1. What is a main assumption of market model?

   Answer: It assumes that two random variables are bivariate normally distributed.

2. What is the intuitive meaning of $\mathbb{V}(r_{it}|r_{mt}) = \sigma_i^2 - \dfrac{\sigma_{im}^2}{\sigma_m^2}$?

   Answer: The variance of r_{it} becomes smaller conditional on the knowledge about r_{mt} and that the covariance $\sigma_{im} \neq 0$.

3. What is the standard error of regression?

   Answer: The standard error of regression is the unbiased standard deviation of residuals.

4. What is the meaning of the security market line's slope?

   Answer: The slope of SML is the expected excess return of *the* market portfolio.

5. Is the estimation of market risk premium a model?

   Answer: Yes, $r_{mt} - r_{ft} = \lambda \sigma_{mt} + u_t$ is a linear regression model.

6. If Jensen's measure indicates inferior performance, so does Treynor's measure. True or False?

   Answer: True

7. Information ratio is obtained by replacing the risk-risk rate with a benchmark of risky performance's return. True or False?

   Answer: The statement is true if you look at the numerator of the Sharpe ratio. If you also look at the denominator of the information ratio, you will find that it is the tracking error (standard deviation of the active return), which is different from that of the Sharpe ratio.

8. Let $\boldsymbol{X'X} = \begin{pmatrix} -1 & 2 \\ 3 & -4 \end{pmatrix}$ and $\boldsymbol{X'y} = \begin{pmatrix} -3 \\ 7 \end{pmatrix}$ What is the slope of the simple linear regression?

   Answer: First, we need to compute $(\boldsymbol{X'X})'$:

   $$(\boldsymbol{X'X})' = \frac{1}{(-4)(-1)-(-3)(-2)} \begin{pmatrix} -4 & -2 \\ -3 & -1 \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ \frac{3}{2} & \frac{1}{2} \end{pmatrix}$$

   Then we compute

   $$\begin{pmatrix} 2 & 1 \\ \frac{3}{2} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} -3 \\ 7 \end{pmatrix} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}.$$

   Thus, the slope of the simple linear regression is -1.

9. Continuing from Question 8, if the residual sum of squares is $\dfrac{1}{2}$ and the number of (paired) observations is 18. What is the standard error of the y-intercept estimate?

   Answer: First we need to compute the unbiased variance of the residuals:

   $$\sigma_e^2 = \frac{\frac{1}{2}}{18-2} = \frac{1}{32}.$$

   The variance of the y-intercept estimate is 2 from $(\boldsymbol{X'X})^{-1}$ times $\dfrac{1}{32}$, yielding $\dfrac{1}{16}$. Therefore, the standard error of the y-intercept estimate is $\dfrac{1}{4}$.

10. What is the dimension of matrix X in Questions **8** and **9**?

    Answer: X has 18 rows and 2 columns. Thus, the dimension of X is 18 by 2.

11. What are your takeaways (new things learned and new insights and doubts) ?