DAWSON COLLEGE
Mathematics Department
Final Examination
STATISTICS FOR SOCIAL SCIENCE
201-401–DW (sections 00001, 00002)
May 21st, 2019

Student Name _____

Student I.D. # _____

Instructors: O. Diaconescu, M. Beck

TIME: 14:00 –17:00

Instructions:

- Print your name and student ID number in the space provided above.
- All questions are to be answered directly on the examination paper in the provided space.
- Translation and regular dictionaries are permitted.
- The Sharp EL-531XG, EL-531XT or EL-531X calculators are recommended.
- This examination consists of two parts 10 multiple choice questions and 12 long questions.
- There are 17 pages including the cover page.
- **This exam booklet must be returned intact.**

Question #	Marks
Part 1/10	
Q #1/2	
Q #2/6	
Q #3/1	
Q #4/3	
Q #5/2	
Q #6/3	
Q #7/3	
Q #8/2	
Q #9/5	
Q #10/4	
Q #11/4	
Q #12/5	
Total / 50	

60% Class Marks = _____

\+

40% Final Exam = _____

FINAL GRADE =_____

Part 1. Multiple choice questions,
Indicate the answer choice that best completes the statement or answers the question.

Question 1. (1 point) Give an example of a continuous random variable.

a. The number of fishes caught by a fishing boat
b. The number of coins contained in a slot machine
c. The number of traffic accidents in a city
d. The number of gallons of water in a reservoir
e. The number of tables sold at a furniture store

Question 2. (1 point) What is a parameter?

a. A conclusion about the value of a population parameter based on information about the corresponding sample statistic and probability
b. A numerical descriptive measure of a population
c. A set of measurements (or counts), either existing or conceptual
d. A probability distribution for a sample statistic
e. A numerical descriptive measure of a sample

Question 3. (1 point) Give an example of a population.

a. Seven cards chosen at random from a 52-card deck
b. A week of television shows watched by Americans as reported in a survey
c. The lengths of all trout in a lake
d. The automobiles bought by Americans polled in a telephone survey
e. Registered Oklahoma voters who voted in a U.S. presidential election

Question 4. (1 point) Richard has been given a 7-question multiple-choice quiz in his history class. Each question has four answers, of which only one is correct. Since Richard has not attended the class recently, he doesn't know any of the answers. What is considered the 'success'?

a. Number of questions
b. Richard answers a question correctly
c. Number of questions answered
d. Richard answers all questions correctly
e. None of the choices

Question 5. (1 point) What is a sampling distribution?

a. A conclusion about the value of a population parameter based on information about the corresponding sample statistic and probability
b. A numerical descriptive measure of a population
c. A set of measurements (or counts), either existing or conceptual
d. A probability distribution for a sample statistic
e. A numerical descriptive measure of a sample

Question 6. (1 point) What is a statistic?

a. A conclusion about the value of a population parameter based on information about the corresponding sample statistic and probability
b. A numerical descriptive measure of a population
c. A set of measurements (or counts), either existing or conceptual
d. A probability distribution for a sample statistic
e. A numerical descriptive measure of a sample

Question 7. (1 point) Give an example of a discrete random variable.

a. The number of inches of rainfall in a county
b. The number of beverages sold at a lemonade stand
c. The number of gallons of concrete used at a construction site
d. The time required for a runner to finish a marathon
e. The temperature of a pot roast cooking in an oven

Question 8. (1 point). Which of the following scenarios is an example of a binomial experiment?

a. A shopping mall is interested in the income level of its customers and is taking a survey to gather information.
b. A business firm introducing a new product wants to know how many purchases its clients will make each year.
c. A sociologist is researching an area in an effort to determine the proportion of households with a male head of household.
d. A study is concerned with the average number of hours worked by high school students.

Question 9. (1 point) Which of the following is NOT a characteristic of a binomial experiment?

a. There are n identical trials, and all trials are independent.
b. Each trial has two possible outcomes, which are traditionally labeled “failure” and “success,” and the probability of success p is the same on each trial.
c. We are interested in x, the number of successes observed during the n trials.
d. The probability of failure may differ from trial to trial.

Question 10. (1 point) Which of the following statements holds for the standard normal random variable z?

a. The values of z are always positive
b. The values of z could be positive or negative
c. The values of z are between –1 and 1
d. Most values of z are to the left of the mean.

Part 2. Calculation questions.

Answer the question in full details.

Question 1. (2 points)[**Social Media Use**] On a given day, of all surveyed teenagers in a high school, 60% used WhatsApp, 90% used Facebook, and 55% used both WhatsApp and Facebook.

a. If a randomly selected teenager is known to have used Facebook, what is the probability that she or he also used WhatsApp?
b. What is the probability that a randomly selected teenager uses either Facebook, or WhatsApp, or both?

Question 2. (6 points)[**Working Mothers in Canada**] Statistics Canada wanted to find the distribution of ages of working women living in Canada who were single mothers. The researcher drew a random sample of some 300 families from the government tax records and found the following distribution:

	Age Group			
Marital Status	Under 25 Years (A1)	25–40 Years (A2)	Over 40 Years (A3)	Total
Married (M)	25	59	36	120
Single (S)	72	54	54	180
Total	97	113	90	300

One family was selected at random from tax base records of families with working mothers.

a. If the randomly selected working mother is between 25 and 40 years of age, what is the probability that she is single?
b. What is the probability that the randomly selected working mother is either single or over 40 years of age?
c. If the randomly selected working mother is married, what is the probability she is over 40 years of age?
d. What is the probability that the randomly selected working mother is married?
e. What is the probability that the randomly selected working mother is under 25 years of age?
f. What is the probability that the randomly selected working mother is single and under 25 years of age?

