MATH 1342
Final Exam Study Guide - Spring 2019

1) The Golden Comet is a hybrid chicken that is prized for its high egg production rate and gentle disposition. According to recent studies, the *mean* rate of egg production for 1-year-old Golden Comets is **5.0** eggs/week. 1) _____

Sarah has **39** 1-year-old hens that are fed exclusively on natural scratch feed: insects, seeds, and plants that the hens obtain as they range freely around the farm. Her hens exhibit a *mean* egg-laying rate of **5.2** eggs/day.

Sarah wants to determine whether the mean laying rate μ for her hens is higher than the mean rate for all Golden Comets. Assume the population *standard deviation* to be $\sigma = 1.1$ eggs/day.

i. State the appropriate *null* and *alternate* hypotheses.
ii. Compute the value of the test statistic.
iii. State a conclusion. Use the $\alpha = 0.01$ level of significance.

2) A(n) _____ probability distribution consists of the finite number of values a random variable can assume and the corresponding probabilities of the values. 2) _____

3) A study was conducted to determine if there was a linear relationship between a person's age and his/her peak heart rate. 3) _____

a. Draw the scatter plot for the variables.
b. Give a brief explanation of the type of relationship.

Age	Peak Heart Rate
16	220
26	194
32	193
37	178
42	172
53	160
48	174
21	214

4) Determine whether the outcome is a Type I error, a Type II error, or a correct decision. 4) _____

A test is made of $H_0: \mu = 40$ versus $H_1: \mu \neq 40$. The true value of μ is **40** and H_0 is rejected.

5) A poll found that **37%** of male voters and **45%** of female voters support a particular candidate. To test whether this candidate has equal levels of support between male and female voters, the null hypothesis should be 5) _____

6) Determine which branch of statistics was used to make the following statement. Based on a sample of **2739** respondents, it is estimated that pet owners spent a total of **14** billion dollars on veterinarian care for their pets. 6) _____

7) What level of measurement classifies data into mutually exclusive categories in which no order or ranking can be imposed on the data? 7) _____

8) A local fundraiser wants to graphically display the contributions he has received over the past five years. Construct a time series graph for the following data. 8) _____

Year	**Contributions**
1996	$550
1997	$700
1998	$800
1999	$1050
2000	$1200

9) Given the following two sets of data, draw a **back-to-back stem and leaf plot**. A - 9) _____
12, 22, 22, 24, 34, 31, 26, 35, 27, 39, 49, 10
B - 45, 36, 23, 16, 37, 28, 18, 13, 10, 23, 30, 31

10) The following data represent the total price, in dollars, of **20** randomly-selected gasoline purchases at a certain convenience store. 10) _____

31.87	41.83	24.81	29.28	46.20	37.55	32.13	33.27	49.22	30.25
40.76	38.68	25.97	23.11	31.59	41.16	47.31	43.15	37.85	47.33

Find the median price for these purchases.

11) Approximate the population standard deviation given the following frequency distribution. 11) _____

Class	**Frequency**
0 - 9	11
10 - 19	13
20 - 29	19
30 - 39	12
40 - 49	14

12) Indicate which student has the higher z score. 12) _____

Art Major	X = 46	$\overline{X}$ = 50.5	s = 5.2
Theater Major	X = 70	$\overline{X}$ = 75.1	s = 7.3

13) The average weekly earnings in dollars for various industries are listed below. Find the *percentile rank* of **683**. 13) _____

755, 683, 604, 706, 649, 729, 800, 547, 821, 851

14) A probability experiment has two steps. There are two possible results for the first step, call them "A" and "B". If the result for the first step was "A", then there would be **5** possible results for the second step. If the result for the first step was "B", then there would be **12** possible results for the second step. *How many possible outcomes are there for this experiment?* 14) _____

15) A poll was taken of **14,499** working adults aged 40-70 to determine their level of education. The participants were classified by sex and by level of education. The results were as follows. 15) _____

Education Level	Male	Female	Total
High School or Less	3157	2794	5951
Bachelor's Degree	3723	3714	7437
Master's Degree	529	482	1011
Ph.D.	50	50	100
Total	7459	7040	14,499

A person is selected at random. Compute the probability that the person is female and has a bachelor's degree.

16) A lot of **1000** components contains **250** that are defective. Two components are drawn at random and tested. Let A be the event that the first component drawn is defective, and let B be the event that the second component drawn is defective. 16) _____

Find **P(B and A)**.

