

## Exercises

**E1:** Define suitable populations from which the following samples are selected:

- (a) Persons in 200 homes in the city of Hanoi are called on the phone and asked to name the candidate they favor for election to the school board.
- (b) A coin is tossed 100 times and 34 tails are recorded.
- (c) Two hundred pairs of a new type of tennis shoe were tested on the professional tour and, on average, lasted 4 months.
- (d) On five different occasions it took a lawyer 21, 26, 24, 22, and 21 minutes to drive from her suburban home to her midtown office.

**E2:** The lengths of time, in minutes, that 10 patients waited in a doctor's office before receiving treatment were recorded as follows: 5, 11, 9, 5, 10, 15, 6, 10, 5, and 10. Treating the data as a random sample, find

- (a) the mean;
- (b) the median;
- (c) the mode.

**E3:** The grade-point averages of 60 college seniors selected at random from a graduating class are as follows:

3.2	1.9	2.7	2.4	2.8	2.9	3.8	3.0	2.5	3.3	1.8	2.5	3.7	2.8	2.0
3.2	2.3	2.1	2.5	1.9	2.7	3.5	3.1	2.6	3.2	1.6	2.8	3.9	2.5	2.1
2.2	2.5	3.1	3.4	2.6	1.6	2.7	3.0	2.2	2.9	1.7	1.8	3.2	2.3	2.7
1.9	2.4	2.8	3.1	3.4	1.8	3.6	2.3	2.7	2.4	1.8	2.9	3.5	3.1	2.6

Calculate the mean, the median, the variance and the standard deviation.

**E4:** An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life of less than 775 hours.

**E5:** If the standard deviation of the mean for the sampling distribution of random samples of size 36 from a large or infinite population is 2, how large must the sample size become if the standard deviation is to be reduced to 1.2?

**E6:** The heights of 1000 students are approximately normally distributed with a mean of 174.5 centimeters and a standard deviation of 6.9 centimeters. Suppose 200 random samples of size 25 are drawn from this population and the means recorded to the nearest tenth of a centimeter. Determine

- (a) the mean and standard deviation of the sampling distribution of  $\bar{X}$  ;
- (b) the number of sample means that fall between 172.5 and 175.8 centimeters inclusive;
- (c) the number of sample means falling below 172.0 centimeters.

**E7:** The average zinc concentration recovered from a sample of measurements taken in 36 different locations in a river is found to be 2.6 grams per milliliter. Find the 95% and 99% confidence intervals for the mean zinc concentration in the river. Assume that the population standard deviation is 0.3 gram per milliliter.

**E8:** It is claimed that automobiles are driven on average more than 20,000 kilometers per year. To test

this claim, 100 randomly selected automobile owners are asked to keep a record of the kilometers they travel. Would you agree with this claim if the random sample showed an average of 23,500 kilometers and a standard deviation of 3900 kilometers? Use a P-value in your conclusion.

**E9:** Guess that,  $x(t)$  is a WSS process with autocorrelation:  $R(\tau) = Ae^{-\alpha|\tau|}$ . Determine the second moment of r.v  $y=x(8)-x(5)$ .

**E10:** A stationary process  $v(t)$  has autocorrelation  $R(\tau) = A\delta(\tau)$ . The process is applied at  $t = 0$  to a linear system with impulse response  $h(t) = e^{-ct}U(t)$ , where  $U(t) = 1$  when  $t \geq 0$  and 0 otherwise. Determine autocorrelation  $R_{yy}(t_1, t_2)$  of output process where  $t_2 > t_1 > 0$ .