Midterm Exam #2
Solutions

FINM 36700- Portfolio and Risk Mgmt

Nov 10, 2025

Name: _____

UChicago ID: _____

- This exam is **closed book** and **closed notes**.
- You are **not** allowed any electronics.

Section	Questions	Points per Question	Points Awarded	Points Possible
1	25	2		50
2	30	2		60
Total	110	-		**110**

1 Select exactly ONE answer.

1. When evaluating the **time-series** performance of the CAPM, what statistics are the most important?

   ✓ Alpha estimates from time series regression
   x r^2 from time series regression
   x Beta estimates from time series regression
   x Alpha estimate from cross-sectional regression
   x None of the above

2. When evaluating the **cross-sectional** performance of the CAPM, what statistics are the most important?

   x Average r^2 from time series regressions
   ✓ r^2 from cross-sectional regression
   x Beta estimates from cross-sectional regression
   x Alpha estimate from the cross-sectional regression
   x None of the above

3. If the CAPM were true, then the Treynor Ratios of all assets would be...

   ✓ All equal to each other, and equal to the market return
   x All equal to each other, and equal to the market Sharpe Ratio
   x Proportional to their betas with the market
   x Proportional to their volatilities
   x None of the above

4. If the CAPM were true, then the Information Ratios of all assets would be...

   ✓ All equal to zero
   x Greater than zero for assets with positive mean return, and less than zero for assets with negative mean return
   x Proportional to their betas with the market
   x Proportional to their volatilities
   x Proportional to their mean returns

5. If we compute a tangency portfolio across many factors, then:

   x Factors with lower tangency weights are more important
   x Factors with higher Sharpe Ratios will have higher tangency weights
   ✓ Factors with higher tangency weights are more important
   x Computing a tangency portfolio across many factors is nonsensical

6. Suppose you estimate a momentum regression on daily returns. Compared to trading it daily, trading it monthly has...

- x A higher pre-cost Sharpe Ratio
- ✓ A lower pre-cost Sharpe Ratio
- x The same pre-cost Sharpe Ratio
- x None of the above

7. Continue with the previous question's premise. Compared to daily implementation, monthly implementation has...

   - x Higher transaction/rebalancing costs
   - ✓ Lower transaction/rebalancing costs
   - x The same transaction/rebalancing costs
   - x None of the above

8. Assuming the CAPM is true, the Sharpe Ratio of any asset depends only on...

   - ✓ Its correlation with the market
   - x Its variance
   - x Its mean return
   - x Its maximum drawdown
   - x None of the above

9. Assuming i.i.d. normal returns, as our time horizon increases, our mean (μ) scales ____ and our standard deviation (σ) scales ____.

   - ✓ linearly; sub-linearly
   - x linearly; linearly
   - x sub-linearly; linearly
   - x sub-linearly; sub-linearly

10. Assuming i.i.d. normal returns in two assets, Asset A and Asset B, where $\mu^A = \mu^B > 0$ and $\sigma^A < \sigma^B$. Over the next 30 years, which asset is more likely to have a negative cumulative return?

    - x Asset A
    - ✓ Asset B
    - x Both assets are equally likely to have a negative cumulative return
    - x Not enough information to tell

11. Assuming i.i.d. normal returns in two assets, Asset A and Asset B, where $\mu^A = \mu^B > 0$ and $\sigma^A < \sigma^B$. Assume that σ^A is only slightly smaller than σ^B. Over the next **day**, which asset is more likely to have a negative cumulative return?

    - x Asset A is **much more** likely.
    - x Asset A is **slightly more** likely.
    - x Equally likely for both assets.
    - ✓ Asset B is **slightly more** likely.

- x Asset B is **much more** likely.
- x Not enough information to tell
- x None of the above

12. Which of the following is the strictest test of the CAPM where we have n test assets?

- x A t-test for each of n time-series errors.
- ✓ A single chi-squared test on n time-series errors.
- x A t-test for each of n cross-sectional errors.
- x A single chi-squared test on n cross-sectional errors.

