Name: _____　**Seat#:** _____　**Academic#:** _____

1. (50 pts.) You submitted a homework (HW) regarding MLE. In the HW, you are asked to define MLE and give an example.

   (a) (10 pts.) MLE is the abbreviation of _____.

   (b) (20 pts.) One student claims that one important and necessary step using MLE is: "taking log function for the likelihood function", and then finding the corresponding maximum value via calculus (微積分). Do you agree? Why or why not.

   (c) (20 pts)Let a random variable X follow a uniform $(\theta, 1)$, where θ is the parameter that we are interested in. Suppose we take a sample of size 5: 0.1, 0.11, 0.2, 0.3, 0.4. Below we list 4 estimates of θ. Which value is the MLE of θ. Why or why not.

      (1) $\hat{\theta}_1 = 0.2$
      (2) $\hat{\theta}_2 = 0.4$
      (3) $\hat{\theta}_3 = -10$
      (4) $\hat{\theta}_4 = 0.1$

2. (50 pts.) You presented some concept regarding Design of Experiments (DOE) in class.

   (a) (10 pts.) What is the role of "random numbers" in simulation experiments?

   (b) (20 pts.) How do you evaluate the "effect" of using CRN (common random numbers)?

   (c) (20 pts.) Fill the blank. The insight of ANOVA (Analysis of Variance) in DOE: We decompose (分解) _____ in order to statistically test (統計檢定) _____. (hint: Relate to Problem 2(b))