Midterm exam #2
Investments (FIN 423), Fall 2022
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Please print your name on the line below:

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- This test has 25 questions. Each question counts for one point.
- You have 75 minutes to take the test (3 minutes per question).
- There are 15 multiple choice questions. These have only one answer.
  Mark your answer clearly in the box next to the question.
- There are 10 free-answer questions. **The answer is always a number.** Write your answer on the line. I will only grade the answer, not the calculations that you did.
- You can bring one page of notes, front and back.
- You should bring a calculator, but it should not have wireless capability.

I. Portfolio optimization

Suppose you forecast the following annual performance for four funds:

Fund	Average return (μ)	Volatility of return (σ)
A	2%	0%
B	5%	20%
C	10%	40%
D	15%	50%

Notice that A is the risk-free investment.

Also, remember that the numbers in the last column can be seen as both the volatility of *raw* returns, and the volatility of *excess* returns.

Question 1: What would be the average annual return that you forecast for a strategy that equal-weights the four funds? (I am asking for the simple or "arithmetic" average.)

8%

Question 2: Which fund do you forecast to have the highest *cumulative* future return?
- ☐ A)   Fund A.
- ☐ B)   Fund B.
- ☐ C)   Fund C.
- ☐ D)   Fund D.

Question 3: What is the volatility of a portfolio that allocates 25% to fund A, 75% to C?

30%

Question 4: If an investor divides their wealth between funds A and C, what Sharpe ratio would they achieve? (*Hint*: The answer does not depend on the weights they use.)

0.20

Question 5: Suppose a mean-variance investor can only hold fund A and *one* of the other three funds. Which of the other three funds should they choose?
- ☐ A)   Impossible to say without knowing the individual's risk aversion.
- ☐ B)   Fund B.
- ☐ C)   Fund C.
- ☐ D)   Fund D.

Question 6: Mutual funds with risky portfolios often try to market themselves to a specific clientele. The idea is that different people need different investment strategies. Why does the portfolio optimization framework *not* support this idea?
Answer: It says that every investor should just want their risky portfolio to have…
- ☐ A) …the lowest possible volatility.
- ☐ B) …the lowest possible market beta.
- ☐ C) …the highest possible average return.
- ☐ D) …the highest possible Sharpe ratio.

Question 7: If "two-fund separation" was an accurate description of the world, then, which of the following things would *never* matter to a mutual fund manager?
- ☐ A) An individual investor's risk tolerance.
- ☐ B) Correlations between available risky investments.
- ☐ C) Diversifying across investments in order to lower volatility.
- ☐ D) The efficient frontier.

Question 8: Suppose you have mean-variance utility with A = 4. Suppose you allocate your wealth between a risk-free investment, and a risky portfolio. The excess return on the risk-free investment is always zero. You forecast that the excess return on the risky portfolio will be 2% on average, with a volatility of 10%. What percentage of your wealth should you allocate to the risky portfolio? (The answer is a multiple of 10%.)

50%

Question 9: Use the same numbers as the previous question. Suppose you simulate many possible portfolios with different weightings between the risk-free and risky portfolios. Suppose you plot these portfolios in a figure like the ones we have seen in class: average excess return on the vertical axis, volatility of excess return on the horizontal axis. These portfolios would trace out a line. What is the **slope** of that line?

0.2

Question 10: Suppose you have two risky investments, and you find that you can build a portfolio of them that has less volatility than *either* of the two investments on its own. What is definitely *not* the correlation of the returns between the two investments?
- ☐ A) $\rho = -1$
- ☐ B) $\rho = 0$
- ☐ C) $\rho = 0.5$
- ☐ D) $\rho = 1$

II. CAPM theory and implementation

For questions 11 through 16, use the table below, which gives some historical data about the annual excess returns for a specific investment strategy, and for the market portfolio.

Market beta of the strategy's annual excess return	1.2
Average of the strategy's annual excess return	15%
Volatility of the strategy's annual excess return	30%
Average of the **market portfolio's** annual excess return	10%
Volatility of the **market portfolio's** annual excess return	20%

Question 11: If we built a scatter plot with the market excess return on the horizontal axis, and the strategy's excess return on the vertical axis, what would be the slope of a best-fit line in that plot?

<u>1.2</u>

Question 12: What was the CAPM's benchmark annual excess return for this strategy?

<u>12%</u>

Question 13: Compare your answer with the 15% reported in the table. What is the most accurate conclusion you can draw from this comparison?

