Name: **Zhou Shen** Assignment Number: **2**

Course: **QF603 Quantitative Analysis of Financial Market** Date: September 20, 2021

Problem 1. Based on the Assumptions of OLS:

$$E(e_i) = 0 \text{ for every i}$$
$$E(e_i^2) = \sigma_e^2$$
$$E(e_i e_j) = 0 \text{ for every i, j}$$
$$X_i, e_j \text{ are independent for each i, j}$$
$$e_i \overset{d}{\sim} N(0, \sigma_e^2)$$

The answer is 3.

Problem 2.

$$\begin{aligned}\text{Annual Return Volatility} &= \text{Daily Return Volatility} \times \sqrt{\text{tradedays}} \\ &= 0.5\% \times \sqrt{252} \\ &= 7.93\%\end{aligned}$$

So the answer is 1. 7.93%.

Problem 3.
Ordered probit regression is for dependent variable which takes a number of infinite and discrete values that contain ordinal information.

So the answer is 2. Ordered probit regression.

Problem 4.
Total number of heads follow the Binomial Distribution. According to

$$Var(X) = np(1-p)$$

So the answer is $100p(1-p)$.

Problem 5.
According to the concept of Uniform Distribution, we have probability distribution function of x:

$$f(x) = \begin{cases} \frac{1}{5} & 5 \le x \le 10 \\ 0 & \text{other} \end{cases}$$

So we can calculate variance of X by

$$\begin{aligned} E(X) &= \int_{X_1}^{X_2} f(x)xdx = \int_{5}^{10} \frac{1}{5}xdx \\ &= 7.5 \\ E(X^2) &= \int_{X_1}^{X_2} f(x)x^2dx = \int_{5}^{10} \frac{1}{5}x^2dx \\ &= \frac{175}{3} \\ Var(X) &= E(X^2) - E(X)^2 = \frac{175}{3} - 7.5^2 \\ &= \frac{25}{12} \end{aligned}$$

So the variance of x is $\frac{25}{12}$.

Problem 6.
The cumulative distribution function of defaults in portfolio is

$$\begin{aligned} \mathbb{P}(X = n) &= \frac{\lambda^n}{n!}e^{-\lambda} \\ &= \frac{10^n}{n!}e^{-10} \end{aligned}$$

So in one year, the probability that there are exactly 2 defaults is

$$\begin{aligned} \mathbb{P}(X = 2) &= \frac{10^2}{2!}e^{-10} \\ &= 50e^{-10} \\ &\approx 0.23\% \end{aligned}$$

In two years, the probability that there are exactly 2 defaults is

$$\begin{aligned} \mathbb{P}(X = 2) &= \frac{20^2}{2!}e^{-20} \\ &= 200e^{-20} \\ &\approx 4.12 \times 10^{-5}\% \end{aligned}$$