STATISTICS 211

Tutorial 4

1.

1 ticket $\underline{1}$, 3 ticket $\underline{0}$'s

(a) Find the probability that ticket 1 is picked.
(b) Find the average of the box and the SD
(c) Find the expected sum and SE for 100 draws made with replacement
(d) Find the expected value and SE for the average of 100 draws made with replacement
(e) Find the probability that the sum of 100 draws is 30 or more.
(f) Find the probability that the sum of 100 draws is between 22 and 30

2. Two hundred draws are made at random from the box $\underline{-3, -3, +7, +7, +7}$ with replacement. Find the approximate probability that the sum is 499 or more.

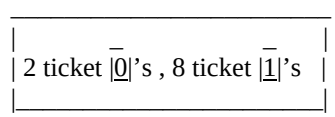
3. A group of 50,000 tax forms has an average gross income of $37,000, with a SD of $20,000. Furthermore, 20% of the forms have a gross income over $50,000. A group of 900 forms is chosen at random for audit. To estimate the chance that between 19% and 21% of the forms chosen for audit have gross incomes over $50,000, a box model is needed.
   (a) Should the number of tickets in the box be 900 or 50,000?
   (b) Each ticket in the box shows
       a. zero or one b. gross income
   (c) True or false: the SD of the box is $20,000
   (d) True or false: the number of draws is 900
   (e) Find the chance that between 19% and 21% of the forms chosen for audit have gross incomes over $50,000.
   (f) Find the chance that the total gross income of the audited forms is over $33,000,000.

4. In human engineering and product design, it is often important to consider the weights of people so that airplanes or elevators are not overloaded, chairs don't break, and other such dangerous or embarrassing mishaps do not occur. An engineer is designing a large elevator for a hotel to lift 50 people. On average, guests weight 150 pound with a SD of about 35 pounds. If it's designed to handle 4 tons (8000 pounds), find the chance it will be overloaded by a random group of 50 people.

5. The total weight of garbage that households discard weekly is approximately normally distributed, with an average of 12.5 kg and a standard deviation of 5.7kg.
   (a) If 120 households are randomly selected, find the probability that the average weight of their discarded garbage is over 13.5 kg.
   (b) If the town's waste transfer station allocates capacity for 1690 kg of temporary garbage storage per 120 households per week, and the typical garbage route is based on 120 households, what percentage of garbage routes will exceed the allocated capacity for their garbage? Is this an acceptable level or should the town council take corrective action? Explain.

6. Assume that human body temperatures are normally distributed with an average of 36.4°C and a standard deviation of 0.62°C.
   (a) If we define a fever to be a body temperature above 37.8°C, what percentage of normal and healthy persons would be considered to have a fever? Does this percentage suggest that a cutoff of 37.8°C is appropriate?
   (b) If we defined a fever so that only 0.5% of the population would have a body temperature above a certain temperature, what is this temperature?
   (c) If 50 people are randomly selected, find the probability that their average is more than 37°C

7. 100 draws (with replacement) are made from the following box



(a) What's the expected number of 1's?
(b) What's the SE for the number of 1's drawn?
(c) What's the probability of getting exactly 80 1's?
(d) What's the probability of getting exactly 80 1's ?(use area under normal curve to approximate)
(e) What's the probability of getting between 70 and 85 1's inclusive? (use area under normal curve to approximate)
(f) What's the probability of getting more than 75 1's? (use area under normal curve to approximate)

8. A multiple choice test consist of 50 questions with possible answers of a, b, c, d, and e.
   (a) Estimate the probability of getting at most 30% of all questions correct if all answers are random guesses.
   (b) Estimate the probability of passing (getting at least 50% of the answers correct).

9. John Dukhia plans to place 200 bets of $1 each on the number 7 at roulette. On any one spin there is a probability of 1/38 that 7 will be the winning number. For John to end up with a profit, the number 7 must occur at least 6 times among the 200 trials. Estimate the probability that John finishes with a profit.

10. *Simplified Craps*. A bet of $1 is taken to play the game. Two fair dice are rolled, and sum of the points on the dice is recorded. If the sum is 12, you win $5; if it is 2 you win $3; if a 10 or 11 appears you win $2, and if a 3 or a 4 appears you win $1. Any other outcome results in the loss of your initial wager.
    (a) Set up the box diagram to represent this problem.
    (b) Should you play this game?

11. (a) State the correction factor.
    (b) Find the correction factor for the SE of Christians from a random sample of 8000 drawn from 1 million people where 850,000 are Christians. Does the correction factor affect SE?

