

COMP 233 Probability and Statistics for Computer Science

Fall 2016, Assignment 3

Due: November 18, 2016

Question 1 The following scores represent the final examination grade for an elementary statistics course:

23 60 79 32 57 74 52 70 82 36
 80 77 81 95 41 65 92 85 55 76
 52 10 64 75 78 25 80 98 81 67
 41 71 83 54 64 72 88 62 74 43
 60 78 89 76 84 48 84 90 15 79
 34 67 17 82 69 74 63 80 85 61

- Construct a stem-and-leaf plot for the examination grades in which the stems are 1, 2, 3, 9.
- Set up a relative frequency distribution.
- Construct a relative frequency histogram, draw an estimate of the graph of the distribution and discuss the skewness of the distribution.
- Compute the sample mean, sample median, and sample standard deviation.

Question 2 The average particulate concentration, in micrograms per cubic meter, was measured in a petrochemical complex at 36 randomly chosen times, with the following concentrations resulting:

5, 18, 15, 7, 23, 220, 130, 85, 103, 25, 80, 7, 24, 6, 13, 65, 37, 25,
 24, 65, 82, 95, 77, 15, 70, 110, 44, 28, 33, 81, 29, 14, 45, 92, 17, 53

- Represent the data in a histogram.
- Is the histogram approximately normal?
- Calculate the sample mean \bar{x} .
- Calculate the sample standard deviation S .
- Determine the proportion of the data values that lies within $\bar{x} \pm 1.5S$ and compare with the lower bound given by Chebyshev's inequality.
- Determine the proportion of the data values that lies within $\bar{x} \pm 2S$ and compare with the lower bound given by Chebyshev's inequality.

Question 3 An instructor knows from past experience that student exam scores have mean 77 and standard deviation 15. At present the instructor is teaching two separate classes — one of size 25 and the other of size 64.

- Approximate the probability that the average test score in the class of size 25 lies between 72 and 82.
- Repeat part (a) for a class of size 64.

- c) What is the approximate probability that the average test score in the class of size 25 is higher than that of the class of size 64?
- d) Suppose the average scores in the two classes are 76 and 83. Which class, the one of size 25 or the one of size 64, do you think was more likely to have averaged 83?

Question 4 If 10 pairs of fair dice are rolled, approximate the probability that the sum of the values obtained (which ranges from 20 to 120) is between 30 and 40 inclusive.

Question 5 The temperature at which a thermostat goes off is normally distributed with variance σ^2 . If the thermostat is to be tested five times, find

- a) $P\{S^2/\sigma^2 \leq 1.8\}$
- b) $P\{0.85 \leq S^2/\sigma^2 \leq 1.15\}$

where S^2 is the sample variance of the five data values.

Question 6 An electric scale gives a reading equal to the true weight plus a random error that is normally distributed with mean 0 and standard deviation $\sigma = .1$ mg. Suppose that the results of five successive weighings of the same object are as follows: **3.142, 3.163, 3.155, 3.150, 3.141.**

- a) Determine a 95 percent confidence interval estimate of the true weight.
- b) Determine a 99 percent confidence interval estimate of the true weight.

Question 7 A sample of 20 cigarettes is tested to determine nicotine content and the average value observed was 1.2 mg.

- a) Compute a 99 percent two-sided confidence interval for the mean nicotine content of a cigarette if it is known that the standard deviation of a cigarette's nicotine content is $\sigma = 0.2$ mg.
- b) Suppose that the population variance is not known in advance of the experiment. If the sample variance is **0.04**, compute a 99 percent two-sided confidence interval for the mean nicotine content.

Question 8 Consider the following data on the diameter of a rivet. Assume a normal population.

6.68 6.66 6.62 6.72 6.76 6.67 6.70 6.72
 6.78 6.66 6.76 6.72 6.76 6.70 6.76 6.76
 6.74 6.74 6.81 6.66 6.64 6.79 6.72 6.82

- a) Estimate the population variance σ^2 .
- b) Compute a 95 percent two-sided confidence interval for σ^2 .