Fairweather Pension Plan
Due on the day of Class # 11, in recitation

In this case, you are to play the role of Leslie Rentleg, an independent investment consultant specializing in providing institutional investment clients, such as pension funds and endowment funds, with strategic advice regarding portfolio allocations. You should work in teams of 3 students each. (If necessary, a few 2-person teams will be permitted, but no 4-person teams.) Each team should prepare a PowerPoint presentation and a 2-page Word file executive summary covering all five of the "scenes" in the case. On the due-date of the case, one team will be selected randomly to present in class each of the scenes, using your PowerPoint presentation for that scene (a different team will be randomly selected for each scene). All teams should hand in to the TA printouts of their PowerPoint files (6 slides to the page), as well as a printout of their Word file executive summaries.

Note: This case requires use of a specialized portfolio analysis software package called *EnCorr*, produced by Ibbotson Associates.

Background:

It had taken Leslie almost an hour and a half to navigate the Audi A4 Quattro through yet another Boston snowstorm that was timed perfectly for the morning commute. He was beginning to wonder why he had bothered, when he received a call from Cate Polleys, Director of Real Estate Research for Fidelity Investment Management, just down the street. Cate was trying to land a new client, the pension fund of Fairweather Corporation, a major manufacturing firm in the packaging industry. Cate was hoping that Leslie's expertise and experience could be helpful to her in convincing Fairweather that Fidelity was the right firm to provide strategic investment advice for the firm's pension fund portfolio allocation decision.

Fairweather had recently had a major change in management. A closely held family firm, the original founder had recently stepped aside in favor of a professional management team, including a new CFO by the name of Tyler Knight. Tyler had been surprised to learn that Fairweather's pension plan was 100% in bonds. He believes that "a pension plan should be managed so as to maximize return within well-defined risk parameters," and "anyone can buy bonds and sit on them". Tyler contacted Cate, who convinced him that Fidelity should be one of a short list of investment management firms that Fairweather should consider hiring to assist with both planning and implementation of a more broad-based and profitable policy for the firm's pension fund.

What Cate wanted from Leslie was an overview of the portfolio allocation implications of "Modern Portfolio Theory" (MPT). Cate knew that strategic investment decision making needed to consider other issues besides those treated in MPT, but she felt that this rigorous scientific model would be a good starting point and frame of reference for an objective discussion with Fairweather's CFO. Also, Cate felt that one of Fidelity's comparative advantages relative to their competition was their expertise in including alternative investment asset classes in clients'

portfolios, going beyond just the traditional asset classes of stocks and bonds. She was especially excited about Fidelity's ability to include real estate as a third major asset class in the portfolio, even for funds as small as Fairweather's, by the use of various types of real estate securitization (both public and private).

Cate had already done some background research on Fairweather, which she summarized for Leslie. Fairweather is the eighth largest domestic packaging company, with annual revenues of $500 million. Revenues have grown about 8.0% per year over the past five years, with one down year. The company employs about 7,000 people, compared with 6,500 five years ago. The annual payroll is about $300 million. Company profits last year were $20 million, compared with $12 million five years ago. Pension assets are currently $100 million, invested entirely in bonds. The average age of the pension eligible work force is 43 years. Leslie felt that this average age was slightly on the young side, suggesting a relatively long average holding period for Fairweather's pension fund investments.

Leslie agreed to meet Cate next Monday to present her with a preliminary portfolio analysis. Leaving his donut and coffee half finished, he got right on the case…

Scene I: Preparation for Monday Meeting with Cate

Based on discussions with Cate considering the size and sophistication of Fairweather's financial staff, Leslie decided to explore a relatively simple five asset class portfolio for Fairweather. The analysis would consider large stocks (S&P500), small stocks, long-term bonds, intermediate-term bonds, and REITs. Leslie decided to base the initial analysis on the historical returns that had actually been achieved by these five asset classes during the 1978-2002 period, analyzing the calendar year annual-frequency total returns achieved.

