MATH 2300
Fall 2016 Final Exam

You have 150 minutes to complete this exam. Unless your exam proctor gives you alternative instructions, please observe the following:

- For the multiple choice questions, select the *best answer* and *write it clearly* in the space preceding the question number. There is *only one* correct answer for each question. If your instructor requires the multiple choice answers on another answer sheet (*e.g.* a Scantron), please place your answers there.
- For the non-multiple choice questions, provide your answers in the space provided. Show your work as appropriate.
- All problems are worth 2 points except #49, which is worth 4 points.

MULTIPLE CHOICE (40 Questions)

1. _____ An employee at the local ice cream parlor asks three customers if they like chocolate ice cream. Identify the sample and population.
A) Sample: all customers; population: the 3 selected customers
B) Sample: the 3 selected customers; population: all customers
C) Sample: the customers who like chocolate ice cream; population: all customers
D) Sample: the 3 selected customers; population: the customers who like chocolate ice cream

2. _____ True or False: A variable whose values are observed by counting something must be a discrete variable.
A) True B) False

3. _____ The following table gives the top five movies at the box office this week.

Rank	Last week	Movie title	Studio	Box office sales ($ millions)
1	N/A	Pirate Adventure	Movie Giant	35.2
2	2	Secret Agent Files	G.M.G.	19.5
3	1	Epic Super Hero Team	21st Century	14.3
4	5	Reptile Ride	Movie Giant	10.1
5	4	Must Love Cats	Dreamboat	9.9

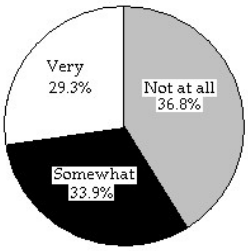
What kind of data is provided by the information in the third column?
A) Qualitative B) Quantitative

4. _____ The salaries of ten randomly selected doctors are shown below. Find the median.
$148,000 $149,000 $187,000 $212,000 $228,000
$106,000 $124,000 $875,000 $226,000 $155,000
A) $171,000 B) $241,000 C) $268,000 D) $187,000

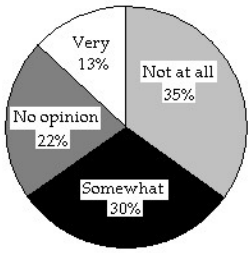
5. _____ A class of sixth grade students kept accurate records on the amount of time they spent playing video games during a one-week period. The times (in hours) are listed below. Find the <u>range</u> for the data set.
13.8 17.2 8.1 13.3 25.8 28.0 24.3 12.1 25.0 26.6
A) 8.1 hr B) 19.9 hr C) 25.8 hr D) 3.4 hr

6. _____ The data below represent the results of a poll in which the following question was asked: "To what degree are you satisfied with your current health insurance?" Select the pie chart which represents this data set.
Very: 13% Somewhat: 30% Not at all: 35% No opinion: 22%

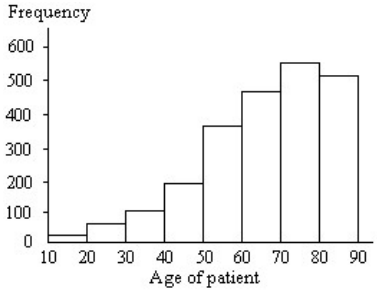
A)



B)



7. _____ The ages of a group of patients being treated at one hospital for osteoporosis are summarized in the frequency histogram below. Identify the overall shape of the distribution.



A) Uniform B) Left skewed C) Right skewed D) Bell-shaped

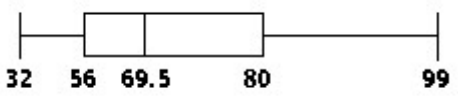
8. _____ At one college, GPAs have a roughly bell-shaped distribution with a mean of 2.9 and a standard deviation of 0.6. Use the empirical rule to give the percentage of students at the college with a GPA between 2.3 and 3.5.

A) 99.7% B) 68% C) 84.13% D) 95%

9. _____ The weights (in pounds) of 18 randomly selected adults are given below. Find the third quartile, Q_3.
114, 119, 120, 127, 132, 143, 144, 146, 151, 156, 159, 165, 168, 173, 179, 180, 187, 202

A) 174.5 lb B) 176 lb C) 173 lb D) 170.5 lb

10. _____ The following boxplot given is for the test scores of 32 students in an introduction statistics course. Classify the shape of the distribution.



