Final exam
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Please print your name and student ID number on the line below:

_____answer key_____

- This exam has 30 questions. You have 90 minutes to take it.
- There are 20 multiple choice questions. These have **only one answer**.
  Mark your answer clearly in the box next to the question.
- There are 10 computation questions. For these, the answer is **always a number**.
  Write it in the line under the question. I will not check your work.
- You can bring one page of notes, front and back.
- You should bring a calculator, but it should not have wireless capability.

I. Short sales and dollar-neutral strategies

Question 1: Suppose you short one share of a stock that is currently trading for $100. You leave the proceeds from the sale as cash collateral for your short position, and you also deposit an additional $95 in cash collateral. What is the highest the stock price can go without you violating the 130% maintenance margin requirement of Regulation T?

<u> $150   </u>

Question 2: In the prior question, suppose the stock price goes to $50, and you then close out your position. What is the dollar profit you have made from this trade?

<u> $50   </u>

Question 3: In question 1, what is the most you could theoretically lose from your position if the stock price moves against you?
- ☐ A) $95
- ☐ B) $100
- ☐ C) $195
- ☐ D)   More than $195

Question 4: Suppose a stock pays a dividend of $5 while you have an open short position in that stock. How will the dividend impact you as the short-seller?
- ☐ A)   You will receive $5 from your broker on the ex-dividend date.
- ☐ B)   You will pay $5 to your broker on the ex-dividend date.
- ☐ C)   You will have to pay $5 more when you acquire the stock at a later date.
- ☐ D)   There will be no impact on you.

Question 5: Which of the following is a common source of profit for brokers who facilitate short selling, and is implicitly a fee charged to the short seller?
- ☐ A)   Keeping some or all of the interest earned on your cash collateral.
- ☐ B)   Keeping dividend payments on stocks that you have sold short.
- ☐ C)   Keeping dividend payments on stocks that you have pledged as collateral.
- ☐ D)   Seizing your collateral when you cannot meet margin requirements.

Question 6: Most equity funds try to outperform a stock index like the S&P 500. Market-neutral equity funds only aim to outperform the risk-free rate. Why?
- ☐ A)   It is impossible for any fund to outperform the S&P 500 in the modern era.
- ☐ B)   Investors should put all of their money into a market-neutral fund.
- ☐ C)   Market-neutral funds exhibit almost no volatility, making them risk-free.
- ☐ D)   The risk-free rate is the CAPM hurdle rate for a market-neutral fund.

Question 7: We have assumed in most of our examples that a dollar-neutral fund receives the risk-free rate of return on any cash that it pledges as collateral for short positions. What would change if the fund instead received **zero** return on this cash?
- ☐ A)   The fund's **raw return** would have a positive market beta.
- ☐ B)   The fund's **excess return** would have a positive market beta.
- ☐ C)   The fund's **raw return** would equal the difference of the return on its long positions, minus the return on its short positions ($r_H - r_L$).
- ☐ D)   The fund's **excess return** would equal the difference of the return on its long positions, minus the return on its short positions ($r_H - r_L$).

Question 8: Suppose that over a long time horizon, a market-neutral fund generates an average excess return of 5% per year, while the market excess return is 8% per year, and the risk-free rate is 2% per year. What is the alpha of the fund during this time?

5%

Question 9: In Homework 4 you studied a dollar-neutral strategy that used both a growth ETF and a value ETF. It was important to use ETFs, because you could *not* implement this dollar-neutral strategy with growth and value mutual funds. Why not?
- ☐ A)   Because mutual funds always have a positive market beta.
- ☐ B)   Because mutual funds must always hold the entire stock market.
- ☐ C)   Because mutual funds are not allowed to short-sell stocks.
- ☐ D)   Because investors can short-sell ETFs but cannot short-sell mutual funds.

Question 10: All four of the statements below are possible for a market-neutral strategy, but only three are guaranteed to be true. Which one is *not* guaranteed to be true?
- ☐ A)   It will have positive volatility.
- ☐ B)   It will have a higher Sharpe ratio than the market portfolio.
- ☐ C)   It will have a market beta of approximately zero.
- ☐ D)   Its CAPM alpha will be approximately equal to its average excess return.

In questions 11 through 15, imagine that investors give you $1 million to set up a dollar-neutral fund, following the setup that we have described in class. That is: You use your investors' capital to purchase long positions, then open an equal amount of short positions, and pledge cash collateral equal to the value of your short positions.

Question 11: How will the fund's short positions and collateral appear on its balance sheet immediately after you initially set up the fund?
- ☐ A)   A liability of $1m (short position) and an asset of $1m (collateral).
- ☐ B)   An asset of $1m (short position) and a liability of $1m (collateral).
- ☐ C)   Two assets, each worth $1m (short position and collateral).
- ☐ D)   Two liabilities, each worth $1m (short position and collateral)

Question 12: What is the gross leverage ratio of the strategy as long as you maintain the setup described above?

2

Question 13: If your broker allowed you to distribute $200,000 of cash to your investors, while pledging additional stock as collateral, what would your gross leverage ratio be after making this distribution?

2.5

Question 14: Ignore the prior question and return to the setup at the top of this page. Suppose that, during the year after you set up the fund,
- the stocks that you purchased long earn a total return of 11%;
- the stocks that you sold short earn a total return of 2%;
- the fund receives interest income of 1% on its cash collateral.

If there are no other expenses, what will be the fund's net assets at the end of the year?