For the "mainstream" (or "core") asset classes of stocks and bonds, Leslie was already familiar with the historical returns data series that he would use in the analysis. Like many portfolio analysts, he found it convenient to use the Ibbotson Associates data series from the *"Stocks, Bonds, Bills, & Inflation"* Yearbook (SBBI), especially as this data could be easily retrieved in his *EnCorr Analyzer* software. (Leslie's first step was to update his data by getting on the internet and using his web browser to download the latest data update file from Ibbotson, at the www.ibbotson.com/dataupdate site.[*]) Leslie would use the SBBI historical total return indices to represent large stocks (S&P500), small stocks, and Government bonds (recognizing that ex post risk and return characteristics of Government bonds are not very different from corporate bonds, as the credit losses largely cancel out the effect of higher stated yields in the corporate bonds).[†]

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[*] Students should check with the TA for tutorial assistance with the EnCorr data update process. Try to get the latest data, so your historical analysis can cover through the end of the 2002 calendar year. If this is not possible, you can work through the end of 2001 using the data that came with the EnCorr software CD that should be available for you to load onto your laptop.

[†] Start the EnCorr Analyzer, then from the top menu bar select *File*, and then in the popdown menu click on *New Folder* to create a new historical returns series folder (".fld") file (or click on *Open Folder* to open a pre-existing ".fld" file). Then use the *Select Series* window to add or remove historical return data series from the folder. (The *Select Series* window can be invoked at any time within the analyzer case file by clicking on the *Select* button on the top toolbar.) In the *Select Series* window, in the top left panel, click to open the *Raw Data* folder, and then the *Ibbotson Database* folder. Within that folder you will see folders representing several Ibbotson database *modules*, including *Stocks, Bonds, Bills & Inflation* (SBBI), and *US Investment Benchmarks*, the two major modules you will be using in this assignment. When you click to open a module, a list of all the historical returns series appears in the lower left panel. Select the series that

As Leslie's familiarity with REIT investment returns data was a bit rusty, he decided to first check out the NAREIT web site (www.nareit.org), to explore what sort of historical returns data was available on that site. One thing Leslie wanted to think about was whether to use the *NAREIT All REIT Index* or the *NAREIT Equity REIT Index* to represent the returns to the real estate asset class in his portfolio analysis.

Although the NAREIT web site provided some interesting perspective (and could clearly provide more detailed REIT data if he needed it), Leslie eventually decided to simply download the REIT data he needed directly from within his EnCorr Analyzer, as he discovered that NAREIT total returns series are included in the "US Investments Benchmarks" module within the Analyzer. Leslie also decided he would also keep track of 30-day T-Bill annual returns and annual inflation in his analysis, so he also downloaded these series from the SBBI module in the Analyzer.

Once the historical data was retrieved and saved in an EnCorr "folder" (".fld" file) from the EnCorr Analyzer, it was very quick and easy for Leslie to create a portfolio optimization input (".inp") file using the Ibbotson *Inputs Generator*, and then to use that inputs file to perform portfolio optimization analysis using the *EnCorr Optimizer* (to create an ".aax" file by saving the optimization "case file").

For his Friday meeting with Cate, Leslie generated the Markowitz (mean-variance) efficient frontier using the five risky asset classes in the portfolio choice set he had developed, based on the 1978-2002 calendar year historical returns actually achieved.[*] He summarized the frontier in a table that specifically showed the efficient portfolio composition and risk and return statistics for six different risk/return points along the frontier, at target returns of 11%, 12%, …, and 16%. For each target return, the table showed the share of the efficient portfolio in each of the five asset classes (if any), and the expected return, volatility (standard deviation of return).[†] Leslie also

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you wish to *Add* to the presently active Analyzer case file folder. Then click on *OK*, and in the *Date Settings* window that appears, set the beginning and ending dates and the return frequency as you want them. (The *Date Settings* window can be invoked anytime by clicking on the *Select* button on the top menu bar and then clicking on *Date Settings*.) You can save the folder as an Analyzer ".fld" file by clicking *File* and then either *Save* or *Save As* (to give the file a new name).