13. During 2024, more than 50% of the S&P 500's gain was attributed to seven large, growth tech stocks. Considering this, which of the following factors most likely performed the best during 2024?

- ✓ Market
- x Size
- x Value
- x Momentum

Comparing Two Assets where CAPM Holds

We have two assets, Asset A and Asset B. We run the following time series regressions against the market factor:

$$\tilde{r}_t^i = \alpha^i + \beta^i \tilde{r}_{m,t} + \epsilon_t^i, \quad i = A, B$$

Note,

- For all the questions in this subsection, suppose that **the CAPM is true.**
- Assumptions cumulate. If you are told to assume something, consider that assumption to hold for any following questions in the subsection.

14. What should the values of α^A and α^B be from the regression above?

- ✓ $\alpha^A = \alpha^B = 0$
- x $\alpha^A > 0$, $\alpha^B < 0$
- x $\alpha^A < 0$, $\alpha^B > 0$
- x Not enough information to tell
- x None of the above

15. What should the values of the R_A^2 and R_B^2 (the regression R-squared) be from the regression above?

- x $R_A^2 = R_B^2 = 1$
- x $R_A^2 > R_B^2$

x $R_A^2 < R_B^2$

✓ Not enough information to tell

x None of the above

16. We find that $\beta^A > \beta^B$. According to the CAPM, which asset should have a higher average return?

✓ Asset A

x Asset B

x Both should have the same average return

x Not enough information to tell

17. Based on the information above, which asset has a higher Sharpe Ratio?

x Asset A

x Asset B

x Both have the same Sharpe Ratio

✓ Not enough information to tell

18. Based on the information above, which asset has a higher Treynor Ratio?

x Asset A

x Asset B

✓ Both have the same Treynor Ratio

x Not enough information to tell

19. Suppose that we find that the mean return of Asset A is higher than that of Asset B, $\mu^A > \mu^B$. Based on this new information, which asset has a higher Sharpe Ratio?

x Asset A

x Asset B

x Both have the same Sharpe Ratio

✓ Not enough information to tell

20. Based on the information above, which asset has a higher Information Ratio?

x Asset A

x Asset B

x $\text{IR}^A = \text{IR}^B \neq 0$

✓ $\text{IR}^A = \text{IR}^B = 0$

x Not enough information to tell

x None of the above

21. Suppose we find that $\rho^{A,m} > \rho^{B,m}$, where $\rho^{i,m}$ is the correlation between asset i and the market. Based on this new information, which asset has a higher Sharpe Ratio?

- ✓ Asset A
- x Asset B
- x Both have the same Sharpe Ratio
- x Not enough information to tell
- x None of the above

22. Based on the information above, which of the assets will have a higher var(ϵ^i)?

- x Asset A
- ✓ Asset B
- x Both have the same var(ϵ^i)
- x Not enough information to tell
- x None of the above

23. Based on the information above, which asset will have a *wider* confidence interval for β^i?

- x Asset A
- ✓ Asset B
- x Both have the same width for the confidence interval
- x Not enough information to tell
- x None of the above

End of Subsection Assuming CAPM Holds

Comparing Two Factor Models

Suppose we have two factor models, Model A and Model B. We test these models on a large set of assets, through the following regressions:

$$\tilde{r}^i_t = \alpha^i_A + \beta^i_A \tilde{f}_{A,t} + \epsilon^i_{A,t}, \quad \text{Model A} \tag{1}$$
$$\tilde{r}^i_t = \alpha^i_B + \beta^i_B \tilde{f}_{B,t} + \epsilon^i_{B,t}, \quad \text{Model B} \tag{2}$$
$$\bar{\tilde{r}}^i = \gamma^i + \lambda_A \beta^i_A + \eta^i, \quad \text{Cross-Sectional Test} \tag{3}$$
$$\bar{\tilde{r}}^i = \gamma^i + \lambda_B \beta^i_B + \eta^i, \quad \text{Cross-Sectional Test} \tag{4}$$

Note that (1) and (2) are the **time series** tests of Model A and Model B, respectively, and (3) and (4) are the **cross-sectional** tests of Model A and Model B, respectively.

