MTH6113 - MATHEMATICAL TOOLS FOR ASSET MANAGEMENT - 2021/22

YOU CAN PREVIEW THIS QUIZ, BUT IF THIS WERE A REAL ATTEMPT, YOU WOULD BE BLOCKED BECAUSE:

This quiz is not currently available

INFORMATION

Problem 1 (consists of questions 1-2)

Do the following statements contradict the semi-strong form of the efficient market hypothesis?

Answer yes/no and then briefly explain your reasoning with no more than 50 words.

QUESTION 1

Not yet answered Marked out of 5.00

Today's returns are positively correlated with tomorrow's returns.

QUESTION 2

Not yet answered Marked out of 5.00

By taking a higher risk, we can achieve a higher expected return.

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QUESTION 3

Not yet answered Marked out of 5.00

Problem 2 (consists of question 3 only)

One of the following figures shows the empirical returns of a stock since 1993. The other figure shows simulated returns using the lognormal model with parameters fitted to the empirical data.

Figure 1:

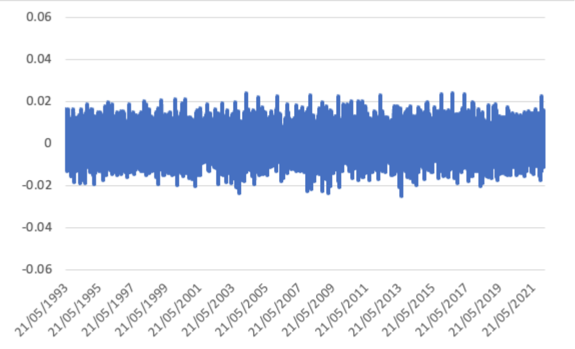
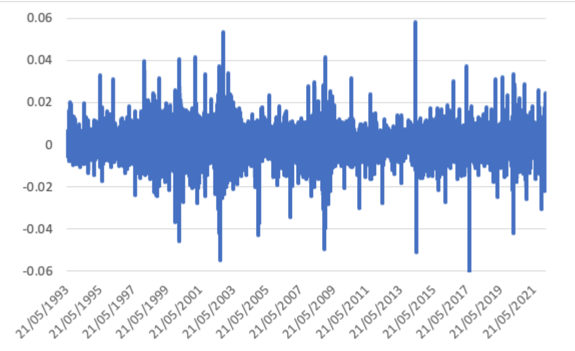


Figure 2:



Complete the following statements, such that they are true.

The daily return shown in Figure 1	Choose...
The daily returns shown in Figure 2	Choose...

INFORMATION

Problem 3 (consists of questions 4 - 7)

For the next questions, the following investment opportunities are given based on their mean return μ and their standard deviation of the return σ:

Asset 1	$\mu_1 = 10\%$	$\sigma_1 = 5\%$
Asset 2	$\mu_2 = 15\%$	$\sigma_2 = 7\%$
Asset 3	$\mu_3 = 15\%$	$\sigma_3 = 6\%$
Asset 4	$\mu_4 = 20\%$	$\sigma_4 = 10\%$
Asset 5	$\mu_5 = 20\%$	$\sigma_5 = 7\%$

QUESTION 4

Not yet answered Marked out of 2.00

Does the following pairwise dominance hold?

$(\mu_5,\sigma_5) > (\mu_2,\sigma_2)$

Select one:

- ○ True
- ○ False

QUESTION 5

Not yet answered Marked out of 2.00

Does the following pairwise dominance hold?

$(\mu_3, \sigma_3) > (\mu_2, \sigma_2)$

Select one:

- True
- False

QUESTION 6

Not yet answered Marked out of 5.00

Let also the correlation between Asset 2 and Asset 4 be given as ρ_{24}= -0.25. Construct Asset 6 as the portfolio with equal parts in Assets 2 and 4.

Compute the **standard deviation** of the returns of Asset 6.

(state the answer in decimals with four digits after the decimal point)

Answer:

QUESTION 7

Not yet answered Marked out of 10.00

We note that Asset 6 now dominates Asset 2, even though Asset 4 does not dominate Asset 2. Use this example to explain the benefits of diversification.

INFORMATION

Problem 4 (consists of questions 8 to 10)

We consider the lognormal model with returns modelled as
$X \sim \mathcal{N}(\mu, \sigma^2)$.
Let $\mu = 0.04$ and $\sigma = 0.25$. We denote the density function of X as f_X and the distribution function of X as F_X (with the inverse F_X^{-1}).

QUESTION 8

Not yet answered Marked out of 7.00

Which of the following values equals to the value at risk $VaR_{99\%}(X)$?

- a. $-1/ f_X(0.01) \approx -0.6312$
- b. $1/f_X(0.99) \approx$ -856.3200
- c. $-F_X^{-1}(0.01) \approx 0.5416$
- d. $F_X^{-1}(0.99) \approx 0.6216$

QUESTION 9

Not yet answered Marked out of 5.00

Which of the following scaling properties holds for any random variable X and α ∈ (0, 1)?