[*] If you have already saved an inputs (".inp") file, then upon invoking the Optimizer, select *File* in the top toolbar, and then *New* to create a new optimization case file (or select *File*, and *Open* to open a previously-saved optimization case ".aax" file). In the *Optimization Inputs* window, select the asset classes you want in the portfolio choice set, and then click on the *Optimize* button at the bottom of the window to generate the efficient frontier. (The *Optimize* button appears in the *Start Up* tab of the *Optimization Inputs* window.) Save the optimization case as an ".aax" file by selecting *File*, and *Save* (or *Save As*, to give the file a new name). To view the efficient frontier, click on *View* in the top toolbar, then on *Efficient Frontier*. Various different "views" or representations of the efficient frontier are then available by clicking the appropriate representation label in the *View* popdown menu, or by clicking the appropriate icon on the toolbar. You should examine at least three views: *Efficient Frontier*, *Portfolio Statistics*, and *Area Graph*. (Note: the *Optimization Inputs* window opens blank when the Optimizer is first invoked. This blank inputs window may be closed unless you want to directly enter risk and return expectation statistics inputs in the *Inputs* and *Correlations* tabs, which you will not do at this stage because you are using historical inputs created from the Analyzer. Clicking on *File* and *New* or on *File* and *Open* will open a new *Optimization Inputs* window with the inputs of the ".inp" or ".aax" file that you have just opened. The difference between *File New* and *File Open* is that the former requires input from a pre-existing ".inp" inputs file, whereas the latter requires input from a previously-saved ".aax" optimization case file.)

[†] To create the table, activate the *Portfolio Statistics* window (by *View*ing the *Efficient Frontier* after clicking the *Optimize* button from the *Optimization Inputs* window). With the *Portfolio Statistics* window active, click on *Frontier* in the top toolbar, then in the popdown menu click on *Find/Label Point…* and in

depicted the efficient frontier visually by generating an "efficient frontier graph" and a "frontier area graph", which he *exported* to both Excel and PowerPoint files.[*] His presentation to Cate was prepared in PowerPoint, including the table of target return portfolios and the two graphs of the frontier.

Scene I: Monday Meeting with Cate

Leslie's Friday meeting with Cate went pretty well. However, Cate pointed out a major "hole" in Leslie's analysis. Cate pointed out that there are really two rather different types of real estate investment vehicles: the publicly-traded REITs that Leslie had considered, but also private investment directly in the underlying property assets, which Leslie had ignored. Cate pointed out that private direct real estate investment was possible even for smaller pension funds nowadays, using private "securitization" vehicles such as co-mingled real estate funds (CREFs), or even one of the newer "fund of funds" that allows even smaller denominated investments in diversified portfolios of property by pooling CREF units and issuing smaller-denominated interests in the pool. She suggested that the NCREIF Index of institutional property returns would be a good measure of the investment performance of the private real estate asset class. She also suggested that, since each of the other two asset classes in the portfolio was represented by two "sub-classes" (stocks by both large and small cap indices, bonds by both long-term and intermediate-term indices), it was a bit "unfair" to represent the real estate asset class by only one index. Such an arbitrary asymmetry of "granularity" in the portfolio asset class choice set could bias the result against the asset class that was less well represented by sub-indices.

Well, of course, Leslie could have kicked himself for not recognizing Cate's point earlier by himself. Now he was afraid he had made a bad impression. Leslie realized that the private property market is not perfectly correlated with the REIT market, because Leslie knew that REITs often trade at temporally varying premia and discounts to their "net asset values" (NAV). In effect, the stock market (where REIT equity trades) and the private property market (where the underlying properties trade directly) do not always agree about the value of real estate, and this "disagreement" varies over time. (Also, firm level effects such as management actions, agency concerns, financing, property development and trading, and other REIT activities, may influence REIT firm equity value and stock returns in ways that may differ from those of the underlying "bricks and mortar".) Thus, including private direct real estate in the portfolio asset class choice set should improve on the efficient frontier possibilities, allowing greater diversification. Leslie was determined to impress Cate better the next time around. They arranged to meet the following Wednesday after Leslie had incorporated the private direct real estate asset class into the analysis.

Scene II: Preparation for Wednesday Meeting with Cate

As with the NAREIT data previously, Leslie's first step was to go to the NCREIF web site (www.ncreif.org), and familiarize himself with the nature of the private real estate investment returns data.[†] He saw how it was possible to use NCREIF's query screens to generate "custom

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the dialog box that opens up enter "11" in the *Expected Return:* box (with "Expected Return" selected in the *Find By:* box), then click on the *Find and Label* button. The 11% target return efficient frontier portfolio will then appear in the *Portfolio Statistics* window. Repeat this process to add the 12%, 13%, …, etc, up to 16% target return portfolios to the table. You can then place your cursor on the *Portfolio Statistics* table, right click, and export the table to Excel or PowerPoint or Word.

