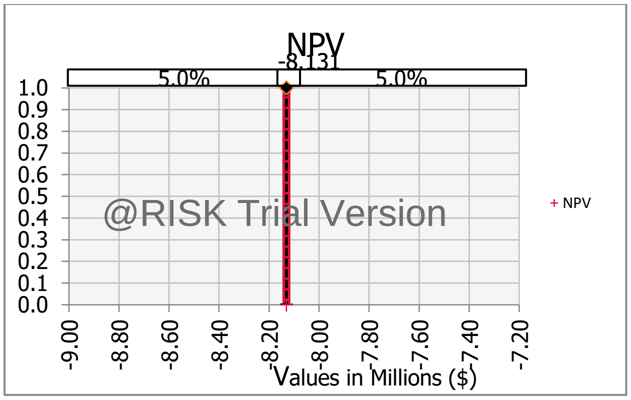
- Average NPV **$576,489.33** is lower than the static NPV of part A: **$ 2,967,368.33.** It is expected that the average value will be less as than aggregation will reduce the uncertainty in the value.

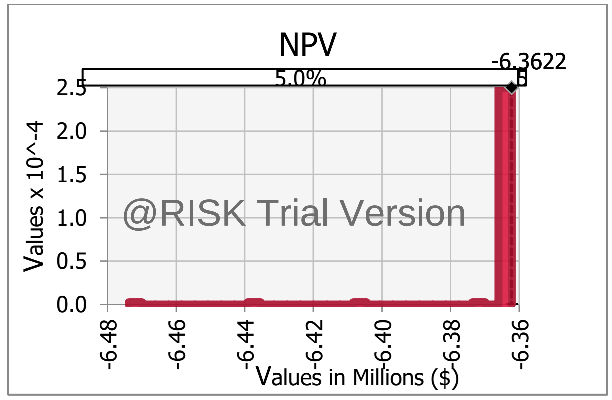
- Chance of losing money will be ~ **36.60%**

- Graph is approx. exponentially distributed.

- This is the expected shape as the major density of values is skewed to the right since the NPV is expected to increase.

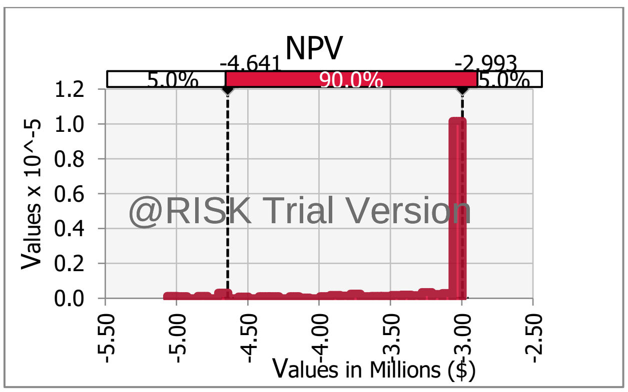
(4) Given the results of the Monte Carlo analysis, maybe your chosen optimal number of levels is not optimal after all. Compare the different NPV distributions that result from changing the number of levels in your model from Part C. Produce risk profiles for various designs. How many levels would you build? And, how does risk come into your decision? Think back on the lecture and previous stages, and then try to explain your decision in intuitive or management terms.

