Introduction to the Practice of Statistics

List 3

Laboratory

1. For each of the set of parameters draw a histogram of the binomial distribution and the graph of the density of the appropriate normal distribution (of the same expected value and variance):
   (a) $p = 0.5$, $n = 20$
   (a) $p = 0.5$, $n = 100$
   (b) $p = 0.1$, $n = 20$
   (b) $p = 0.1$, $n = 100$
2. Consider the standard normal distribution $N(0, 1)$.
   (a) Generate a 100-element random sample and construct a confidence interval for the expected value at the 95% confidence level.
   (b) Repeat (a) 1000 times and calculate how often the constructed confidence intervals contain the actual expected value.
   (c) Repeat (a) for a 200-element sample. Compute the probability of containing the actual expected value and compare the average width of the confidence intervals determined based on a 100- and 200-element samples.
3. Referring to the data set `income.txt`:
   (a) Construct a new variable U being the square root of the income. Draw a histogram of that variable and determine the mean μ_U of that variable for the whole data set. Determine alse the mean income μ_D.
   (b) Draw a 200-element random sample from the data set and use it to contruct estimators for μ_U and μ_D. Construct 95% confidence intervals for those parameters and check if the intervals contain the actual values of the parameters.
   (c) Repeat (b) 200 times and draw histograms of the distributions of the above estimators. Determine how often the confidence intervals contain the actual value of the estimated parameter.
4. Referring to the data set `grades.txt`, assuming it is a simple random sample from some population, construct confidence intervals for the average IQ and the average result of the psychological test.