The New School for Social Research
Advanced Econometrics 1
Fall 2017
Christian Schoder
Jangho Yang

Assignment 1

Due Sep 18 (Mon) 6:00 pm

1. Basic Probability 1

   (a) Suppose you have 4 different dice; two fair and two biased ones. For the first biased die, a 3 appears twice more often than the other numbers. For the second biased one, a 6 appears 5 times more often than the other rest. You throw these dice 100 times. 1) Simulate this experiment in R using **set.seed(300)** and store generated numbers. 2) Let $D = d_1, ...d_4$ and $X = 1, .., 6$ be the random variable representing the dice and 6 numbers on the die, respectively. Calculate and plot $p(X, D), p(D), p(X), p(D|X)$, and $p(X|D)$. 3) Calculate $\mathrm{E}(D), \mathrm{E}(X), \mathrm{E}(D|X)$, and $\mathrm{E}(X|D)$. 4) Calculate $\mathrm{Var}(D), \mathrm{Var}(X), \mathrm{Var}(D|X)$, and $\mathrm{Var}(X|D)$. For question 3) and 4), do not use functions **mean()** and **var()**. 5) Are D and X independent? Prove it.

   (b) Suppose you repeat the same experiment in (a) with the different number of trials. Now you throw the first die 200 times, second die 100 times, and the other rest 50 times. Using **set.seed(300)**, repeat (1) to (5) in (a).

   (c) Suppose that you repeat the same experiment in (a) 5 more times. 1) Simulate these five experiments using **set.seed(300)** and store numbers. 2) Let $T = t_1, ..., t_5$ be the random variable representing the experiments. Plot $p(T, X, D)$ using 5 two dimensional plots for each T, 3) Plot three marginal distributions, $p(D), p(X)$, and $p(T)$. 4) Plot $p(X|D = 1, T = 4)$, 5) Calculate $p(X = 2|D = 1, T = 5)$.

2. Basic Probability 2: Load the attached data file on country-level labor and capital productivity growth and the rate of cost reduction.

   (a) Let χ, γ, and ζ be the growth rate of capital and labor productivity and the rate of cost reduction, respectively. 1) Plot $p(\chi)$, $p(\gamma)$, and $p(\zeta)$ with the mean and the variance included in the figure. 2) plot the scatterplot of χ and γ.

   (b) Plot the scatterplot of χ and γ *conditional on* ζ. To do this, discretize the continuous variable ζ by 1%, $\zeta_1 = [-9\%, -8\%], \zeta_2 = [-8\%, -7\%], \ldots$. All the conditional scatterplots need to be in the same figure with different colors. Explain the result you find out.