24. Suppose that the average r^2 from (1) is higher than that from (2). Therefore:

- x Model A is better than Model B
- x Model B is better than Model A
- x Both models are equally good

- ✓ Not enough information to tell
- x None of the above

25. Suppose that the average absolute value of α_A^i from (1) is lower than that of α_B^i from (2). Therefore:
    - ✓ Model A is better than Model B
    - x Model B is better than Model A
    - x Both models are equally good
    - x Not enough information to tell
    - x None of the above

2 Select all correct answers–whether that is 0, 1, or multiple.

1. Which of the following statements are consistent with an asset having a negative CAPM beta?
    - x The asset is riskier than the market and amplifies market movements
    - x The asset moves in the same direction as the market but with less volatility
    - ✓ The asset has negative correlation with the market
    - x The asset has a negative expected return.
    - ✓ The asset has an expected return less than the risk-free rate.
2. Which of the following statements are implied by the CAPM.
    - ✓ Investors earn a premium for holding the market factor.
    - x Investors earn no premium for holding investments besides the market.
    - ✓ Risks uncorrelated with the market factor are idiosyncratic.
    - ✓ Risks uncorrelated with the market factor are uncompensated.
    - ✓ Mean-variance investors hold only the market portfolio.
    - x Every investor holds only the market portfolio.
3. Which three parameters are used as inputs to the CAPM to compute expected return?
    - ✓ The expected market return, the asset's beta, and the risk-free rate.
    - x The asset's alpha, the asset's beta, and the regression R^2.
    - x The expected market return, the risk-free rate, and the asset's standard deviation.
    - x The risk-free rate, the asset's beta, and the asset's historical average return.
4. In constructing factors, which of the sorted portfolios following show evidence of higher mean excess returns?
    - ✓ Higher book-to-market ratio
    - x Lower book-to-market ratio
    - x Bigger market capitalization

- ✓ Smaller market capitalization
- ✓ Higher returns in the previous period
- x Lower returns in the previous period
- ✓ Higher profitability
- x Lower profitability
- x Higher firm re-investment
- ✓ Lower firm re-investment

5. Why are factor returns constructed using long-short portfolios instead of simple long-only portfolios?

   - x To minimize the transaction costs associated with portfolio rebalancing.
   - x To maximize the absolute return of the strategy regardless of market direction.
   - x To provide a high positive correlation with inflation and other macroeconomic risks.
   - ✓ To reduce the portfolio's overall exposure to the broad market return.

6. A researcher analyzes a specific firm and finds it is a "large-cap" stock (e.g., in the 90th percentile by market cap). However, they also find it has a high, positive beta on the Size (SMB) factor. How is this firm's expected return determined?

   - x The firm's expected return is determined by its large market cap, so it will have a lower expected return
   - ✓ The firm's expected return is determined by its high, positive beta, so it will have a higher expected return
   - x The firm's beta and its fundamentals contradict, so the Fama-French model cannot be applied to this security.
   - x The firm's expected return is determined only by its market beta as size and value are accounting-based.

7. In factor construction, we saw a commonly-used approach that took explicit steps to try to neutralize the newly-constructed factor's correlations to which other factor(s)?

   - ✓ Market
   - ✓ Size
   - x Value
   - x Momentum
   - x Profitability
   - x Investment
   - x Earnings

8. Which of the following is true of testing linear factor pricing models? As we increase the number of factors...

   - ✓ The time-series r-squared must improve.

- x The cross-sectional r-squared must improve.
- x The time-series pricing MAE must improve.
- x The cross-sectional pricing MAE must improve.

9. According to the time-series test of the CAPM, the scatter plot of beta against risk premium should...
   - ✓ Have intercept 0
   - ✓ Be linear
   - x Have a slope of 1

10. Consider the time-series versus cross-sectional (free intercept and free slope) tests of a linear factor pricing model. Select all which are true...
    - x For a given set of assets and factors, the cross-sectional test will have higher r-squared than the average of the time-series r-squared stats.
    - ✓ For a given set of assets and factors, the cross-sectional test will have lower mean absolute pricing errors than the time-series test.
    - ✓ The time-series factor premia equal the time-series average of factor excess returns.
    - x The cross-sectional factor premia equal the cross-sectional average of factor excess returns.