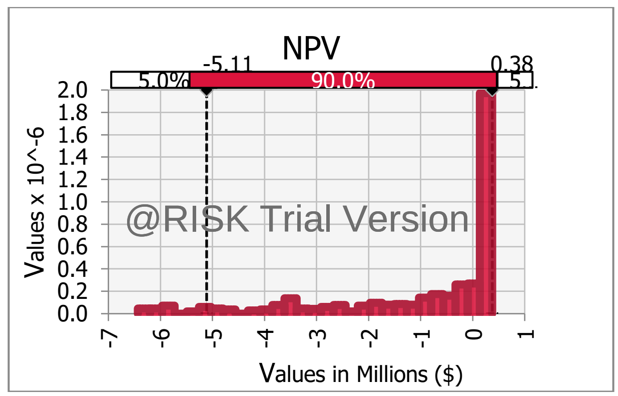




 # Level 1

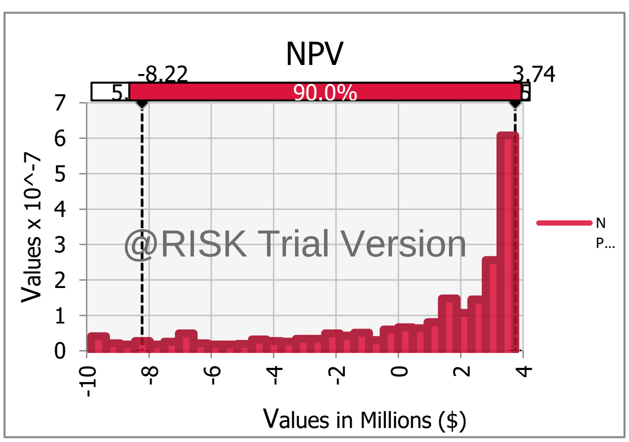
 # Level 2

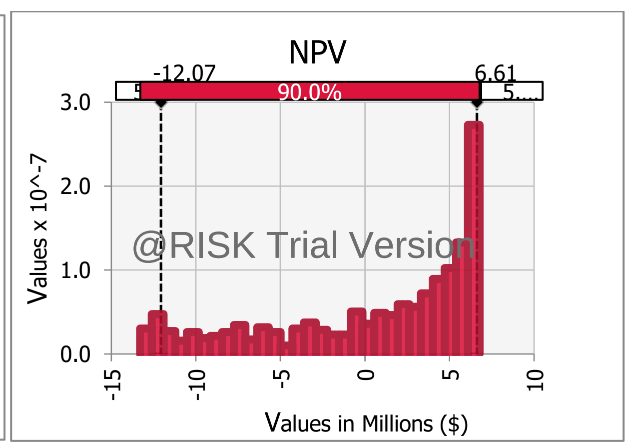




 # Level 3

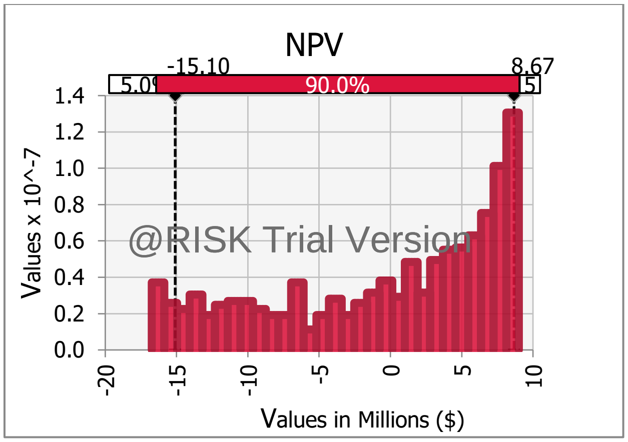
 # Level 4

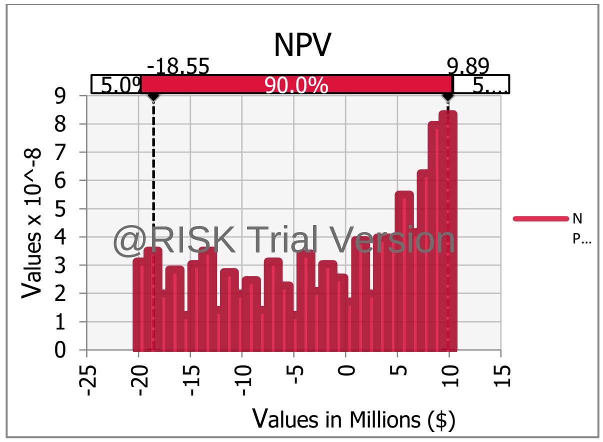




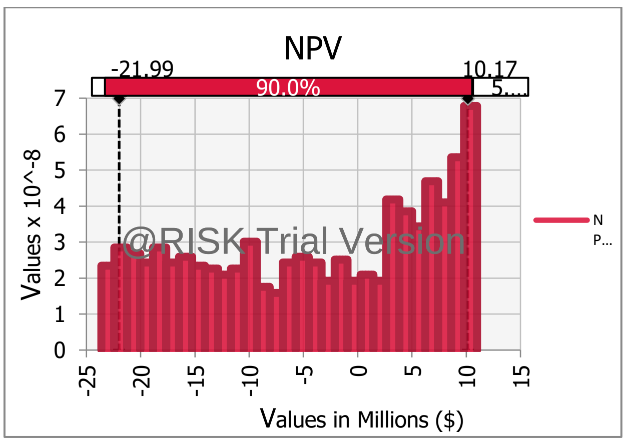
 # Level 5

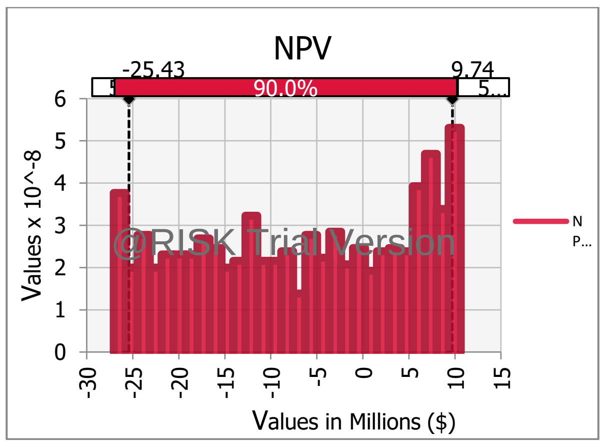
 # Level 6





 # Level 7 **# Level 8**





 # Level 9 **# Level 10**

Trial	Elapsed Time	Iterations	Result	Goal Cell Statistics				Adjustable Cells
				Mean	Std. Dev.	Min.	Max.	B19
1	0:00:15	1000	$874,668	$874,668	$5,851,268	$(13,295,980)	$6,777,772	6

Optimum Number of Levels	**6**
NPV	**$ 874, 668**

The optimum number of levels is 6. Increasing the number of levels from 1 to 10, it is observed that the distribution is coming to close to a uniform distribution which was expected.

(5) Suppose you could build the parking garage with an initial configuration of two or more levels, and then add more levels in later years as demand grows. Model this, starting with your solution to C.i., using the following expansion rule: build one new level whenever

demand exceeds capacity for two years in a row. (Assume that you do not expand beyond year 8 because CinPark does not want to take the risk of not clawing back its investment). Under the expansion rule, how many levels should we build now and how much extra value does the parking garage with expansion earn on average, if any? Again, it is critical to be able to explain your recommendations using intuition and management language.

Optimum Number of Levels we should build at Starting	**5**
NPV from Part C	**$ 576,489.33**
NPV from this part : Avg. NPV at #Levels 5	**$ 2,222,255.27**
Extra Earnings on Average	**$ 1,645,765.94**

Since the Max. Avg NPV is highest for #Levels 5 after performing simulation, I would recommend 5 number of levels to be built. Earnings will be increased by 1,645,765.94