Question 3.(1 point) An Italian restaurant in Québec City offers a special summer menu in which, for a fixed dinner cost, you can choose from one of two salads, one of three entrees, and one of four desserts. How many different dinners are available?

Question 4.(3 points) There are 3 white marbles, 2 green marbles, 2 red marbles, and 1 blue marble in a jar. 3 marbles are drawn without replacement. What is the probability that the first is white, the second green, and the third green?

Question 5.(2 points) Hotels, like airlines, often overbook, counting on the fact that some people with reservations will cancel at the last minute. A certain hotel chain has found that 10% of the reservations will not be used.

a. If we randomly selected 20 reservations, what is the probability (strictly) more than 10 but (strictly) fewer than 14 reservations will be used?
b. If 6 reservations are made, what is the chance (strictly) fewer than two will not be used?

Question 6.(3 points) [**Weight of a Salmon]** The weight of a salmon is normally distributed, with a mean of 1.8 kg and a standard deviation of 0.2 kg.

a. What percentage of salmon weigh more than 2 kg?
b. What percentage of salmon weighs less than 1.5 kg?
c. Find the value *b* such that 11.5% of salmon weigh less than *b* kg.

Question 7.(3 points) **[Final Exam Scores]** Suppose a random sample of 25 students is selected from a community college where the scores on the final exam (out of 125 points) are normally distributed having mean equal to 112 and standard deviation equal to 12.

a. Find the mean and the standard deviation of the sampling distribution of the sample mean $\bar{x}$.
b. Find the probability that $\bar{x}$ exceeds 116.
c. Find the probability that the sample mean deviates from the population mean $\bar{x} = 112$ by no more than 4.

Question 8.(2 points) An airline executive estimates that 25% of all flights arrive late. How many flights must we include in a simple random sample if we want to be 90% confident that the true population proportion of flights that arrive late lies within 0.01 of our sample proportion? Justify your conclusion.

Question 9.(5 points) [**Rh-Positive Blood Type**] The proportion of individuals with an Rh-positive blood type is 88%. You have a random sample of n = 500 individuals.

a. What are the mean and standard deviation of $\hat{p}$, the sample proportion with Rh-positive blood type?
b. Is the distribution of $\hat{p}$ approximately normal? Justify your answer.
c. What is the probability that the sample proportion $\hat{p}$ exceeds 85%
d. What is the probability that the sample proportion $\hat{p}$ lies between 86% and 91%?
e. Between which two limits would the sample proportion $\hat{p}$ lie 99% of the time?

Question 10. (4 points) **[Earthquake Analysis]** The length of duration, in minutes, of earthquakes in British Columbia has been recorded for future analysis and information. The length of duration of a random sample of six earthquakes is as follows: 1.1, 0.9, 1.5, 0.7, 1.4, and 1.3. An earthquake expert claims that the average duration of earthquakes in British Columbia is 0.5 minutes. Assuming that the population distribution is approximately normal, can this claim be rejected? Justify your answer. Use $\alpha = 0.02$.

Question 11(4 points) **[Price Differences]** A consumer was interested in determining whether there is a significant difference in the price charged for tools by two hardware stores. The consumer selected five tools and recorded the price for each tool in each store. The following data were recorded:

Tool Store	1	2	3	4	5
1	\$32.00	\$3.95	\$1.50	\$2.95	\$4.00
2	\$30.00	\$2.95	\$1.50	\$2.45	\$5.00

a. Are the samples independent? Justify your answer.
b. Assuming that both distributions are approximately normal. Perform the appropriate test of hypothesis to determine whether there is a significant difference, on average, in the price of tools between the two stores. Use $\alpha = 0.05$.

Question 12.(5 points) [**Life Insurance**]An insurance company wants to test the hypothesis that the mean amount of life insurance held by professional men equals that held by professional women. Accordingly, two independent simple random samples are taken from appropriate professional listings of men and women. The sample of 200 men reveals a mean amount of $133,000 with a standard deviation of $26,000. The sample of 400 women shows a mean amount of $128,000 with a standard deviation of $3,000.

a. Using a significance level $\alpha = 0.05$, what is your conclusion? (Perform the appropriate test of hypothesis)

b. Construct a 95% confidence interval for the difference in mean amount of life insurance held by professional men and women. Explain how to use the 95% confidence interval for $\mu_1 - \mu_2$ to test the appropriate hypotheses at $\alpha = 0.05$.

Answers

Part 1. Multiple choice questions,

1.d, 2.b, 3.c, 4.b, 5.d, 6.e, 7.b, 8.c 9.d, 10.b

Part 2. Calculation questions.

Question 1. a. 61% b.95%

Question 2. a. 48% b.72% c. 30% d. 40% e.32% f. 24%

Question 3. 24

Question 4. 1.78%

Question 5. a. 0.23% b. 90.2%

Question 6. a. 15.87% b. 6.68% c. 1.559kg

Question 7. a. $\mu = 112$ $\sigma = 2.4$ b. 4.75% c. 90.5%

Question 8. 5074 flights

Question 9. a. $\mu = 0.88$ $\sigma = 0.0145$ b. approx. normal c. 98.08% d. 89.07% e. Between 84.27% and 91.73%

Question 10. The claim is rejected.

Question 11. a. dependent b. Not sufficient to reject null hypothesis.

Question 12. a. p-value is very close to zero, so null hypothesis is rejected. b. Calculations confirm rejection of null hypothesis.