[*] To export, place your cursor directly over the picture part of the chart, right-click the mouse, and select the type of export file you want to create (Excel, PowerPoint, or Word).

indices" consisting of particular types of properties in particular geographic locations, and how the returns indices could be generated based on either value-weighting or equal-weighting of the constituent property returns (the former being the "official" NCREIF method), and with income and appreciation return components computed based either on subtracting capital expenditures from the appreciation component or from the income component (the former being the official NCREIF method).

Although the NCREIF web site was interesting, once again Leslie opted to download the NCREIF historical returns data directly in his EnCorr Analyzer, using the "NCREIF Property Index TR" series that he found in the same "US Investment Benchmarks" data module from which he had obtained his NAREIT returns. The EnCorr Analyzer allowed easy conversion of the quarterly NCREIF data to the annual calendar year frequency Leslie was using for his historical portfolio analysis, and facilitated the creation of a new (or modified) inputs file for use in the Optimizer.

To prepare for his Wednesday meeting with Cate, Leslie produced tabular and graphical representations of the efficient frontier and target return portfolios exactly as he had before, only now with six asset classes including private real estate as represented by the NCREIF Index. In addition, to clarify the effect of the addition of the private real estate asset class, Leslie employed the *Multiple Frontiers* feature of the EnCorr Optimizer to display the frontier both with and without NCREIF on a single graph of the efficient frontier.[*] Finally, Leslie summarized the general characteristics of the efficient frontier with a brief discussion (in *executive summary* format, both in his PowerPoint presentation and in a hardcopy Word file he prepared for Cate). In this summary Leslie made particular mention of the nature and role of the real estate asset classes in the efficient frontier.

Scene II: Wednesday Meeting with Cate

The Wednesday meeting went better than Monday's. Indeed, reflection on the real estate role in the efficient frontier led Cate and Leslie to brainstorm a bit about what was going on, and whether they ought to explore the analysis further. They were both troubled by the difference between the results implied by the MPT analysis based on the historical performance data, and the typical makeup of real world pension portfolios, which they knew had on average only about 3% in real estate, with most small funds like Fairweather having no real estate allocation at all. They were not really satisfied with the data Leslie was using in the inputs of his optimization. They realized

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[*] In the Optimizer, *Open* the previously-saved ".aax" optimization case file that has all six asset classes in the inputs. In the *Optimization Inputs* window that appears, click on the *Multiple Frontiers* button at the bottom left of the window. (The *Multiple Frontiers* button appears in the *Start Up* tab of the *Optimization Inputs* window.) In the *Multiple Frontiers* dialog box that appears, give a name (by clicking *Rename*) to the pre-existing efficient frontier based on the six asset classes, such as *"With NCREIF"*. Then add another efficient frontier by clicking the *Add* button in the *Multiple Frontiers* dialog box, and filling in the *New Frontier* dialog box that appears. Fill in the *Description:* box at the bottom with the name of the second frontier, such as *"Without NCREIF"*. You might as well copy the second frontier inputs from the pre-existing *With NCREIF* frontier. Click on *OK*, then close the *Multiple Frontiers* box, and notice that the *Optimization Inputs* window now applies to the *Without NCREIF* frontier. *Remove* the NCREIF asset class from among the selected series, then click on *Optimize*. Both efficient frontiers will appear simultaneously in the *Efficient Frontier* graph, and you can switch from one to the other by clicking on *Frontier* in the top menu bar and then clicking on whichever frontier you want to see and work with. Click on the *Portfolio Statistics* window to activate that view, and then fill out the target return portfolio table for both efficient frontiers, as before. Don't forget to save the dual frontier optimization case file under a new name using the *File* and *Save As* buttons.

that historical returns reflected the *past*, but what was relevant for investment decision making were present expectations about the *future*. They felt they should (or, more exactly, Cate felt that Leslie should) address this issue *somehow* (and she made it clear that she thought it was *his job* to figure out exactly *how*). They made plans to meet the following Friday (under some time pressure, as the scheduled presentation to Tyler Knight at Fairweather was fast approaching).

