

## **Statistics and Econometrics I: Midterm Exam (40 points), October 31, 2017**

*An assignment will include a statement with proof (15 points), another theoretical question (10 points), and a problem to compute expectations, variance, and correlation for two random variables (15 points).*

### *Selected statements with proof*

1. The sample mean is an unbiased estimator of the population mean.
2. Chebyshev's Theorem about the percent of observations around the mean.
3. Shortcut formula for the variance of discrete random variable.
4. Expectation and variance of binomial distribution.
5. Expectation and variance of Poisson distribution.
6. A sum of two independent Poisson random variables has Poisson distribution as well.
7. Expectation and variance of uniform distribution.
8. Expectation and variance of exponential distribution.
9. Characteristic function of normal random variable. A sum of two independent normally distributed random variables has normal distribution as well.
10. If jointly Gaussian random variables are uncorrelated then they are independent.
11. The lemma about chi-square distribution and the distribution of the sample mean for normal population.
12. Expectation and variance of chi-square distribution.
13. Optimal investment in two stocks.

### *Other theoretical questions*

1. Classification of variables.
2. Graphs to describe categorical variables.
3. Histograms and ogives, stem-and leaf display.
4. Mean, median, mode, percentile, and quartile of a sample. Box-and-whisker plot.
5. Approximate mean and variance of grouped data.
6. Operations for events. Mutually exclusive and collectively exhaustive events.
7. Classical probability. Orderings, permutations (i.e., arrangements) and combinations.
8. Conditional probability. Independent events.
9. Bivariate probabilities.
10. Overinvolvement ratios.
11. Bayes' Theorem.

12. Discrete random variables.
13. Poisson approximation and normal approximation of binomial distribution.
14. Hypergeometric distribution.
15. Expectation and variance of a sum of random variables.
16. Normal probability plot.
17. Population proportion, its mean and variance.
18. Acceptance interval for sample mean with known population variance.
19. Unbiased and efficient estimators. Relative efficiency. List efficient estimators.
20. Confidence interval for the mean with known population variance.
21. Confidence interval for the mean of normal distribution with unknown population variance.
22. Confidence interval for population proportion.
23. Confidence interval for the variance of normal population.