Fall 2018 EE511 Simulation

Project #6: due 5pm, Friday November 30

The attached datasheet represents a set of $n = 100$ independent samples from some population.

a) Compute the sample mean, m, and the sample variance, s^2.

b) Use the data to generate a discrete approximation to the Cumulative Distribution Function – the empirical distribution, $F_{X^*}(x)$ Plot this distribution.

c) By splitting the data into equal size intervals (0-5, 6-10, etc), generate a discrete approximation to the distribution and determine the values of the Probability Mass Function for this discrete approximation.

d) Use the bootstrapping technique to generate M bootstrap sets of samples based on the empirical distribution found in part b), with each set containing n independent samples from the Empirical Distribution (repetition allowed). Compute the sample mean and sample variance for each of the Bootstrap sample sets, call these m_i^* and s_i^{*2} for $i = 1,\ldots,M$ respectively. Use $M = 50$ and $M = 100$.

e) The (population) mean of the empirical distribution is m and let m^* (RV based on the empirical distribution) be the mean of a bootstrap sample set. We could compute the MSE of the bootstrap sample means $MSE^* = E_{F^*}[(m^* - m)^2]$ by looking at the comprehensive evaluation of all possible bootstrap sample sets (all n^n of them). This is impractical, so we use a smaller set of bootstrap sample sets as in d) and estimate the MSE by:

$$MSE(m^*) = \frac{1}{M}\sum_{i=1}^{M}(m_i^* - m)^2$$

We take this value to be an estimate of the MSE of the sample mean for the overall population distribution.

f) We can do a similar evaluation of the MSE of the bootstrap sample variance s^{*2} (RV based on the empirical distribution). The (population) variance of the empirical distribution is s^2 so we estimate the MSE by:

$MSE(s^{*2}) = \frac{1}{M}\sum_{i=1}^{M}\left(s_i^{*2} - s^2\right)^2$. We take this value to be an estimate of the MSE of the sample variance for the overall population distribution.

37.12	8.45	28.96	0.27	36.22
2.78	3.98	32.79	0.14	24.87
1.33	33.25	19.91	30.43	25.84
33.55	31.10	1.86	30.57	5.34
45.39	28.67	7.12	35.38	1.92
9.25	12.55	27.49	33.72	2.30
28.32	30.92	32.62	24.10	33.56
35.62	27.88	20.71	36.62	24.03
28.00	31.44	33.32	5.01	1.30
4.56	2.28	11.33	0.24	8.53
5.27	18.52	7.63	31.03	4.06
12.83	15.43	8.75	4.65	5.21
7.90	26.48	6.81	32.20	25.69
18.18	4.48	30.33	1.68	28.44
23.26	3.35	0.17	8.90	13.29
31.54	26.16	22.79	6.89	27.92
30.99	6.93	13.27	10.08	28.95
13.40	4.57	34.10	0.76	36.40
0.60	39.74	1.11	2.40	1.05
34.10	29.95	1.94	0.16	1.43