

# **Fall 2025**

## **FRE-GY 6883 Financial Computing**

### **Course Final Project**

#### **General Requirement**

You are required to complete class projects in teams of approximately five members (Tuesday Evening section: 3-4 people per team, Saturday Afternoon section: 4-5 people per team). We will have a total of 5 teams in our class. You should elect one member of your team to be the team leader. Teams, once formed, cannot be changed midway through the project. The team leader is responsible for facilitating the project planning, and the entire team will plan the project under the team leader's guidance. Planning involves identifying what needs to be done (tasks), who should do it (resources), when tasks should be completed (time frames), and how tasks are best sequenced (dependencies).

The team leader is required to provide a brief weekly update of the team's progress.

Each team will submit PowerPoint slides and all project files, including source code and the Makefile (remove objective files and the executable file), in a tar/zip format to our course website three days before the presentation day (December 10, 2025, 11:55 pm for the Saturday session, and December 13, 2025, 11:55 pm for the Tuesday session). The PowerPoint presentation should include your research on Russell 3000 stocks, focusing on their earnings, a diagram of the project design (UML is preferred), class declarations and data structures, program outputs, and discussion of your results. All the teams are requested to present and demonstrate their projects. Team members will be quizzed with written questions based on the team's project source codes. Each team can resubmit their presentation once on the designated day if necessary. Your project will be evaluated based on its program efficiency, complexity, and the success of your demonstration and presentation. The team leader will submit all the necessary documents.

#### **Project Description**

#### **Evaluate the impact of quarterly earnings reports on stock price movement**

#### **Programming Requirements:**

- Use libcurl to retrieve historical price data from eodhistoricaldata.com: A function retrieves the adjusted close prices for selected Russell 3000 stocks and IWV (Russell 3000 ETF used as market benchmark) into memory.
- Create a set of classes such as a Stock class to store EPS estimates, earnings data, price history, industry sector and group information.

- Use member functions or independent functions for all calculations. Overload a few arithmetic operators for vector/matrix.
- The stocks and their corresponding price information for each group should be stored in an STL map, with stock symbols as the keys.
- Store expected AAR, AAR-STD, expected CAAR, and CAAR-STD for all three groups in a matrix. The row of the matrix is the group#, and matrix columns are for expected AAR, AAR-STD, expected CAAR, CAAR-STD
- Use gnuplot to show the expected CAAR outputs for all three groups in one graph.
- Your program should have a menu of 5 options:
  - Enter N to retrieve  $2N+1$  days of historical price data for all stocks (you need to validate user input to make sure  $N \geq 30$  and  $\leq 60$ ).
  - Pull information for one stock:
    - Daily Prices (Adjusted Closing Prices)
    - Cumulative Daily Returns
    - The group the stock belongs to
    - Earning Announcement Date, Period Ending, Estimated, Reported Earnings, Surprise and Surprise %.
  - Show expected AAR, AAR-STD, expected CAAR and CAAR-STD for one group.
  - Use gnuplot to display the chart for the expected CAAR of all three groups using X11 (do not save as an external image file).
  - Exit your program.

### **Calculation Details:**

1. Based on the 1<sup>st</sup> quarter of 2025 earnings announcement for Russell 3000 stocks (See the Earnings Announcements sheet), use sector-neutral strategy to build three groups of stocks, to ensure balanced and economically meaningful Beat/Meet/Miss groups:
  - a. In the Excel file, iShares-Russell-3000-ETF\_fund, stocks are categorized by industry sector. For each industry sector, **sort stocks in the descending order** of earnings surprise.
  - b. Remove earnings-surprise outliers by eliminating **the top 2% and bottom 2%** of stocks within each sector.
  - c. After outlier removal, **equally divide the remaining stocks** into three groups within each sector:
    - Beat (positive surprises)
    - Meet (surprises closest to zero)
    - Miss (negative surprises)
  - d. **Combine the sector-level allocations** to form the final Beat, Meet, and Miss groups. As a result, all three groups contain stocks from every industry sector, ensuring sector-neutral event study comparisons.
2. **Define day “zero”** for a stock as the day the earning is announced.

3. Implement Bootstrapping:

- a. Randomly selecting **30 stocks** from each group, a total of 90 stocks.
- b. Use libcurl lib to retrieve  $2N+1$  days of historical prices for Russell 3000 stocks and ETF ticker IWV (used as market benchmark) around the date of earning release (You could enhance our class example for this purpose). N is an integer that must be greater or equal to 30 and will be entered by users. Users will be warned if there are not enough historical prices for  $2N+1$ .
- c. For each stock, calculate the daily returns  $R_{it}$  for  $N-1$  days before the day “zero” and N days after, such as  $t = -60, -59, \dots, -1, 0, 1, \dots, 59, 60$ :

$$R_{it} = \log(\text{Price}_t / \text{Price}_{t-1})$$

Using **adjusted daily closing price** for your calculation

- d. Calculate the corresponding daily return  $R_{mt}$  for IWV for the same days.
- e. Define abnormal returns as the difference  $AR_{it} = R_{it} - R_{mt}$ .
- f. Calculate average daily abnormal returns for each group of stocks (with M stocks,  $M = 30$  in our case) for all  $2N$  reference days:

$$AAR_t = \frac{1}{M} \sum_{i=1}^M AR_{it}$$

- g. Cumulate the returns on the first T days to CAAR:

$$CAAR = \sum_{t=-N+1}^T AAR_t, T \text{ could be } -N+1, -N+2, \dots, N-2, N-1, N$$

- h. Repeat steps a to g 40 times to create 40 samplings and then calculate:
  - i. Average AAR and CAAR for 40 samplings for each group
  - ii. Standard Deviation of AAR and CAAR for each group
- 4. Generate a gnuplot chart showing the average CAAR of all three groups and discuss the impact the earning releases have on their stock prices. Is there any conclusion you could draw from your project?

## **Project Tasks:**

Task 1: Earnings research — apply the sector-neutral grouping method to assign Russell 3000 stocks into Beat, Meet, and Miss groups based on earnings surprises.

Task 2: Project Design:

- a) Create classes and data structures such as vectors, matrices, and maps.
- b) Figure out how to handle historical price retrieval from eodhistoricaldata.com for all IWV 3000 stocks and the benchmark IWV, and parse the retrieved data.
- c) Figure out how to implement your Bootstrap algorithm.
- d) Write member functions or independent functions (with operator overloading) for all the calculations.
- e) Design and implement a menu.

Task 3: Figure out how to implement menu options and graph your results with gnuplot.

Task 4: Divide the project into modules and assign team members to work on each module.

Task 5: Module Integration and Testing

Task 6: Presentation Preparation.