Chapter 2

1. The administrator at Saint Frances Hospital is concerned about the amount of overtime the nursing staff is incurring and wonders whether so much overtime is really necessary. The hospital employs 60 nurses. Following is the number of hours of overtime reported by each nurse last week. These data are the population of interest.

Nurse	Overtime	Nurse	Overtime	Nurse	Overtime
1	2	21	4	41	3
2	1	22	2	42	3
3	7	23	3	43	2
4	0	24	5	44	1
5	4	25	5	45	3
6	2	26	6	46	3
7	6	27	2	47	3
8	4	28	2	48	3
9	2	29	7	49	4
10	5	30	4	50	6
11	5	31	4	51	0
12	4	32	3	52	3
13	5	33	3	53	4
14	0	34	4	54	6
15	6	35	5	55	0
16	0	36	5	56	3
17	2	37	0	57	3
18	4	38	0	58	7
19	2	39	4	59	5
20	5	40	3	60	7

Using the random numbers table in Appendix A with a starting point in column (digit) 14 and row 10, select a random sample of 6 nurses. Go down the table from the starting point. Determine the mean hours of overtime for these 6 nurses and calculate the sampling error associated with this particular sample mean.

1511	4745	8716	2793	9142	4958	5245	8312	8925
6249	7073	0460	0819	0729	6806	2713	6595	5149
2587	4800	3455	7565	1196	7768	6137	4941	0488
0168	1379	7838	7487	7420	5285	8045	6679	1361
9664	9021	4990	5570	4697	7939	5842	5353	7503
1384	4981	2708	6437	2298	6230	7443	9425	5384
6390	8953	4292	7372	7197	2121	6538	2093	7629
6944	8134	0704	8500	6996	3492	4397	8802	3253
3610	3119	7442	6218	7623	0546	8394	3286	4463
9865	0028	1783	9029	2858	8737	7023	0444	8575
7044	6712	7530	0018	0945	8803	4467	0979	1342
9304	4857	5476	8386	1540	5760	9815	7191	3291
1717	8278	0072	2636	3217	1693	6081	1330	3458
2461	3598	5173	9666	6165	7438	6805	2357	6994
8240	9856	0075	7599	8468	7653	6272	0573	4344
1697	6805	1386	2340	6694	9786	0536	6423	1083
4695	2251	8962	5638	9459	5578	0676	2276	4724
3056	8558	3020	7509	5105	4283	5390	5715	8405
6887	9035	8520	6571	3233	7175	2859	1615	3349
1267	8824	5588	2821	1247	0967	4355	1385	0727
4369	9267	9377	8205	6479	7002	0649	4731	7086
2888	0333	5347	4849	5526	2975	5295	5071	6011
9893	7251	6243	4617	9256	4039	4800	9393	3263
8927	3977	6054	5979	8566	8120	2566	4449	2414

APPENDIX A : Random Numbers Table

2. SeaFair Fashions relies on its sales force of 220 to do an initial screening of all new fashions. The company is currently bringing out a new line of swimwear and has invited 40 salespeople to its Orlando home office. An issue of constant concern to the SeaFair sales office is the volume of orders generated by each salesperson. Last year, the overall company average was $417,330 with a standard deviation of $45,285. (*Hint*: The finite population correction factor, Equation 7.5, is required.)

a. Determine the probability the sample of 40 will have a sales average less than $400,000.

b. What shape do you think the distribution of all possible sample means of 40 will have? Discuss.

c. Determine the value of the standard deviation of the distribution of the sample mean of all possible samples of size 40.

d. How would the answers to parts a, b, and c change if the home office brought 60 salespeople to Orlando? Provide the respective answers for this sample size.

e. Each year SeaFair invites the sales personnel with sales above the 85th percentile to enjoy a complementary vacation in Hawaii. Determine the smallest average salary for the sales personnel that were in Hawaii last year. (Assume the distribution of sales was normally distributed last year.)