A) Uniform B) Bell-shaped C) Left-skewed D) Right-skewed

11. _____ Find the z-score corresponding to the given value and use the z-score to determine whether the value is unusual (consider a score to be unusual if it is at least 3 standard deviations above or below the mean):
A weight of 240 pounds among a population having a mean weight of 168 pounds and a standard deviation of 22.5 pounds.

A) 3.2; unusual B) 72.0; unusual C) -3.2; not unusual D) 3.2; not unusual

12. _____ A class consists of 31 women and 21 men. If a student is randomly selected, what is the probability that the student is a woman?

A) 1/52 B) 21/52 C) 31/21 D) 31/52

13. _____ In a certain class of students, there are 8 boys from Wilmette, 5 girls from Kenilworth, 10 girls from Wilmette, 4 boys from Glencoe, 3 boys from Kenilworth, and 8 girls from Glencoe. If the teacher calls upon a student to answer a question, what is the probability the student will be from Kenilworth?

A) 0.132 B) 0.211 C) 0.32 D) 0.27

14. _____ When a quarter is tossed four times, 16 outcomes are possible:
HHHH, HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, HTTT,
THHH, THHT, THTH, THTT, TTHH, TTHT, TTTH, TTTT
Here, for example, HTTH represents the outcome that the first toss is heads, the next two tosses are tails, and the fourth toss is heads. The events A and B are defined as follows:

A = event the first two tosses are heads, B = event the first and last tosses are the same

Are the events mutually exclusive?
A) Yes B) No

15. _____ The probability that Luis will pass a statistics test is 0.55. Find the probability that he will fail the test.
A) 0.28 B) 1.82 C) 0.45 D) 1.22

16. _____ The random variable X is the number that shows up when a loaded die is rolled. Its probability distribution is given in the table below. Find the mean of the random variable.

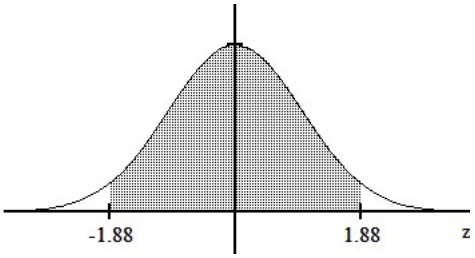
x	1	2	3	4	5	6
P(X=x)	0.15	0.13	0.15	0.12	0.16	0.29

A) 3.75 B) 3.50 C) 3.88 D) 0.17

17. _____ Determine the binomial probability given the number of trials and the success probability for Bernoulli trials. Let X denote the total number of successes: n = 5, p = 1/4, Find P(X = 3)
A) 0.016 B) 0.088 C) 0.114 D) 0.132

18. _____ Dave drives to work each morning at about the same time. His commute time is normally distributed with a mean of 45 minutes and a standard deviation of 5 minutes. The percentage of time that his commute time is less than 49 minutes is equal to the area under the standard normal curve that lies to the __ of __.
A) right; 0.8 B) left; -0.8 C) right; 1 D) left; 0.8

19. _____ Use a table of areas to obtain the shaded area under the standard normal curve.



A) 0.0301 B) 0.0602 C) 0.9398 D) 0.9699

20. _____ Find the z-score for which the area under the standard normal curve to its left is 0.04.
A) -1.63 B) -1.48 C) -1.75 D) -1.89

21. _____ The monthly incomes of trainees at a local mill are normally distributed with a mean of $1,100 and a standard deviation of $150. What percentage of trainees earn less than $900 a month?
A) 9.18% B) 90.82% C) 35.31% D) 40.82%

22. _____ The amount of Jen's monthly phone bill is normally distributed with a mean of $70 and a standard deviation of $11. Find the first quartile, Q_1.
A) $64.50 B) $72.75 C) $62.63 D) $77.37

23. _____ What generally happens to the sampling error of the sample mean as the sample size is decreased?
A) It gets more predictable B) It gets smaller
C) It gets larger D) It gets less predictable

24. _____ The mean and the standard deviation of the sample population are, respectively, 125.4 and 24.1. If a sample of size n=49 is taken, find the mean and standard deviation of the sample mean $\bar{x}$.
A) $\mu_{\bar{x}} = 201.5; \sigma_{\bar{x}} = 1.3$ B) $\mu_{\bar{x}} = 24.1; \sigma_{\bar{x}} = 3.4$
C) $\mu_{\bar{x}} = 3.4; \sigma_{\bar{x}} = 125.4$ D) $\mu_{\bar{x}} = 125.4; \sigma_{\bar{x}} = 3.4$