Select one:

- a. $\mathrm{VaR}_\alpha(2X) = \mathrm{VaR}_\alpha(X) + 1$
- b. $\mathrm{VaR}_{0.5\alpha}(X) = 0.5\,\mathrm{VaR}_\alpha(X)$
- c. $\mathrm{VaR}_\alpha(X+1) = \mathrm{VaR}_\alpha(X) + 1$
- d. $\mathrm{VaR}_\alpha(2X) = 2\,\mathrm{VaR}_\alpha(X)$
- e. $\mathrm{VaR}_{\alpha+1}(X) = \mathrm{VaR}_\alpha(X) + 1$
- f. $\mathrm{VaR}_{0.5\alpha}(X) = \mathrm{VaR}_\alpha(X) - 1$
- g. $\mathrm{VaR}_{0.5\alpha}(2X) = \mathrm{VaR}_\alpha(X)$

QUESTION 10

Not yet answered Marked out of 10.00

Explain your choice in one paragraph.

QUESTION 11

Not yet answered Marked out of 10.00

Problem 5 (consists of questions 11 only)

Consider N assets in Sharpe's Single-Index model with $\mu_0 = 0, \alpha_i = 0,\ \beta_i = 1, \sigma_i = 1, i = 1, \ldots, N$, i.e. the asset returns are given as

$R_i = R_M + \varepsilon_i, i = 1, \ldots, N$

with $R_\mathrm{M} \sim \mathcal{N}(\mu_\mathrm{M}, \sigma^2_\mathrm{M})$ and $\varepsilon_i \sim \mathcal{N}(0,1)$ pairwise independent.

Consider a portfolio P with equal weights of each asset, i.e.

$R_\mathrm{P} = \sum_{i=1}^N R_i/N.$

We note that

$\mathbb{E}(R_i) = \mathbb{E}(R_\mathrm{P}) = \mu_\mathrm{M}$

and

$\mathrm{Var}(R_i) = \sigma^2_\mathrm{M} + 1$

$\mathrm{Var}(R_\mathrm{P}) = \sigma^2_\mathrm{M} + 1/N$

For a large number of assets N, use this result to explain the concepts of

- diversifiable risks,
- non-diversifiable risks.

(respond in 2-4 sentences)

INFORMATION

Problem 6 (consists of questions 12 to 15)

Consider a market where all assumptions of the CAPM (Capital Asset Pricing Model) hold with an interest rate $\mu_0 = 3\%$. The expected return of the market portfolio is $\mu_\mathrm{MP} = 8\%$ and its standard deviation is $\sigma_\mathrm{MP} = 6\%$.
Consider an efficient portfolio P with $\beta = 0.5$.

QUESTION 12 Not yet answered Marked out of 4.00

How is the portfolio constructed?

(use no more than 50 words)

QUESTION 13 Not yet answered Marked out of 4.00

Compute the expected return μ_P of the portfolio.

(Note: return the result in its decimal form with three digits after the decimal point. E.g. 1.5% should be input as 0.015)

Answer:

QUESTION 14 Not yet answered Marked out of 5.00

Now consider a second portfolio P' (not necessarily efficient) with $\beta = 1.2$. Which of the following statements is true?

- a. $\mu_{P'} = 9\%$
- b. $\sigma_{P'} = 7.2\%$
- c. $\mu_{P'} = 3\%$
- d. $\sigma_{P'} \leq 7.2\%$

QUESTION 15 Not yet answered Marked out of 8.00

Consider a third portfolio, which optimises risk and return for your personal risk appetite, by maximising the function $\exp(\mu - 7\sigma^2)$. Compute the standard deviation of this optimal portfolio.

(Note: return the result in its decimal form with three digits after the decimal point. E.g. 1.5\% should be input as 0.015)

Answer:

INFORMATION

Problem 7 (consists of question 16 to 18)

QUESTION 16 Not yet answered Marked out of 4.00

Let two lotteries be given:

$$L\_1 = \begin{cases} 100 & \text{with probability } 50\% \\ -90 & \text{with probability } 50\%. \end{cases}$$

and

$$L\_2 = \begin{cases} 100 & \text{with probability } 25\% \\ 10 & \text{with probability } 50\% \\ -90 & \text{with probability } 25\%. \end{cases}$$

Which lottery does a risk-averse investor strictly prefer and why? Fill the gaps in the following text:

Using the ______ of the utility function u, we can show that

$u(10) \geq u(5) > u(100) + u(-90)/2.$

Therefore we can show that

$\mathbb{E}(u(L\_2)) > \mathbb{E}(u(L\_1))$

and see that the investor prefers ______.

convexity | convexity and monotonicity | concavity and monotonicity | positivity | monotonicity and positivity | concavity and positivity

L_1 | L_2 | none of the above

QUESTION 17

Not yet answered Marked out of 4.00

Which of the given functions 1-4 is a utility function for risk-seeking investors? Briefly explain your choice in the next question.

1. $u_1(x) = \exp(x) - 1$
2. $u_2(x) = \log(x - 1)$
3. $u_3(x) = x^4$
4. $u_4(x) = \sqrt{|x|}$

QUESTION 18

Not yet answered Marked out of 5.00

Briefly explain your choice using no more than 100 words.