Scene III: Preparation for Friday Meeting with Cate

Leslie considered several issues in thinking about how to modify his optimization input assumptions to better reflect current investment risk and return expectations going forward. Surely the historical statistics carried some valid implications for what was reasonable to expect in the future, but just as surely some aspects of those statistics probably reflected idiosyncratic events and relationships and patterns that were unique to the particular historical period covered by the data (1978-2002), and not representative of reasonable or widely held current expectations about the present and future investment environment. For example, Leslie reviewed the long sweep of the history of inflation (which he could easily examine from 1926 through 2002 by downloading the Ibbotson SBBI inflation data in the Analyzer). Could the unique level and volatility of inflation in the 1970s and 80s account for some of the low correlation between private real estate and bonds during the 1978-2002 period? Would it be reasonable to expect less negative correlation between those two asset classes in the future? And what would the difference between the 1978-2002 average inflation rate and the current inflation expectations do to the level of the nominal expected returns employed as the asset class mean returns in the optimization inputs?

Another issue Leslie was concerned about had to do with the extremely low volatility and correlation statistics on the NCREIF Index. He didn't feel they could be realistic, and he suspected they were dampened by the appraisal-based nature of that private market index. Cate, who was a graduate of the MIT MSRED program, suggested that Leslie might take a look at methods to *"unsmooth"* the NCREIF returns, to correct for the appraisal effects. For example, Leslie figured it might be pretty easy to apply the *"Simple One-Step"* unsmoothing procedure described on page 684 of the Geltner-Miller text, by simply copy/pasting the NCREIF annual calendar year appreciation (capital) returns from the ncreif.org query screen (bottom panel) into Excel, and then applying the unsmoothing formula. Leslie knew that periodic returns series second moments (such as volatility and correlations) were generally determined almost entirely by the capital return components of the total returns. Perhaps the "one-step" adjusted capital returns would give a more realistic indication of the true private real estate annual volatility? Perhaps they would also better indicate the correlation between private real estate and other asset classes (whose returns could be downloaded into the same Excel worksheet from the EnCorr Analyzer[*])? Of course, the very low historical correlation between NCREIF and bonds might still be idiosyncratic to the historical period covered.

After some additional analysis, Leslie developed a new 6-class portfolio optimization case file in the EnCorr Optimizer, starting out from his previous 6-class case, but manually modifying some of the input statistics by working in the *Inputs* and *Correlations* tabs in the *Optimizer Inputs*

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[*] In the EnCorr Analyzer, with the data folder (".fld" file) open whose data you want to export to Excel, go into the *File* menu and select *"Export Data to Other…"*. Alternatively, in the Ibbotson Inputs Generator, with the inputs (".inp") file open whose data you want to export, click on the *"Select Series"* tab, and then on the *Data Center…* button at the bottom of the window. Then hit *Series Editor* and the data will appear, and then in the *File* menu *Export* the data as an Excel file.

window.[*] He appended the results as additional tabular and area graph slides in his previous PowerPoint presentation file for Cate, and also added a new summary slide (and addendum to his Word file Executive Summary) describing the reasoned judgments he had made to the portfolio analysis input assumptions regarding the asset classes' expected returns, volatilities, and correlations.

Interlude: Tuesday Meeting with Fairweather

Cate was well satisfied with their preparations for their meeting the following Tuesday with Fairweather. The meeting on Tuesday also went well until Faiweather's CFO, Tyler Knight, raised the question that this frontier analysis: *"has not really solved anything for Fairweather, because how can we know which point along the frontier we should target?"* In response, Cate covered nicely for the two of them, pointing out that this was a question that could ultimately be decided only by Fairweather, based on their risk tolerance and objectives for the pension portfolio. They agreed, however, that Leslie would prepare some additional relevant analysis and some thoughtful discussion prior to a second meeting scheduled for the following Thursday.