3. Airlines have recently toughened their standards for the weight of checked baggage, limiting the weight of a bag to 50 pounds on domestic U.S. flights. Heavier bags will be carried but at an additional fee. Suppose that one major airline has stated in an internal memo to employees that the mean weight for bags checked last year on the airline was 34.3 pounds with a standard

deviation of 5.7 pounds. Further, it stated that the distribution of weights was approximately normally distributed. This memo was leaked to a consumers group in Atlanta. This group had selected and weighed a random sample of 14 bags to be checked on a flight departing from Atlanta. The following data (pounds) were recorded:

| 29 | 27 | 40 | 34 | 30 | 30 | 35 |
| 44 | 33 | 28 | 36 | 33 | 30 | 40 |

What is the probability that a sample mean as small or smaller than the one for this sample would occur if the airline's claims about the population of baggage weight is accurate? Comment on the results.

4. A random sample of size 100 is to be taken from a population that has a proportion equal to 0.35. The sample proportion will be used to estimate the population proportion.
a. Calculate the probability that the sample proportion will be within ±0.05 of the population proportion.
b. Calculate the probability that the sample proportion will be within ±1 standard error of the population proportion.
c. Calculate the probability that the sample proportion will be within ±0.10 of the population proportion.

5. A survey is conducted from a population of people of whom 40% have a college degree. The following sample data were recorded for a question asked of each person sampled, "Do you have a college degree?"

YES	NO	NO	YES	YES
YES	YES	YES	YES	YES
YES	NO	NO	NO	YES
NO	YES	YES	NO	NO
NO	YES	YES	YES	NO
YES	NO	YES	NO	NO
YES	NO	NO	NO	YES
YES	NO	NO	NO	NO
NO	NO	YES	NO	NO
NO	YES	NO	YES	YES
NO	NO	NO	YES	NO
NO	NO	NO	YES	YES

a. Calculate the sample proportion of respondents who have a college degree.
b. What is the probability of getting a sample proportion as extreme or more extreme than the one observed in part a if the population has 40% with college degrees?

6. According to the most recent Labor Department data, 10.5% of engineers (electrical, mechanical, civil, and industrial) were women. Suppose a random sample of 50 engineers is selected.
a. How likely is it that the random sample of 50 engineers will contain 8 or more women in these positions?
b. How likely is it that the random sample will contain fewer than 5 women in these positions?
c. If the random sample included 200 engineers, how would this change your answer to part b?

7. Even before the record gas prices during the summer of 2008, an article written by Will Lester of the Associated Press reported on a poll in which 80% of those surveyed say that Americans who currently own a SUV (sport utility vehicle) should switch to a more fuel-efficient vehicle to ease America's dependency on foreign oil. This study was conducted by the Pew Research Center for the People & the Press. As a follow-up to this report, a consumer group conducted a study of SUV owners to estimate the mean mileage for their vehicles. A simple random sample of 91 SUV owners was selected, and the owners were asked to report their highway mileage. The following results were summarized from the sample data:

$$\bar{x} = 18.2 \text{ mpg} \quad s = 6.3 \text{ mpg}$$

Based on these sample data, compute and interpret a 90% confidence interval estimate for the mean highway mileage for SUVs.

8. According to *USA Today*, customers are not settling for automobiles straight off the production lines. As an example, those who purchase a $355,000 Rolls-Royce typically add $25,000 in accessories. One of the affordable automobiles to receive additions is BMW's Mini Cooper. A sample of 179 recent Mini purchasers yielded a sample mean of $5,000 above the $20,200 base sticker price. Suppose the cost of accessories purchased for all Mini Coopers has a standard deviation of $1,500.
a. Calculate a 95% confidence interval for the average cost of accessories on Mini Coopers.
b. Determine the margin of error in estimating the average cost of accessories on Mini Coopers.
c. What sample size would be required to reduce the margin of error by 50%?