17) A recent poll found that **30%** of those surveyed are worried about aggressive drivers on the road. If three people are selected at random, what is the probability that all three will be worried about aggressive drivers on the road? 17) _____

18) There are **3** blue balls, **5** red balls, and **2** white balls in a bag of balls. If a person selects two of the balls, what is the probability that the second one is blue given that the first one was white? 18) _____

19) A certain system has two components. There are **6** different models of the first component and **11** different models of the second. Any first component can be paired with any second component. A salesman must select **2** of the first component and **3** of the second to take on a sales call.
How many different sets of components can the salesman take? 19) _____

20) In a company there are **8** executives: **5** women and **3** men. **Three** are selected to attend a management seminar.
*Find the probability that **2** men and **1** woman will be selected.* 20) _____

21) If a gambler rolls two dice and gets a sum of **10**, he wins **$10**, and if he gets a sum of three, he wins **$20**. The cost to play the game is **$5**.
What is the expectation of this game? 21) _____

22) Construct a *probability distribution* for the sum shown on the faces when two dice are rolled. Find the mean, variance, and standard deviation of the distribution. 22) _____

23) It is estimated that **30%** of households own a riding lawn mower. A sample of **10** households is studied. What is the probability that more than **7** of these own a riding lawn mower? 23) _____

24) If a student randomly guesses at **20** multiple-choice questions, find the probability that the student gets exactly four correct. Each question has four possible choices. 24) _____

25) A computer store has **75** printers of which **25** are laser printers and **50** are ink jet printers. If a group of **10** printers is chosen at random from the store, find the mean and variance of the number of ink jet printers. 25) _____

26) Last year, a manufacturer produced **1,850,000** DVD players. Of these, approximately **3%** were defective. Assume that a simple random sample of **n = 170** players is drawn. Use the Poisson approximation to the binomial distribution to compute the probability that fewer than four of the **170** DVD players were defective. 26) _____

27) Mrs. Smith's reading class can read an average of **175** words per minute with a standard deviation of **20** words per minute. The top **3%** of the class is to receive a special award.
What is the minimum number of words per minute a student would need to read in order to get the award?
Assume the data is normally distributed. 27) _____

28) The mean annual income for people in a certain city (in thousands of dollars) is **41**, with a standard deviation of **34**. A pollster draws a sample of **58** people to interview. What is the probability that the sample mean income is between **38** and **44** (thousands of dollars)? 28) _____

29) A sample of size **50** will be drawn from a population with mean **76** and standard deviation **14**. Find the **69**th percentile of $\bar{x}$. 29) _____

30) The average score for **100** teenage boys playing a certain computer game was **80,000** points per player. If the standard deviation of the population is **20,000** points, find the **95%** confidence interval of the mean score for all teenage boys. 30) _____

31) Find $\mathbf{t_{\alpha/2}}$ when $n = 12$ for the **95%** confidence interval for the mean. 31) _____

32) **Six** measurements were made of the magnesium ion concentration (in parts per million, or ppm) in a city's municipal water supply, with the following results. It is reasonable to assume that the population is approximately normal. 32) _____

189	175	140	188	179	211

Construct a **98%** confidence interval for the mean magnesium ion concentration.

33) A quality control expert wants to estimate the proportion of defective components that are being manufactured by his company. A sample of **300** components showed that **20** were defective. 33) _____

*How large a sample is needed to estimate the true proportion of defective components to within **2.5** percentage points with **99%** confidence?*

34) The Pizza Shop wanted to determine what proportion of its customers ordered only cheese pizza. Out of **80** customers surveyed, **15** ordered only cheese pizza. What is the **99%** confidence interval of the true proportion of customers who order only cheese pizza? 34) _____

35) The mean annual tuition and fees for a sample of 11 private colleges was **$26,500** with a standard deviation of **$6000**. A dotplot shows that it is reasonable to assume that the population is approximately normal. You wish to test whether the mean tuition and fees for private colleges is different from **$31,000**. 35) _____

i). State the null and alternate hypotheses.
ii). Compute the value of the *test statistic* and state the number of *degrees of freedom*.
iii). State a conclusion regarding $\mathbf{H_0}$. Use the $\boldsymbol{\alpha = 0.05}$ level of significance.

36) At a certain university, **16%** of students fail general chemistry on their first attempt. Professor Brown teaches at this university and believes that the rate of first-time failure in his general chemistry classes is **33%**. He samples **96** students from last semester who were first-time enrollees in general chemistry and finds that **15** of them failed his course. 36) _____

i). State the appropriate null and alternate hypotheses.
ii). Compute the test statistic z.
iii). Using $\boldsymbol{\alpha = 0.05}$, can you conclude that the percentage of failures differs from **33%**?

37) Find the ***equation*** of the *regression line*. 37) _____

x	50	58	43	52	47	42
y	184	187	163	171	171	144

38) A local charity believes they receive more money from people in the River Heights neighborhood than from people in the Lakeview neighborhood. They conducted a survey of **24** people randomly selected form each neighborhood and recorded the results. 38) _____

At $\boldsymbol{\alpha = 0.01}$*, is their hypothesis correct?*

River Heights	**Lakeview**
$\overline{X}_1 = \$35/\text{person}$	$\overline{X}_2 = \$25/\text{person}$
$s_1 = \$5/\text{person}$	$s_2 = \$8/\text{person}$
$n_1 = 24$	$n_2 = 24$

39) Construct a **boxplot** for the data set below. 39) _____

11	20	20	27	11
14	14	10	15	14
34	18	11	17	14
22	25	21	20	10

40) Compute the value of the ***correlation coefficient***. 40) _____

x	40	43	46	41	44
y	182	214	210	194	218

41) A recent survey reported that in a sample of **300** students who attend two-year colleges, **105** work at least **20** hours per week. Additionally, in a sample of **225** students attending private four-year universities, only **20** students work at least **20** hours per week. *What is the test value for a test of the difference between these two population proportions?* 41) _____

42) Check the following data set for *outliers*. 42) _____

73, 82, 84, 84, 86, 87, 89, 91

43) A magazine reported that **6%** of American drivers admit to reading the newspaper while driving. If **500** drivers are selected at random, find the probability that exactly **40** will admit to reading the newspaper while driving. 43) _____

44) A random sample of magnesium concentrations (in parts per million, or ppm) in ground water from various locations follows. Estimate the mean concentration of magnesium in ppm with **90%** confidence. Assume **σ = 20**. 44) _____

44	122	34	114	5
101	68	106	100	56
42	66	36	20	18
98	101	28	89	100
125	7	31	94	21
70	38	18	60	18
98	51	30	120	68

45) The percentage rates of home ownership for **8** randomly selected states are listed below. Estimate the population variance and standard deviation for the percentage rate of home ownership with **99%** confidence. Assume the variable is normally distributed. 45) _____

64.7 76.2 68.9 75.0 61.8 69.9 71.5 67.3

46) Dr. Christina Cuttleman, a nutritionist, claims that the average number of calories in a serving of popcorn is **75** with a standard deviation of **7**. A sample of **50** servings of popcorn was found to have an average of **78** calories. Check Dr. Cuttleman's claim at $\alpha = 0.05$. 46) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

47) Determine which of the following describes *qualitative data*. 47) _____

i). the volume of a shipping container, in gallons
ii). the name of the material from which the container is made
iii). the shape of the container

A) i and iii only B) ii and iii only C) i and ii only D) i, ii, and iii

48) Which one of the following data are *discrete*? 48) _____

A) the pre-season ranking of Duke University's men's basketball team
B) the average preseason ranking of the University of Connecticut's women's basketball team over the past 10 years
C) the height of the tallest player on Duke University's men's basketball team
D) the average height of players on the University of Connecticut's women's basketball team

49) An electronics manufacturer test every **500th** cell phone to verify that it is functioning properly. Identify the kind of sample that is being used. 49) _____

A) systematic sample B) simple random sample
C) cluster sample D) stratified sample

50) A fleet of rental cars - all the same make, model, and year - has a mean fuel efficiency of **24.1** miles per gallon (mpg). A random sample of **45** cars are selected and the air filter of each is replaced with a new one. Let μ be the population mean fuel efficiency score that would occur if every car's air filter were replaced. The air filter change is deemed effective if μ > 24.1 mpg. A test is made of H_0: μ = 24.1 versus H_1: μ > 24.1. 50) _____

Consider these possible conclusions:

i). The air filter changes are effective.

ii). The air filter changes are not effective.

iii). The air filter changes might not be successful.

Which of the three conclusions is best if H_0 is rejected?

A) iii B) ii C) i

51) Which of the following does not explain a possible relationship between variables when the null hypothesis is *rejected*? 51) _____

A) direct cause-and-effect B) uncorrelated

C) negative effect D) caused by a third variable

52) If the *correlation coefficient* is **0.930**, what is the *unexplained variation*? 52) _____

A) 86.5% B) 7% C) 13.5% D) 93%

53) Two researchers run identical experiments except researcher A collects twice as many points as researcher B. For a specific value x, researcher A estimates a y value of y'_A and researcher B estimates a y value of y'_B. We would expect that researcher A's **95%** prediction interval around y'_A to be, in general, 53) _____

A) wider than researcher B's 95% prediction interval around y'_B.

B) narrower than researcher B's 95% prediction interval around y'_B.

C) wider than researcher B's 95% prediction interval around y'_B or narrower than researcher B's 95% prediction interval around y'_B, with equal probability.

D) the same as researcher B's 95% prediction interval around y'_B.

54) A group of college students believes the average grades in psychology courses are different than the average grades in biology courses. The group found the average psychology grades of a sample of 11 students was **82.4** and the average biology grades of a sample of **11** students was **81.2**. What is the null hypothesis for this study? 54) _____

A) H_0: μ = 82.4 and 81.2

B) H_0: $\mu_{psychology} = 82.4$ and H_0: $\mu_{biology} = 81.2$

C) H_0: $\mu_{psychology} = \mu_{biology}$

D) H_0: $\mu_{psychology} + \mu_{biology} = 163.6$

55) If a researcher manipulates one of the variables and tries to determine how the manipulation influences other variables, the researcher is conducting a(n) 55) _____

A) experimental study.
B) confounding study.
C) independent study.
D) observational study.

56) A paint manufacturer discovers that the mean volume of paint in a gallon-sized pail is 1 gallon with a standard deviation of **0.05** gallons. The paint volumes are approximately bell-shaped. Estimate the percent of pails with volumes between **0.95** gallons and **1.05** gallons. 56) _____

A) 68%
B) 32%
C) almost all (greater than 95%)
D) 95%

57) In a study of reaction times, the time to respond to a visual stimulus (x) and the time to respond to an auditory stimulus (y) were recorded for each of **8** subjects. Times were measured in thousandths of a second. The results are presented in the following table. 57) _____

Visual	**Auditory**
218	209
153	150
240	226
202	196
243	225
165	161
207	196
209	198

Compute the ***least squares regression line*** for predicting auditory response time (y) from visual response time (x).

A) y = 0.853345 + 20.509336x
B) y = 20.509336x
C) y = 0.853345x
D) y = 20.509336 + 0.853345x

58) Compute the **standard error** of the estimate for the data below. Round to the thousandths place. 58) _____

x	27	28	29	30	31	32
y	116.95	120.37	125.26	124.90	129.37	130.90

A) 1.510
B) 1.291
C) 1.057
D) 1.289

59) A marketing firm asked a random set of married and single men how much they were willing to spend on a vacation. 59) _____

Is there sufficient evidence at ***α = 0.05*** *to conclude that is there a difference in the two amounts*?

	Married Men	**Single Men**
Sample size	70	70
Sample mean	$880	$825
Population variance	5700	7900

A) Yes, because the test value 1.39 is inside the critical region $-1.96 < z < 1.96$.

B) No, because the test value 0.28 is inside the critical region $-1.96 < z < 1.96$.

C) Yes, because the test value 3.95 is outside the critical region $-1.96 < z < 1.96$.

D) No, because the test value 1.39 is outside the critical region $-1.96 < z < 1.96$.

60) A machine fills **12**-ounce bottles with soda. For the machine to function properly, the standard deviation of the sample must be less than or equal to **0.02** ounce. A sample of **8** bottles is selected, and the number of ounces of soda in each bottle is given. At **α = 0.05**, can you reject the claim that the machine is functioning properly? Justify your answer. (Assume that the variables are approximately normally distributed.) 60) _____

12.04 11.91 11.91 11.91
11.91 11.97 12.01 12.06

A) $\chi^2 = 72.000$, $\chi^2_{\text{critical}} = 15.507$; There is evidence to reject the claim that the machine is working properly.

B) $\chi^2 = 65.570$, $\chi^2_{\text{critical}} = 15.507$; There is not enough evidence to reject the claim that the machine is working properly.

C) $\chi^2 = 72.000$, $\chi^2_{\text{critical}} = 14.067$; There is evidence to reject the claim that the machine is working properly.

D) $\chi^2 = 65.570$, $\chi^2_{\text{critical}} = 14.067$; There is evidence to reject the claim that the machine is working properly.

Answer Key

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1) i. H_0: $\mu = 5.0$, H_1: $\mu > 5.0$

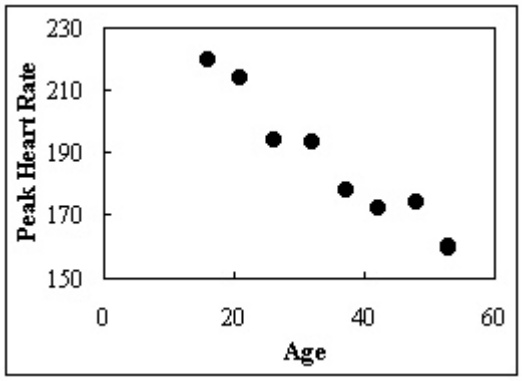
   ii. $z = 1.14$

   iii. Do not reject H_0.

   There is not enough evidence to conclude that the egg production rate of Sarah's hens exceeds that of the general population.

2) discrete

3) a.



   b. There appears to be a negative relationship between age and peak heart rate.

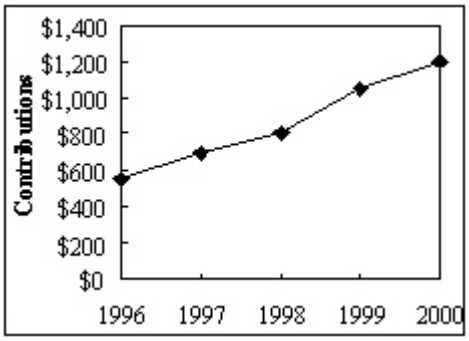
4) Type I error

5) H_0: $P_{male} = P_{female}$.

6) descriptive statistics

7) nominal

8)



9)

2, 0	1	0, 3, 6, 8
7, 6, 4, 2, 2	2	3, 3, 8
9, 5, 4, 1	3	0, 1, 6, 7
9	4	5

10) $37.70

11) 13.4

12) The theater major has a higher score than the art major.

13) 35th

14) 17

15) 0.256

16) 0.0623

17) 0.027

18) $\frac{1}{3}$

19) ${}_6C_2 \cdot {}_{11}C_3$

20) 0.2679

21) –$3.06

22)

X	2	3	4	5	6	7	8	9	10	11	12
P(X)	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

$\mu = 7$

$\sigma^2 = 5.83$

$\sigma = 2.41$

23) 0.0016

24) 0.190

25) Mean = 6.7, Variance = 2.2

26) 0.2513

27) 213

28) 0.4971

29) 77.0

30) $76{,}000 < \mu < 84{,}000$

31) 2.20

32) $148.3 < \mu < 212.4$

33) 663

34) $0.075 < p < 0.301$

35) i). H_0: $\mu = 31{,}000$, H_1: $\mu \neq 31{,}000$

ii). -2.487; 10 degrees of freedom

iii). Do not reject H_0. There is insufficient evidence to conclude that the mean annual tuition and fees is different from $31,000.

36) i). H_0: $p = 0.33$, H_1: $p \neq 0.33$

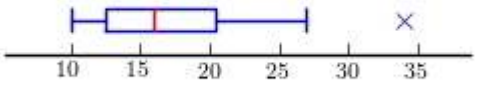
ii). -3.63

iii). Yes

37) $y' = 2.186x + 63.621$

38) H_0: $\mu_1 = \mu_2$, and H_1: $\mu_1 > \mu_2$ (claim)
Critical value: 2.500
Test value: t = 5.19
Reject the null hypothesis since the test value is greater than the critical value.
There is enough evidence to support the claim that people from River Heights givemore money to the charity than people from Lakeview.

39)



40) 0.814
41) 6.95
42) 73 is an outlier. $Q_1 = 83$, $Q_3 = 88$, IRQ = 5, lower limit = 75.5, upper limit = 95.5
43) 1.3%
44) $57.2 < \mu < 68.3$
45) $8.22 < \sigma^2 < 168.62$
$2.87 < \sigma < 12.99$
46) H_0 : $\mu = 75$ (the claim) and H_1 : $\mu \neq 75$
Critical values: ±1.96
Test value: 3.03
Reject the null hypothesis.
There is not enough evidence to support the claim that the average number of calories in a serving of popcorn is 75.
47) B
48) A
49) A
50) C
51) C
52) C
53) B
54) C
55) A
56) A
57) D
58) D
59) C
60) C