Scene IV: Preparation for Thursday Meeting with Fairweather

Leslie spent the intervening two days collecting his thoughts regarding the risk posture Fairweather might consider for the pension portfolio. He organized his thoughts into three stages: (i) In the context of the classical MPT model, where along the efficient frontier should Fairweather position itself? (ii) What are the implications of bringing in a slightly different (but also "classic") model, in which the existence of a riskless asset is postulated? And (iii) Broader considerations, including the recognition that risk in the management of a pension portfolio is not just one-dimensional, and is not completely captured simply in the volatility of the portfolio assets. As part of his analysis in (ii), Leslie used the EnCorr Optimizer to identify the Sharpe Ratio Maximizing portfolio, using as the "riskfree rate" the historical average T-Bill return during 1978-2002.[†] Tyler collected his presentation in three succinct PowerPoint slides and another brief Word file Executive Summary.

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[*] In the Optimizer, open the previously-saved ".aax" file with the six asset classes. Go first to the *Inputs* tab, and then to the *Correlations* tab. You can copy/paste data directly from an Excel worksheet (e.g., where you might perform the unsmoothing and related statistical computations) into the *Inputs* and *Correlations* statistics for the NCREIF asset class in the EnCorr Optimizer *Optimization Input* window. Note that "true EnCorr experts" are able to import entire user-defined historical returns series by invoking the Ibbotson *Data Center* software package from the Ibbotson Investment Analysis Software suite. If you want to try this (not necessary), first save the unsmoothed returns series data in a column in an Excel file with the dates (years) running down the rows in column A and the returns data running down the rows in col.B, starting with the first year of data in row 2, labels in row 1. In the Data Center menu click on the *Import/Export Wizard*, and then on *Import a File*, and then browse to the Excel file in which your returns series you want to import is located. Keep clicking on *Next* until the returns series data is saved in a new *"User-defined Module"* (e.g., you could name it "NCREIF Unsmoothed"). This series can then be imported into any inputs created in the *Inputs Generator*. Find it in a folder in the *Raw Data/User-Defined Database* folder. However, in the present exercise it is not necessary to create a user-defined unsmoothed series for importation into an inputs file. (In the optimization case file you would have to modify the mean return to reflect a total return rather than just the capital return component.)

[†] This statistic was easily seen in the EnCorr Analyzer folder (.fld) file and/or the Inputs (.inp) file that Leslie had created, by looking at the *statistics* or the *inputs summary* tabs in those files.

Interlude: The Thursday Meeting at Fairweather

Cate and Leslie's second-round presentation at Fairweather went very well, to the point that Tyler got sufficiently excited about MPT that he wanted to be able to run through some "sensitivity analysis" on the input assumptions by himself. But when he heard the price tag on the EnCorr software, he balked. Leslie then couldn't resist telling them how he had learned in graduate studies at MIT how to do the same analysis that he just did (more or less, in Scene IV), using nothing more than Microsoft Excel (and its "Solver" utility).[*] Cate rolled her eyes as this outburst led to yet another follow-up meeting being scheduled with Fairweather, for Leslie to demonstrate to Tyler how to do the portfolio analysis in Excel.

Scene V: Preparation for the 3rd Meeting at Fairweather

The key to Leslie's preparations for the third meeting with Tyler was the Excel file "template" that he still had saved from his days as a student at MIT. The "Portfo1" file was useful in that it sort of opened up the *"black box"* of EnCorr, revealing what was actually going on, at a computational level, in the portfolio analysis and optimization that occurred "behind the scenes" (as it were) in EnCorr. While Leslie did not attempt to replicate in Excell all of the graphical outputs EnCorr provided, he did replicate some of the key results he had previously shown Fairweather, both with and without the riskless asset construct. He also conducted a very simple and brief sensitivity analysis, by changing some of the input assumptions and seeing how the Excel Solver changed the resulting optimal portfolio.[†]

[*] Although admittedly in a somewhat more cumbersome manner, and with less flexibility and less spiffy graphical outputs.

[†] Note that it is usually necessary to "reset" the Excel spreadsheet before running the Solver, by entering either zeros or all equal shares in the policy weights in row 39. The point is to make the Solver start searching again for a new optimum. The Solver is a numerical algorithm that works by trial and error. It can sometimes "get stuck", and needs a sort of "kick" to get it moving.