12. As part of his review for a chemistry test, a student randomly selects (without replacement) 40 out of the 102 elements listed on the standard tables, and tries to guess their atomic numbers. Given that the average of all 102 atomic numbers is 51.794, and the population standard deviation is 29.804, what is the probability that the average of the 40 atomic numbers selected by the student will be at least 58.3?

13. A patio building company believes that it takes 27 days on average with a SD of 2.1 days to complete a job. If the job is done in less time, the owner is afraid that the job may be rushed and will sacrifice quality. Records of fifty completed jobs are randomly selected. The average length of job was found to be 25.3. Do records indicate that the mean length of a job is not 27 days as believed by Noah? Set up a test procedure. Draw the box model. (Hint: find the chance that the average of 50 jobs 25.3 days or less)

14. Industrial espionage is a growing problem. It has been estimate that corporate extortion cost companies more than $3.35 million on average with a SD of $1.21 million. Sixty-five cases of this nature were examined and found to average $3.71 million. Do the data support the statement concerning the estimated cost of corporate extortion? (Hint: find the chance that the average of 65 cases is 3.71 million or more)

15. The owner of a small publishing firm thinks that business has improved lately. Last year the daily revenue for the firm was $5,000 on average. A random sample of 20 recent days reveals an average daily revenue of $5,200 with a standard deviation of $507 (SD+). Do the data support the owner's belief? (Hint: find the chance that the average of 20 days is $5,200 or more)

16. It is believed that 30% of infants are born with a certain disease at birth. Suppose that 200 infants are examined at birth and that 50 have the disease. Do the data support the belief?
(Hint: find the chance that the percentage of babies is 25% (50/200x 100%) or less or that the number of babies is 50 or less)

17. A firm establishes a committee to investigate the amount each contract costs over and above the amount quoted in the original contract (overruns). The committee has determined that the standard deviation of overruns is $17,500. The average overrun for a random sample of 50 contracts is $12,000. Determine a 90% confidence interval estimate of the true mean overrun based on this sample.

18. A technician takes a series of 35 measurements as accurately as possible and the results show an average of 20 micrograms with a SD+ of 3.847mg. Find a 95% CI for the true average. Show all details of your answer including the box model, assumptions, etc.

19. The earnings per share for a random sample of technology stocks listed on the NYSE were (in $'s):
1.90 2.15 2.01 0.94 1.53 1.89 2.12 2.05 1.75 2.22 3.44

(a) Assuming that earnings per share are normally distributed, determine a 95% confidence interval estimate of the average earnings per share of the NYSE technology stocks.

(b) A broker stated that the NYSE technical average earning was $1.25 per share. Do the data confirm this or not. Use the results of (a) only.

20. A simple sample of five people provided the following data on ages: 21, 25, 20, 18, and 21. Develop a 95%confidence interval for the average age of the population being sampled. State any assumptions you must make in you method.

21. An archaeologist found that the average cranial width of 17 skulls was 5.3 inches with a standard deviation of 0.5 inches (SD+). Using a 90% confidence level, set a confidence interval for the true average cranial width. Assume that the cranial width is normally distributed.

22. An economist claims that the unemployment rate for non-English speaking people is at least 30% in a specific region of the country. In a random sample of 400 non-English-speaking people in this region 90 were found to be unemployed. Determine a 95% confidence interval estimate of the proportion of non-English-speaking people in the region that are unemployed. Do these data support the economist's claim? Explain why or why not.

23. A hotel chain gives an aptitude test to job applicants and considers a multiple-choice test question to be easy if at least 80% of the responses are correct. A random sample of 6503 responses to one particular question includes 84% correct responses. Construct the 99% confidence interval for the true percentage of correct responses. Is it likely that the question is really easy? Why?

24. In a survey, 1039 adults were asked " How much respect and confidence do you have in the public school system?" The results, reported in the Toronto Star (Sept. 26, 1988), are shown below:

Responses	A great deal	Quite a lot	Some	Very little	No opinion
Percentages	12%	30%	35%	13%	10%

Estimate with a 90% confidence the proportion of all adults who had "a great deal" or quite a lot" of respect for the public school system. Interpret this interval

25. Of the 200 individuals interviewed, 80 said they were concerned about fluorocarbon emissions in the atmosphere. Obtain a 99% confidence interval estimate for the true proportion of individuals who are concerned. Interpret this interval.

26. Do as many questions from chapter 16,17,18,20,21,23 as possible. Midterm is up to and including this assignment.