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4. Sampling Distribution Data Set 3 "Births" in Appendix B includes a sample of birth weights. If we explore this sample of 400 birth weights by constructing a histogram and finding the mean and standard deviation, do those results describe the sampling distribution of the mean? Why or why not?

Data Set 3: Births

Data are from 400 births (first five rows shown here). For **GENDER** 0 = female and 1 = male. **LENGTH OF STAY** is in days, **BIRTH WEIGHT** is in grams, and **TOTAL CHARGES** are in dollars.

TI-83/84 list names (BIRTHS): FLOS, MLOS, FBWT, MBWT, FCHRG, MCHRG [Separate lists provided for female (F) and male (M) babies. No list for FACILITY, INSURANCE, ADMITTED, and DISCHARGED]

FACILITY	INSURANCE	GENDER (1 = M)	LENGTH OF STAY	ADMITTED	DISCHARGED	BIRTH WEIGHT	TOTAL CHARGES
Albany Medical Center Hospital	Insurance Company	0	2	FRI	SUN	3500	13986
Albany Medical Center Hospital	Blue Cross	1	2	FRI	SUN	3900	3633
Albany Medical Center Hospital	Blue Cross	0	36	WED	THU	800	359091
Albany Medical Center Hospital	Insurance Company	1	5	MON	SAT	2800	8537
Albany Medical Center Hospital	Insurance Company	1	2	FRI	SUN	3700	3633

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6. Physicians There are about 900,000 active physicians in the United States, and they have annual incomes with a distribution that is skewed instead of being normal. Many different samples of 40 physicians are randomly selected, and the mean annual income is computed for each sample.

a. What is the approximate shape of the distribution of the sample means (uniform, normal, skewed, other)?

b. What value do the sample means target? That is, what is the mean of all such sample means?

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In Exercises 7–10, use the same population of {4, 5, 9} that was used in Examples 2 and 5. As in Examples 2 and 5, assume that samples of size n = 2 are randomly selected with replacement.

7. Sampling Distribution of the Sample Variance

a. Find the value of the population variance σ^2.

b. Table 6-2 describes the sampling distribution of the sample mean. Construct a similar table representing the sampling distribution of the sample variance s^2. Then combine values of s^2 that are the same, as in Table 6-3 (*Hint:* See Example 2 on page 244 for Tables 6-2 and 6-3, which describe the sampling distribution of the sample mean.)

c. Find the mean of the sampling distribution of the sample variance.

d. Based on the preceding results, is the sample variance an unbiased estimator of the population variance? Why or why not?

TABLE 6-2 Sampling Distribution of Mean

Sample	Sample Mean $\bar{x}$	Probability
4, 4	4.0	1/9
4, 5	4.5	1/9
4, 9	6.5	1/9
5, 4	4.5	1/9
5, 5	5.0	1/9
5, 9	7.0	1/9
9, 4	6.5	1/9
9, 5	7.0	1/9
9, 9	9.0	1/9

TABLE 6-3 Sampling Distribution of Mean (Condensed)

Sample Mean $\bar{x}$	Probability
4.0	1/9
4.5	2/9
5.0	1/9
6.5	2/9
7.0	2/9
9.0	1/9

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8. Sampling Distribution of the Sample Standard Deviation For the following, round results to three decimal places.

a. Find the value of the population standard deviation σ.

b. Table 6-2 describes the sampling distribution of the sample mean. Construct a similar table representing the sampling distribution of the sample standard deviation s. Then combine values of s that are the same, as in Table 6-3. (*Hint:* See Example 2 on page 244 for Tables 6-2 and 6-3, which describe the sampling distribution of the sample mean.)

c. Find the mean of the sampling distribution of the sample standard deviation.

d. Based on the preceding results, is the sample standard deviation an unbiased estimator of the population standard deviation? Why or why not?

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9. Sampling Distribution of the Sample Median

a. Find the value of the population median.

b. Table 6-2 describes the sampling distribution of the sample mean. Construct a similar table representing the sampling distribution of the sample median. Then combine values of the median that are the same, as in Table 6-3. (*Hint:* See Example 2 on page 244 for Tables 6-2 and 6-3, which describe the sampling distribution of the sample mean.)

c. Find the mean of the sampling distribution of the sample median.

d. Based on the preceding results, is the sample median an unbiased estimator of the population median? Why or why not?

Sec 6-4 P258

2. Small Sample Weights of adult human brains are normally distributed. Samples of weights of adult human brains, each of size $n = 15$, are randomly collected and the sample means are found. Is it correct to conclude that the sample means cannot be treated as being from a normal distribution because the sample size is too small? Explain.

Sec 6-4 P258

4. Annual Incomes Annual incomes of physicians are known to have a distribution that is skewed to the right instead of being normally distributed. Assume that we collect a large $(n > 30)$ random sample of annual incomes of physicians. Can the distribution of those incomes in that sample be approximated by a normal distribution because the sample is large? Why or why not?

Sec 6-4 P258

Using the Central Limit Theorem. ***In Exercises 5–8, assume that females have pulse rates that are normally distributed with a mean of 74.0 beats per minute and a standard deviation of 12.5 beats per minute (based on Data Set 1 "Body Data" in Appendix B).***

7. a. If 1 adult female is randomly selected, find the probability that her pulse rate is between 72 beats per minute and 76 beats per minute.

b. If 4 adult females are randomly selected, find the probability that they have pulse rates with a mean between 72 beats per minute and 76 beats per minute.

c. Why can the normal distribution be used in part (b), even though the sample size does not exceed 30?

Sec 6-4 P259

13. Mensa Membership in Mensa requires a score in the top 2% on a standard intelligence test. The Wechsler IQ test is designed for a mean of 100 and a standard deviation of 15, and scores are normally distributed.

a. Find the minimum Wechsler IQ test score that satisfies the Mensa requirement.

b. If 4 randomly selected adults take the Wechsler IQ test, find the probability that their mean score is at least 131.

c. If 4 subjects take the Wechsler IQ test and they have a mean of 132, but the individual scores are lost, can we conclude that all 4 of them are eligible for Mensa?

Sec 6-4 P260

17. Southwest Airlines Seats Southwest Airlines currently has a seat width of 17 in. Men have hip breadths that are normally distributed with a mean of 14.4 in. and a standard deviation of 1.0 in. (based on anthropometric survey data from Gordon, Churchill, et al.).

a. Find the probability that if an individual man is randomly selected, his hip breadth will be greater than 17 in.

b. Southwest Airlines uses a Boeing 737 for some of its flights, and that aircraft seats 122 passengers. If the plane is full with 122 randomly selected men, find the probability that these men have a mean hip breadth greater than 17 in.

c. Which result should be considered for any changes in seat design: the result from part (a) or part (b)?