$1.1m

Question 15: Suppose the the long and short positions are each value-weighted portfolios of US stocks, with half of all stocks in the long position and the other half in the short position. Then, what will be (approximately) the market beta of your fund?
- ☐ A) $\beta = 2$
- ☐ B) $\beta = 1$
- ☐ C) $\beta = 0$
- ☐ D) $\beta = -1$

II. Factor models

For questions 16 through 18, use the table below. It lists returns in a specific month on the portfolios that Fama and French create to calculate their momentum factor (UMD):

$$S/D = 1\% \qquad S/M = 4\% \qquad S/U = 5\%$$
$$B/D = 3\% \qquad B/M = 3\% \qquad B/U = 3\%$$

Question 16: What is the value of UMD during this month?

2%

Question 17: Which of the following *could* be the market return during this month?
- ☐ A)   1%
- ☐ B)   4%
- ☐ C)   6%
- ☐ D)   8%

Question 18: If there are 3000 public stocks in existence when this table is formed, approximately how many of them are used in the calculation of UMD?

1800

Question 19: To calculate HML, we build a similar table to the one above, but there are some important differences. Which of the following is *not* a difference between the two tables? That is, which of the following is true when building *both* UMD and HML?
- ☐ A)   The six portfolios are reconstructed every month.
- ☐ B)   The six portfolios are reconstructed only at the end of each June.
- ☐ C)   The columns are sorted on a number that is six months old.
- ☐ D)   The rows are sorted on a number from the most recent available month.

Question 20: Which of the following would *not* be surprising to find in the data?
- ☐ A)   A strong negative correlation between SMB and the market excess return.
- ☐ B)   A strong negative correlation between HML and the market excess return.
- ☐ C)   A strong negative correlation between HML and SMB.
- ☐ D)   A strong negative correlation between HML and UMD.

For questions 21 through 25, use the table below. It reports the results of a factor model regression for the annual excess returns on a specific mutual fund from 1975–2020:

Intercept	β_M	β_{SMB}	β_{HML}	β_{UMD}
0%	1.0	0	0	0.5

Also use the following data on the average values of each factor in the regression:

r_{M-r_f}	SMB	HML	UMD
8.8%	2.8%	2.4%	6.8%

Question 21: What is the most likely description of this fund's strategy?
- ☐ A)   A long-only momentum fund.
- ☐ B)   A market-neutral momentum fund.
- ☐ C)   A long-only value fund.
- ☐ D)   A market-neutral value fund.

Question 22: Why would it not be important for us to add RMW into this regression?
- ☐ A)   RMW does not measure the returns to an investable strategy.
- ☐ B)   RMW has a high correlation with the market excess return.
- ☐ C)   RMW has a high correlation with the SMB factor.
- ☐ D)   We have already fully explained this fund's performance without RMW.

Question 23: What was the fund's average excess return from 1975-2020?

12.2%

Question 24: What was the fund's CAPM alpha during 1975-2020?

3.4%

Question 25: Now suppose that α in the regression had come out to be -2.0% (note that this is a negative number), but everything else was the same. What would this mean?
- ☐ A)   The fund's average excess return is below the market average excess return.
- ☐ B)   The fund's average excess return is above the market average excess return, but below the CAPM required return.
- ☐ C)   The fund's average excess return is above the CAPM required return, but below what we would expect given its momentum factor loading.
- ☐ D)   The fund's average excess return is above the CAPM required return, and also better than we would expect given its momentum factor loading.

Question 26: In class, we examined the idea of equal-weighting the S&P 500. What did we conclude about the historical returns to such a strategy? It has delivered…
- ☐ A) …higher returns than value-weighting, by holding more value stocks.
- ☐ B) …higher returns than value-weighting, by holding more growth stocks
- ☐ C) ….lower returns than value-weighting.
- ☐ D) …similar returns to value-weighting, with lower volatility.

Question 27: A popular strategy is to invest in stocks with high profitability. We looked at two different approaches to implement that idea. The first was to invest in stocks with high cash flow / price multiples. What did we find about this approach?
- ☐ A) It has delivered returns that are below the market average.
- ☐ B) It has delivered returns that are about equal to the CAPM hurdle rate.
- ☐ C) It has delivered returns that are about equal to what we would expect, based on its factor loadings on size and value strategies.
- ☐ D) It has delivered that are better than what we would expect, based on its factor loadings on size and value strategies.

Question 28: Continuing question 28, the second approach was to invest in stocks with high ratios of operating profits to book equity. What did we find about this approach?
- ☐ A) It has delivered returns that are below the market average.
- ☐ B) It has delivered returns that are about equal to the CAPM hurdle rate.
- ☐ C) It has delivered returns that are about equal to what we would expect, based on its factor loadings on size and value strategies.
- ☐ D) It has delivered that are better than what we would expect, based on its factor loadings on size and value strategies.

Question 29: We saw a paper that analyzed Warren Buffett's investments through a factor model. The main regression showed an intercept close to zero, and strong loadings on three specific factors. What does this tell us about Buffett's performance?
- ☐ A) He has underperformed the CAPM required rate of return.
- ☐ B) He has exactly matched the CAPM required rate of return.
- ☐ C) He has outperformed the CAPM through successful bets on three big ideas.
- ☐ D) He has outperformed the CAPM by holding a high-beta portfolio.

Question 30: The asset manager AQR maintains a "quality minus junk" strategy (QMJ) that buys "quality" stocks (those with high earnings and profits, per dollar of book value) and short-sells "junk" stocks (the rest of the market). If you regress their QMJ on all the factors we have seen, which factor loading would you expect to be the strongest?
- ☐ A) SMB.
- ☐ B) HML.
- ☐ C) UMD.
- ☐ D) RMW.