9. The concession managers for the Arkansas Travelers (a minor league baseball team located in Little Rock) are interested in estimating the average amount spent on food by fans attending the team's Friday night home games. Suppose a random sample of 36 receipts for food orders was taken from last year's receipts for Friday night home games with the following food expenditures recorded:

$30.50	$10.63	$3.77	$21.90	$21.95	$9.65
$14.31	$11.39	$25.36	$15.79	$30.88	$12.20
$8.48	$20.70	$28.54	$9.13	$15.54	$14.95
$11.96	$11.91	$8.28	$12.87	$24.26	$21.04
$20.08	$10.08	$25.37	$12.02	$11.61	$11.22
$25.36	$28.07	$17.71	$23.00	$31.79	$17.70

a. Based on the sampled receipts, what is the best point estimate for the mean food expenditures for Friday night home games?
b. Use the sample information to construct a 95% confidence interval estimate for the true mean expenditures for Friday night home games.
c. Before the sample was taken, the food concessions manager stated that mean food expenditures were about $19.00 per order. Does his statement seem consistent with the results obtained in part b?

10. A survey of 499 women for the American Orthopedic Foot and Ankle Society revealed that 38% wear flats to work.

a. Use this sample information to develop a 99% confidence interval for the population proportion of women who wear flats to work.
b. Suppose the society also wishes to estimate the proportion of women who wear athletic shoes to work with a margin of error of 0.01 with 95% confidence. Determine the sample size required.

11. Most major airlines allow passengers to carry two pieces of luggage (of a certain maximum size) onto the plane. However, their studies show that the more carry-on baggage passengers have, the longer it takes to unload and load passengers. One regional airline is considering changing its policy to allow only one carry-on per passenger. Before doing so, it decided to collect some data. Specifically, a random sample of 1,000 passengers was selected. The passengers were observed, and the number of bags carried on the plane was noted. Out of the 1,000 passengers, 345 had more than one bag.
a. Based on this sample, develop and interpret a 95% confidence interval estimate for the proportion of the traveling population that would have been impacted had the one-bag limit been in effect. Discuss your result.
b. The domestic version of Boeing's 747 has a capacity for 568 passengers. Determine an interval estimate of the number of passengers that you would expect to carry more than one piece of luggage on the plane. Assume the plane is at its passenger capacity.
c. Suppose the airline also noted whether the passenger was male or female. Out of the 1,000 passengers observed, 690 were males. Of this group, 280 had more than one bag. Using this data, obtain and interpret a 95% confidence interval estimate for the proportion of male passengers in the population who would have been affected by the onebag limit. Discuss.
d. Suppose the airline decides to conduct a survey of its customers to determine their opinion of the proposed onebag limit. The plan calls for a random sample of customers on different flights to be given a short written survey to complete during the flight. One key question on the survey will be: "Do you approve of limiting the number of carryon bags to a maximum of one bag?" Airline managers expect that only about 15% will say "yes." Based on this assumption, what size sample should the airline take if it wants to develop a 95% confidence interval estimate for the population proportion who will say "yes" with a margin of error of ±0.02?

12. A report released by the College Board asserted the percentage of students who took and passed Advanced Placement (AP) courses in all subjects has increased in every state and the District of Columbia since 2000. Among public school students, 14.1% earned a passing grade on at least one AP exam, the report indicated. In an attempt to determine if the proportion of those passing the math and science AP exams is equal to the 14.1% success rate, a random sample of 300 students enrolled in AP math and science classes has been selected.
a. If 35 of the students in the sample passed at least one AP math or science exam, calculate the proportion of those students who passed at least one AP math or science exam. Does this statistic indicate that the proportion of students who pass at least one AP math or science exam is less than that of those taking AP exams as a whole? Support your assertions.
b. Calculate the probability that a sample proportion equal to or less than that calculated in part a would occur if the population proportion was actually 0.141. Answer the question posed in part a using this probability.
c. Calculate a 98% confidence interval for the proportion of those students who passed at least one AP math or science exam. Answer the question posed in part a using this confidence interval. Does this answer correspond to that of part b? Support your assertions.