11. Suppose that in a perfectly estimated cross-sectional pricing test, we find a positive intercept. This is evidence that...
    - x A single asset is mispriced by the model.
    - ✓ The risk-free rate is mispriced by the model.
    - ✓ The true model needs additional factors.
    - x The true model is a subset of this model.

12. Suppose the true pricing model is composed of pricing factors: market, size, value, momentum. Suppose every investor knows this and is rational. Which statements reflect the average of all the investors' holdings?
    - ✓ Long market
    - x Long size
    - x Long value
    - x Long momentum

13. Some firms do not use the "investment" factor, as they believe it is redundant to which of the following factors?
    - x Market
    - x Size
    - ✓ Value
    - x Momentum

x Profitability

14. Which of the following factors are used in Fama-French's expanded (2014) model?

✓ Market
✓ Size
✓ Value
x Momentum
✓ Profitability
✓ Investment
x Volatility

15. Why might Fama and French disagree with Warren Buffett's value stock approach?

x HML's premium is zero.
✓ Betas matter, not characteristics.
x Value cannot be measured in a timely way.
x Fama and French find the profitability factor makes value unnecessary.

16. Which of the following is true about Linear Factor Decompositions (LFDs) vs Linear Factor Pricing Models (LFPs).

x Factors useful in an LFD are helpful in LFP.
x Factors useful in an LFP are helpful in LFD.
✓ Factors of a perfect LFD make a perfect LFP.
x Factors of a perfect LFP make a perfect LFD.

17. APT's no-arbitrage logic implies that for a well-diversified portfolio, the α should be:

x Unconstrained - can be nonzero without implying arbitrage.
✓ Zero in the limit as idiosyncratic risk diversifies away.
x Negative if the portfolio has positive factor exposure.
x Positive if the portfolio has negative factor exposure.
x Strictly positive or the factor model is invalid.

18. For the purposes of our class discussion, what is meant by a "perfect" Linear Factor Decomposition?

x LFD has r-squared of 100% for all assets.
x LFD has r-squared of 100% for some assets.
x Intercepts are zero.
x Factors have zero cross-correlation.
✓ Residuals have zero cross-correlation.

19. Momentum strategies are known for high transaction costs. Which of the following approaches can reduce the transaction costs?

    ✓ Less frequent rebalancing (quarterly rebalance instead of daily)

    x Strict boundary conditions to capture true "winners" and "losers"

    ✓ Slower, more flexible implementation of trades

    x Focusing the strategy on small-cap stocks, where momentum effects are strongest.

    x Using a Fama-French 3-Factor model to hedge out market, size, and value risk.

    ✓ Increasing the number of stocks in the "winner" and "loser" portfolios.

20. Per the AQR case study, the (long-short) momentum factor had significantly positive pairwise correlations with which of the following factors?

    x Market

    x Value

    x Profitability

    x Size

21. Why does the Momentum premium exist? Select all hypotheses discussed in class:

    x High-frequency trading firms are able to react to news faster than human investors, and the momentum premium is the profit they capture from this speed advantage.

    ✓ Investors irrationally overreact to news, creating a "bandwagon effect" of follow-on buying based on the mistaken belief that good news will be followed by more good news.

    ✓ Investors undereact to new information, causing prices to "drift" upward over a long period as the full impact of the news slowly leaks into the market.

    x Investors are indifferent to new information, thus perpetuating historical return trends.

    ✓ Returns are a compensation for bearing risk.

22. Why did AQR not simply benchmark its retail momentum fund to academic UMD?

    x UMD is not transparent.

    ✓ UMD is long-short, monthly rebalanced

    ✓ UMD uses the full universe of stocks

    x UMD excludes non-S&P 500 stocks.

    x UMD is a proprietary AQR index.

23. Why might small-cap momentum be under-weighted in retail packaging?

    ✓ It is noisier (higher volatility) despite a strong mean.

    x Trading costs and market impact are lower.

