DSC5211C

QUANTITATIVE RISK MANAGEMENT

Workshop 11:

Capacity Management under Uncertainty

Team 22

Professor: Fernando M.S.M.S. De Oliveira

Group members:
Low Zhi Qin (A0046084H)
Luo Xuan (A0186085W)
Martin Autier (A0186803Y)

Task 1 – Risk Neutral

Using the file "hammer_neutral.gms" compute the number of wetsuits to order to maximize the expected profit.

How does the solution change if you use 200, 1000, 10000 scenarios?

Number of scenarios	Expected Profit	Number of Suits Ordered
100	215929.848	4090.588
200	217987.183	4048.967
1000	219833.874	4091.270
10000	222367.665	4188.368
20000	222497.007	4188.258

As the number of scenarios increase, the expected profit and the number of suits ordered increases, but finally stabilizes around an expected profit of $222k and 4188 number of suits ordered.

Compute:

- **the expected sales,**
- **the expected lost sales,**
- **the stockout probability,**
- **the expected leftover inventory.**

Number of scenarios	Expected Sales	Expected Lost Sales	Stockout Probability	Expected Leftover inventory
100	2977.416	98.301	0.190	1113.172
200	2989.665	108.964	0.195	1059.302
1000	3016.593	120.585	0.199	1074.678
10000	3061.350	131.298	0.200	1127.018
20000	3062.622	129.431	0.200	1125.636

The computed scalars seems to stabilize after 10k scenarios.

Task 2 – CVAR

Solve the problem in TASK 1 for MAXIMIZING CV@R, with Beta 0.9, 0.99, 0.999.

Beta	Number of scenarios	Expected Profit	Number of suits ordered	Expected Sales	Expected Lost Sales	Stockout Probability	Expected Leftover inventory	CVAR
0.9	20000	118137.690	1528.534	1487.084	1704.969	0.920	41.450	80832.436
0.99	20000	24618.239	309.862	308.155	2883.898	0.992	1.707	7718.486
0.999	20000	0	0	0	3192.052	0.996	0	0

As the Beta increases with the number of scenarios being 20k, the expected profit decreases. In fact, the smaller the proportion of scenarios from the left in the distribution of profit, the smaller the value of the tail. With a beta of 0.999 and 20k scenarios, we only take 20 scenarios having the worst profit. These scenarios seem to have a null demand of suits. Therefore, the expected profit is null and the CVaR is also null.

Task 3 – General Model

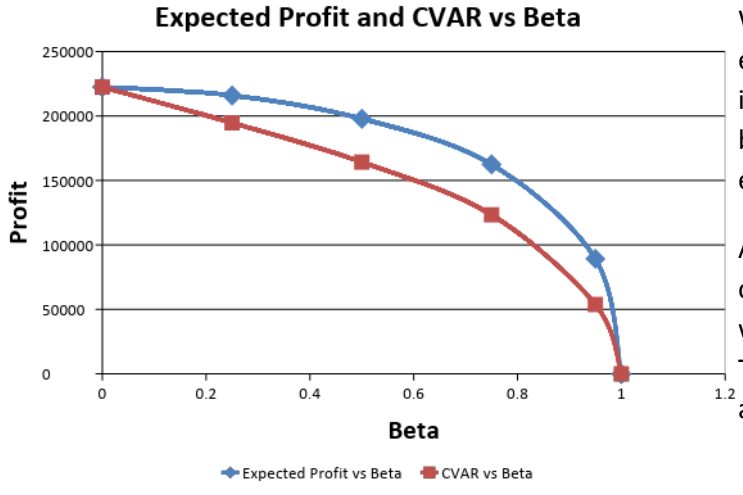
Solve the CV@R maximization problem with beta:

- **0.0, 0.25, 0.5, 0.75, 0.95, 0.99999.**

What is the relationship between the CV@R, the expected Profit, and the Worst-case profit?

Beta	CVAR	Expected Profit
0	222497.007	222497.007
0.25	194711.050	215932.603
0.5	164241.506	197875.168
0.75	123345.336	162452.817
0.95	53770.350	89213.898
0.99999	0.000	0.000

This table illustrates one more time the dynamic previously explained in Task 2:



When beta is zero, cvar is equals to expected profit. This means beta = 0 is equivalent to a risk neutral case. As beta increases, the CVAR and expected profit both decreases.

As beta increases to nearly equal to one, the cvar, expected profit and worst case profit all converge to zero. This means beta at near 1 is equal to a worst case scenario.