Enhanced indexation example question 2

The table below shows the stock prices and index values over a number of time periods, together with the current portfolio.

Period	A	B	C	D	E	Index
0	39.7	3.1	38.2	72.9	3.6	2655.8
1	73.5	0.5	96.3	60.4	77	5039.7
2	17.3	42.3	62.2	49.7	91.5	4717.7
3	31.6	70.8	57.2	5.2	54.7	4946.7
T=4	64.4	86.9	76.1	27.1	14.3	6506.6
Current portfolio	5	67	8	6	10	

For example in period 3 the stock/share price for stock A is 31.6 and the index value is 4946.7. The current portfolio contains 5 units (shares) of stock A, 67 of B, etc.

Use the (modified) Sharpe and Sortino objectives and this data to construct (enhanced indexation) tracking portfolios containing K=3 stocks with an aim of achieving 10% excess per time period. Here you should construct portfolios containing:

- just stocks A, B and C
- just stocks B, C and E
- stocks A and B and either stock D or stock E. All stocks chosen should represent at least 5% of the portfolio by value.

Which of your six constructed portfolios do you prefer and why?

Evaluate how your constructed portfolios would have performed in practice if the stock prices and index values over the next four time periods were:

Period	A	B	C	D	E	Index
5	58.9	85.3	68.6	24.9	13.3	6100.8
6	28.7	70	54	4.8	49.7	4582.2
7	15.5	39.1	57	48.2	85.1	4642.4
8	69	0.4	89.1	56.2	76.5	4994

Do you think you made the right choice as to which of six constructed portfolios you preferred or not?

Note:

- The above data is the data you used in the previous tutorial. If you saved the spreadsheet you created there you can use that as a starting point for this tutorial.
- If you do not have the spreadsheet from the previous tutorial then download the file estart.xls from http://www.brunel.ac.uk/depts/ma/research/jeb/finance/ That file contains the index tracking model we constructed in the lectures for the data we used in the lectures. You can therefore start from that spreadsheet (which includes the index tracking Solver model).

Enhanced indexation example solution 2

Recall from the previous tutorials that because Solver utilises a heuristic solution technique you will probably get different solutions from those shown below.

Here to ensure that we have portfolios containing the desired mix of stocks we:

- just stocks A, B and C
  - set the binary (zero-one) variables appropriately ($z_A = z_B = z_C = 1$, $z_D = z_E = 0$) and use Solver to decide appropriate quantities
- just stocks B, C and E
  - set the binary (zero-one) variables appropriately ($z_A = 0$, $z_B = z_C = 1$, $z_D = 0$, $z_E = 1$) and use Solver to decide appropriate quantities
- stocks A and B and either stock D or stock E. All stocks chosen should represent at least 5% of the portfolio by value.
  - Here we set the binary (zero-one) variables appropriately ($z_A = z_B = 1$ and $z_C = 0$. We can add the constraint $z_D + z_E = 1$ to restrict the choice between D and E if we wish (if fact there is no need as we require a portfolio with three stocks and with two stocks specified as being in the portfolio only one other stock can be chosen). We add the proportion constraint $0.05z_i \leq V_{iT}x_i/C$ (as discussed in the lecture notes when we discussed index tracking)

With an aim of achieving 10% excess per time period with either the (modified) Sharpe or Sortino objectives we get the results shown below by utilising the enhanced indexation Solver model as constructed in the lecture.

We also show below the average portfolio return as well as the difference between that and the average index return, which for the example dealt with here is 22.40178%

Objective	Portfolio	A	B	C	D	E	Average portfolio return	Difference from index return
Sharpe	A, B and C	24.677	62.1759	0.8727	0	0	44.17876	21.77698
	B, C and E	0	65.9518	17.444	0	0	52.31477	29.91299
	A and B and either D or E with proportion constraint	5.48036	4.06139	0	234.42177	0	-22.43931	-44.84109
Sortino	A, B and C	0	75.5756	6.45444	0	0	67.16183	44.76005
	B, C and E	0	75.5756	6.45444	0	0	67.16183	44.76005
	A and B and either D or E with proportion constraint	98.6464	4.06139	0	13.023432	0	9.236799	-13.16498

Here we might well be tempted to choose the Sortino portfolio containing stocks B and C with an average return of over 67%, as that would (historically) have performed best. However when we do the future evaluation, seeing how our investment (enhanced indexation tracking portfolio) would have performed if we had invested in it at T=4 over the period from t=4 to t=8, we get:

Objective	Portfolio	Average portfolio return	Difference from index return
Sharpe	A, B and C	-34.08778	-27.47328
	B, C and E	-37.41076	-30.79626
	A and B and either D or E with proportion constraint	16.31102	22.92552
Sortino	A, B and C	-61.40645	-54.79195
	B, C and E	-61.40645	-54.79195
	A and B and either D or E with proportion constraint	1.649514	8.26401

Here the index returned –6.614496% over the time period t=4 to t=8. Had we chosen the Sortino portfolio containing stocks B and C we would have seen a significant decrease in portfolio value, our portfolio would have dropped in value by over 61%, far worse than the drop in the index.