

American University
The Department of Computer Science
Spring 2021

Introduction to Simulation and Modeling, CSC 432/632

Assignment 4

Normal Distribution
Interval estimation
Hypothesis testing
(Total of 10 points)

Instruction:

For this assignment submit a single file, either MS WORD or PDF in addition to your Python codes with descriptions. The Python codes need to have comments. The assignments must be done **individually**.

Format Requirements for all assignments:

- No page limits
- Single spaced, 12-point or larger font size; 1-inch margins
- Use headers and/or bullets to organize and convey key elements, and page numbers
- Only Latin alphabet characters are allowed (i.e., do not include any words or phrases that contain non-English characters)
- File type: Adobe PDF (recommended) or Word document
- **For the following questions you can use z-tables, Excel, or Python to compute the values for normal distribution. You can also use hand writing or Python codes to find out interval estimation or hypothesis tests (at your choice). If you decide to use Python codes, please upload the .py code in Canvas. In any case, you need to answer the questions and explanations in a WORD file and upload along your answers.**

QUESTIONS:

1. (1 point) Given that z is a standard normal random variable, compute the following probabilities.
 - a) $P(z \leq -1.0)$
 - b) $P(z \geq -1)$
2. (1 point) Given that z is a standard normal random variable, find z for each situation.
 - a) The area to the left of z is .2119.
 - b) The area between $-z$ and z is .9030.
3. (2 point) The U.S. Energy Information Administration (US EIA) reported that the average price for a gallon of regular gasoline is \$2.94. The US EIA updates its estimates of average gas prices on a weekly basis. Assume the standard deviation is \$.25 for the price of a gallon

of regular gasoline and recommend the appropriate sample size for the US EIA to use if they wish to report each of the following margins of error at 95% confidence.

- a) The desired margin of error is \$.10.
 - b) The desired margin of error is \$.07.
 - c) The desired margin of error is \$.05.
4. (1 point) A simple random sample of 50 items from a population with $\sigma = 6$ resulted in a sample mean of 32.
- a) Provide a 90% confidence interval for the population mean.
 - b) Provide a 95% confidence interval for the population mean.
 - c) Provide a 99% confidence interval for the population mean.
5. (2 point) A simple random sample of 400 individuals provides 100 Yes responses.
- a) What is the point estimate of the proportion of the population that would provide Yes responses?
 - b) What is your estimate of the standard error of the proportion, σ_p ?
 - c) Compute the 95% confidence interval for the population proportion.
6. (1 point) The random variable x is known to be uniformly distributed between 10 and 20.
- a) Show the graph of the probability density function.
 - b) Compute $P(x < 15)$.
 - c) Compute $P(12 \leq x \leq 18)$.
 - d) Compute $E(x)$.
 - e) Compute $\text{Var}(x)$.
7. (2 point) Consider the following hypothesis test:
- $H_0: \mu \geq 20$
 $H_a: \mu < 20$
- a) A sample of 50 provided a sample mean of 19.4. The population standard deviation is 2.
 - b) Compute the value of the test statistic.
 - c) What is the p-value?
 - d) Using $\alpha = .05$, what is your conclusion?
 - e) What is the rejection rule using the critical value? What is your conclusion?