    ✓ Open-end funds require daily liquidity/capacity.

    x Cap-weighting increases small-cap concentration by design.

24. Sources of tracking error for a live momentum fund relative to its index:

- ✓ Re-balance timing mismatches.
- ✓ Boundary rules near inclusion thresholds.
- ✓ Execution speed, causing market impact.
- ✓ Tax-aware trading overlays.

25. Suppose we have k proposed factors (each of which is a tradeable portfolio) in a linear factor pricing model. We calculate the tangency portfolio of the k factors. Assume we have perfect estimation (infinite data). If we find the first factor, x_1 has a weight of zero, what can we conclude?

    - ✓ x_1 is unnecessary for the true linear factor pricing model.
    - x x_1 has a risk premium of zero.
    - ✓ x_1 will not increase the cross-sectional test's r-squared relative to the other $k-1$ factors.

26. Continue with the exact setup from the previous question. We now consider a two-factor model using only x_1 and x_2 rather than all k factors.

    - ✓ x_1 will not increase the cross-sectional test's r-squared relative to the test using only factor x_2.
    - x A linear factor decomposition of any investment return on x_1 and x_2 will find $\beta_2 = 0$.
    - x A linear factor decomposition of any investment return on x_1 and x_2 will find the r-squared is the same as regressing onto just x_2.

Liquidity Factor

A researcher wants to propose a new "Liqudity" factor based on a firm's Cash Flow to Debt Ratio (CFDR). The researcher hypothesizes that firms with low CFDR should produce higher returns because they are riskier; relative to their debt obligations, they struggle to generate cash. They fire up their Bloomberg Terminal and pull the list of all currently trading firms that have at least ten years of historical data.

27. This sampling method will most likely exclude which two types of firms?

    - x Large, stable, "blue-chip" firms and utility companies (characterized by stable cash flows)
    - ✓ Young, high-growth firms and failing firms that have been delisted.
    - x Firms with very high Cash Flow to Debt Ratios and firms that have no debt.
    - x All firms in non-technology sectors and firms that have recently been acquired.

28. Given the sampling method used in the previous question, what hypothesis is the researcher *actually* testing?

    - x Young, high-growth firms (which were excluded) would have been the best-performing stocks.
    - x Low CFDR is the only factor that predicts returns for all firms in the market.
    - x Firms that go bankrupt (which were excluded) had low CFDR before they failed.

✓ Among stable firms that have already survived for at least a decade, those with lower CFDR produce higher returns.

29. The researcher conducts the standard asset pricing tests (time series, cross-sectional) and finds that the 'low CFDR' portfolio produced significant excess returns. Which of the following statements are accurate.

✓ The CFDR premium is overstated because firms that went bankrupt (produced zero excess returns) were excluded from the sample.

x The CFDR premium is understated because firms that went bankrupt (produced zero excess returns) were excluded from the sample.

x The 10-year requirement correctly filtered out "noisy" data from new firms and failing firms, making the discovered premium more robust and reliable.

✓ The result is unreliable due to omitted variable bias because the researcher failed to control for standard risk factors like the market (Mkt) and size (SMB).

x The premium is understated because the excluded young, high-growth firms likely had very low CFDR and extremely high returns, and their exclusion made the portfolio look worse.

30. Regardless of the empirical flaws, suppose the researcher has established a significant premium for the CFDR factor and wants to add it to the Fama-French 3 Factor model. Which of the following tests are necessary to justify this?

x Check that the simple pairwise correlation between the CFDR factor and the Mkt, SMB, and HML factors is low (e.g., below 0.2).

✓ Run a cross-sectional test using all four factors (Mkt, SMB, HML, CFDR) and check if the model's R^2 is significantly higher than the R^2 from the FF3 model.

✓ Calculate the tangency portfolio of the four factors; the CFDR factor must receive a significant, non-zero weight.

x Run a time-series regression of the CFDR factor returns on the FF3 factors and confirm that the R^2 is very high.

x Calculate the average beta on CFDR in the multivariate regression; the average beta should be larger than the other factors.

End of Liquidity Factor Subsection