25. _____ The mean height for a population is 65 inches and the standard deviation is 3 inches. Let A and B denote the events described below:

A = event the height of a randomly selected person is within 3 inches of the population mean
B = event the mean height in a random sample of 16 people is within 3 inches of the population mean

True or False: The probability of event A is greater than the probability of event B?
A) True B) False

26. _____ For the population of one town, the number of siblings, x, is a random variable whose relative frequency histogram is highly right-skewed. The mean number of siblings is 1.3 and the standard deviation is 1.5. Let $\bar{x}$ denote the mean number of siblings for a random sample of size 35. Determine the sampling distribution of $\bar{x}$.
A) Approximately normal, mean = 1.3, standard deviation = 1.5
B) Normal, mean = 1.3, standard deviation = 0.25
C) Normal, mean = 1.3, standard deviation = 1.5
D) Approximately normal, mean = 1.3, standard deviation = 0.25

27. _____ The heights of adult women in the U.S. are normally distributed. Let $\bar{x}$ denote the mean height for a random sample of 4 women. Which of the following statements is true concerning the sampling distribution of $\bar{x}$?
A) $\bar{x}$ has a uniform distribution B) $\bar{x}$ is normally distributed
C) $\bar{x}$ is approximately normally distributed D) None of the above statements are true

28. _____ Based on a sample of size 42, a 95% confidence interval for the mean score of all students, μ, on an aptitude test is from 57.1 to 64.9. Find the margin of error.
A) 7.8 B) 1.18
C) 3.9 D) There is not enough information

29. _____ A psychologist has designed a test to measure stress levels in adults. She has determined that nationwide the mean score on her test is 27. A hypothesis test is to be conducted to determine whether the mean score for trial lawyers exceeds the national mean score. The hypotheses are H_0: μ = 27 and H_a: μ > 27, where μ is the mean score for all trial lawyers. Suppose that the results of the sampling lead to nonrejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision if, in fact, the mean score for all trial lawyers is equal to 27.
A) Correct decision B) Type II error C) Type I error

30. _____ Determine the critical value(s) for a right-tailed one-mean z-test with α=0.09.
A) ±1.96 B) ±1.34 C) 1.34 D) 1.96

31. _____ A hypothesis test is run at a significance level of $\alpha = 0.05$ and a resulting p-value of 0.058. What is the correct decision?
A) Reject the null hypothesis B) Do not reject the null hypothesis

32. _____ A left-tailed one-mean z-test is conducted. The resulting z-score is z = -0.58. Determine the p-value.
A) 0.4380 B) 0.2810 C) 0.5620 D) 0.7190

33. _____ A two-tailed one-mean t-test is conducted. The sample size is n = 9, and the resulting t-score is t = 3.479. Use the table of t-values to estimate the p-value for this test.
A) $0.02 < P < 0.05$ B) $P < 0.005$ C) $P > 0.05$ D) $P < 0.01$

34. _____ Consider the case where a variable is measured for two separate populations. The mean and standard deviation for the variable for the first population is 47 and 13, respectively. The mean and standard deviation for the second population is 13 and 15, respectively. For independent samples from the two population of sizes 8 and 12, respectively, find the mean of $\bar{x}_1 - \bar{x}_2$.
A) 34 B) 4.8 C) 60 D) -34

35. _____ Summary statistics are given for independent simple random samples from two populations. Use the nonpooled t-interval procedure to obtain the 95% confidence interval for $\mu_1 - \mu_2$.
$\bar{x}_1 = 72.4, s_1 = 10.9, n_1 = 16, \bar{x}_2 = 69.9, s_2 = 8.2, n_2 = 12$
A) -3.92 to 8.92 B) -5.23 to 10.23 C) -4.94 to 9.94 D) -6.47 to 11.47

36. _____ A nutritionist wants to investigate whether her new diet will be effective in helping women aged 30-40 to lose weight. She will use a paired sample to determine whether the mean weight of women before going on this diet is greater than the mean weight of women after being on this diet for two months. Classify the proposed hypothesis test as two-tailed, left-tailed, or right-tailed.
A) two-tailed B) left-tailed C) right-tailed

37. _____ In a random sample of 192 college students, 128 had part-time jobs. Find the margin of error for the 95% confidence interval used to estimate the population proportion.
A) 0.117 B) 0.06 C) 0.0667 D) 0.00227

