Simulation to calculate $E[NPV]$

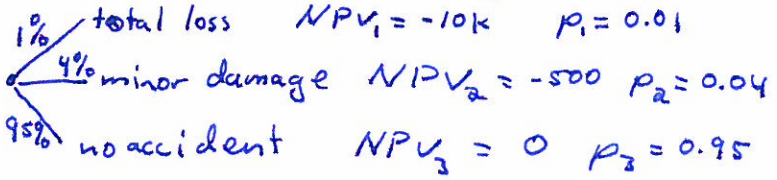
If there are only a few possibilities,

NPV_i the NPV of possibility i

p_i — probability that possibility i occurs

then $E[NPV] = p_1 NPV_1 + \cdots + p_n NPV_n$

Ex. Cost of car accident this year



$E[NPV] = 0.01 \cdot -10k + 0.04(-500) + 0.95 \cdot 0 = \$-120.$

If there are many possibilities, then simulate.

Generate possible NPV using random numbers,

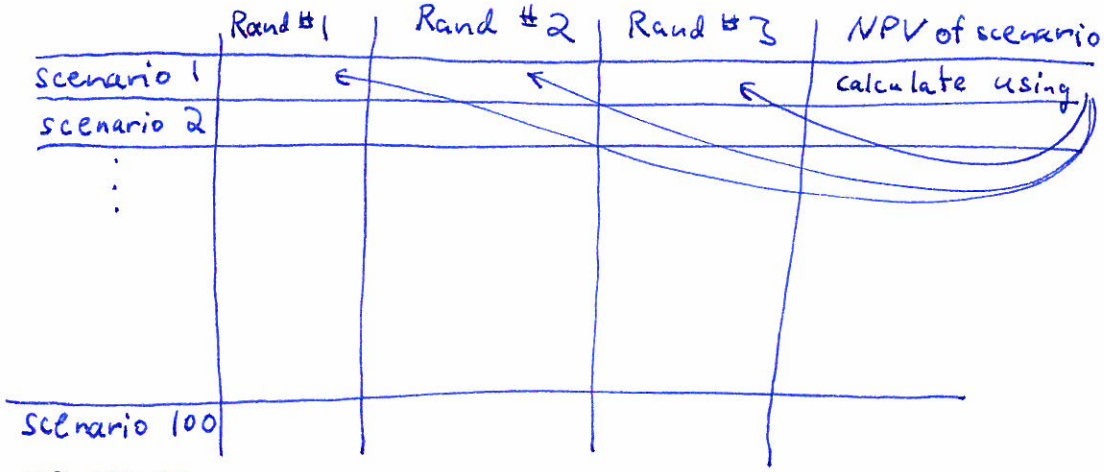
$NPV_1, NPV_2, \ldots$ where NPV_i is the NPV of scenario i.

Then $E[NPV] \simeq \frac{1}{n} \sum_{i=1}^{n} NPV_i$ (the average of n scenarios)

In Excel, $E[NPV]$ = AVERAGE(NPV_1:NPV_n)

and standard deviation of NPV is approximately, STDEV(NPV_1:NPV_n)

Ex. Suppose you need 3 random numbers to determine the NPV (of a scenario)



E[NPV] = AVERAGE(NPV column)
STDEV(NPV column)

practical aspects:

accuracy of E[NPV] when using n scenarios

approach 1: standard error

calculate $\frac{\text{Std. dev NPV}}{\sqrt{n}}$

approach 2: compare E[NPV] calculated with all n scenarios to E[NPV] calculated with the first n/2 scenarios

approach 3: generate the n scenarios again (with different random numbers) and see how E[NPV] changes.

generating random numbers:

Bernoulli (p) $\begin{cases} 1 & \text{w/ probability } p \\ 0 & \text{w/ probability } 1-p \end{cases}$

Excel IF(RAND()<p, 1, 0)

Normal(μ, σ^2) mean expectation μ, standard deviation σ

NORMINV(RAND(), μ, σ)

another option: Excel add-in

Annalysis Tool-Pack