- ☐ A)   The investment had a lower Sharpe ratio than a market index fund.
- ☐ B)   The investment could have improved the Sharpe ratio of an index investor.
- ☐ C)   The investment had a negative alpha.
- ☐ D)   The CAPM does not help us to understand this investment.

Question 14: What would be the **intercept** α (alpha) in the regression that you would run to calculate the value of beta in the table above?

<u>3%</u>

Question 15: What was the **correlation** ρ (rho) between the annual excess return of this strategy, and the annual excess return of the market?

<u>0.8</u>

Question 16: Suppose we forecast that the market's *future* performance will match the last two rows in the table, and all investments will earn exactly the CAPM fair rate of return. What is the highest possible Sharpe ratio that an investor can achieve?

<u>0.5</u>

Question 17: The CAPM says that investors might be willing to hold an investment, even if it is very volatile and barely outperforms the risk-free rate. (An example of this was gold, as we discussed in class.) Which part of the CAPM explains this behavior?
- ☐ A)   Investors only care about non-diversifiable (systematic) risk
- ☐ B)   Investors only care about diversifiable (idiosyncratic, non-systematic) risk
- ☐ C)   Investors only care about the Sharpe ratio of each individual investment
- ☐ D)   Investors only care about the average return on their overall portfolio

Question 18: Which of the following is **impossible** for any risky investment?
- ☐ A)   Correlation (ρ) and beta (β) are both zero.
- ☐ B)   Correlation and beta are both negative.
- ☐ C)   Correlation and beta are both positive.
- ☐ D)   Correlation is negative and beta is positive.

Question 19: Suppose that the excess return on an investment has perfect positive correlation with the excess return on the market portfolio, and twice as much volatility. What is the market beta of the investment?
- ☐ A)   -2.0
- ☐ B)   -0.5
- ☐ C)   0.5
- ☐ D)   2.0

Question 20: Suppose you are convinced that a strategy will earn 10% per year, but the CAPM says its expected return is only 5% per year. If you are a mean-variance investor, and you currently hold a market portfolio, how should you interpret this evidence?
- ☐ A)   You should put all your wealth into the strategy.
- ☐ B)   You should keep all your wealth into the market portfolio.
- ☐ C)   You should allocate some wealth to both this strategy and the market.
- ☐ D)   The CAPM is not a valid model to understand this investment.

III. Investment styles and the CAPM

In class, we analyzed several basic strategies by building portfolios of stocks, and plotting them in figures of average excess return (vertical) against beta (horizontal). Questions 21 through 25 ask about how we built these figures and what they show:

Question 21: Which of the following was *not* a step in building these figures?
- ☐ A)   Sorting stocks according to a simple characteristic, such as book-to-market.
- ☐ B)   Calculating stock returns based on historical data.
- ☐ C)   Analyzing portfolio performance using the CAPM.
- ☐ D)   Recalculating a divisor for an index of stock performance.

Question 22: We drew a line in these figures that connected the risk-free investment with the market portfolios. What does this line mean?
- ☐ A)   Anything above the line has β greater than 1.
- ☐ B)   Anything below the line has β less than 1.
- ☐ C)   Anything above the line has α greater than 0.
- ☐ D)   Anything below the line has α greater than 0.

Question 23: What did we conclude from the figures that sorted stocks on market cap?
- ☐ A)   Small-cap stocks have **higher betas, higher returns** than large-cap stocks.
- ☐ B)   Small-cap stocks have **lower betas, higher returns** than large-cap stocks.
- ☐ C)   Small-cap stocks have **higher betas, lower returns** than large-cap stocks.
- ☐ D)   Small-cap stocks have **lower betas, lower returns** than large-cap stocks.

Question 24: What did we see in the figures that sorted stocks on book-to-market?
- ☐ A)   There was a reliable "value premium" in every year.
- ☐ B)   There was a reliable "value premium" on average since 1927.
- ☐ C)   There was a reliable "value premium" on average since 1950.
- ☐ D)   There has never been a reliable "value premium" in the data.

Question 25: What was *not* an important limitation of these figures?
- ☐ A)   They only show long-run averages, not short-run risk.
- ☐ B)   They ignore trading costs.
- ☐ C)   They are sensitive to the window of data that we use.
- ☐ D)   They focus on volatility instead of just systematic risk.

END OF THE EXAM
Make sure your name is on the front page!