38. _____ The number of successes is x = 122 out of a sample size of n = 194. Use the one-proportion z-interval procedure to find the 95% confidence interval for the population proportion.
A) 0.574 to 0.684 B) 0.575 to 0.683 C) 0.543 to 0.715 D) 0.561 to 0.697

39. _____ A drug company claims that over 80% of all physicians recommend their drug. A total of n = 1200 physicians were asked if they recommend the drug to their patients and 36% said yes. The null hypothesis is H_0: p = 0.8. Compute the value of the test statistic $z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$.
A) -76.21 B) -34.294 C) -38.105 D) -49.536

40. _____ A two-proportions z-test is to be performed. The null hypothesis is H_0: $p_1 = p_2$. For the given sample data, compute the value of the test statistic.
$x_1 = 68, n_1 = 144, x_2 = 60, n_2 = 139$
A) z = 0.889 B) z = 0.684 C) z = 0.479 D) z = 0.460

SHORT ANSWER (9 Questions)

41. The member of a board of directors have the following roles: president (P), vice president (V), secretary (S), treasurer (T), and fundraiser (F). Consider these board members to be the population of interest. The possible samples (without replacement) of size two that can be obtained from these five board members are as follows: PV, PS, PT, PF, VS, VT, VF, ST, SF, TF.

If a simple random sampling method is used to obtain a sample of two of the board members, what are the chances of selecting the secretary and the treasurer?

Probability = ☐ Show work:

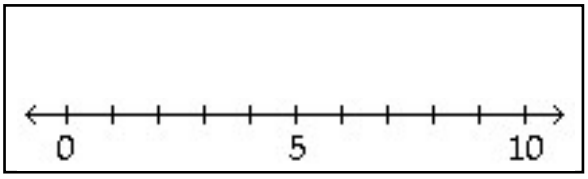
42. The blood types for 40 people who agreed to participate in a medical study were as follows:
O, A, A, O, O, AB, O, B, A, O,
A, O, A, B, O, O, O, AB, A, A,
A, B, O, A, A, O, O, B, O, O,
O, A, O, O, A, B, O, O, A, AB

Construct a frequency distribution for the data.

Blood type	Frequency
O	
A	
B	
AB	

43. Attendance records at a school show the number of days each student was absent during the year. The days absent for each student in a class were as follows:
9, 3, 4, 2, 8, 6, 3, 4, 0, 6, 7, 3, 4, 2, 2

Construct a dotplot for the given data.



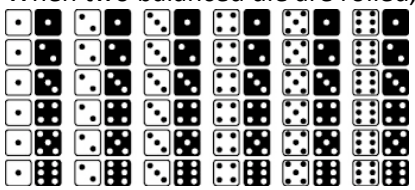
44. The manager of a small dry cleaner employs six people. As part of their personnel file, she asked each one to record, to the nearest one-tenth of a mile, the distance they travel one way from home to work. The six distances are recorded are: 17.1, 17.4, 41.5, 27.4, 10.8, 23.2. Find the sample mean.

$\bar{x} =$ ☐ Show work:

45. For the same data above (problem 44), find the sample standard deviation.

$s =$ ☐ Show work:

46. When two balanced die are rolled, 36 equally likely outcomes are possible as shown below:



Let X denote the smaller of the two numbers (if both numbers come up the same number, then X equals that common value). Find the probability that X = 3.

P(X = 3) = [ ] Show work:

47. For a t-curve with df = 24, find $t_{0.005}$.

$t_{0.005}$ = [ ]

48. A principle of a middle school randomly selected six students to take an aptitude test. Their scores were: 79.5, 88.5, 83.2, 80.2, 71.9, 75.6 (mean = 79.82, sd = 5.79)
Assuming the population is normally distributed, determine a 90% confidence interval for the mean score for all students.

CI = [ ] Show work:

49. A car manufacturer, Swanson, claims that the mean lifetime of its car engines is greater than 220,000 miles, which is the mean lifetime of a competitor. The mean lifetime for a random sample of 23 of the Swanson engines was $\bar{x}$ = 226,450 miles with a standard deviation s = 11,500 miles. Test the Swanson's claim using a significance level of $\alpha = 0.01$. State the appropriate hypotheses, compute the value of the test statistic, find the p-value, and state your conclusion. Assume the population is normal. (4 points)

Hypotheses: [ ] Conclusion: [ ]

Test statistic: [ ]

P-value: [ ]

Show work: