**MATH 2300**
Spring 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. _____ A clinic gives a drug to a group of ten patients and a placebo to another group of ten patients to find out if the drug has an effect on the patients' illness. Identify this study as an observational study or designed experiment.
A) Designed experiment   B) Observational study

2. _____ The members of a board of directors have the following roles: President (P), Vice President (V), Secretary (S), Treasurer (T), and Fundraiser (F). 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 together?
A) 1/5   B) 1/10   C) 2/5   D) 1/20

3. _____ An athlete runs 100 meters in 10.7 seconds. Classify the data (the time) as either discrete or continuous.
A) Discrete   B) Continuous

4. _____ The data in the following table represent heights of students at a high school. Find the value of the missing entry.

Height (cm)	Relative Frequency
[142, 152)	0.03
[152, 162)	0.22
[162, 172)	0.25
[172, 182)	0.26
[182, 192)	
[192, 202)	0.04

A) 0.16   B) 0.20   C) 25%   D) Cannot be determined

5. _____ To get the best deal on a microwave oven, Jeremy called six stores and asked the cost of a specific model. The prices he was quoted are listed below. Find the range of the data set.
$117, $511, $192, $616, $356, $313
A) $117   B) $511   C) $499   D) $121

6. _____   A nurse measured the blood pressure of each person who visited her clinic. The following relative-frequency histogram is for the systolic blood pressure readings for 200 people between the ages 25 and 40. Approximately how many people had a systolic blood pressure reading of 140 or higher?

Relative Frequency

Systolic Blood Pressure (mm Hg)
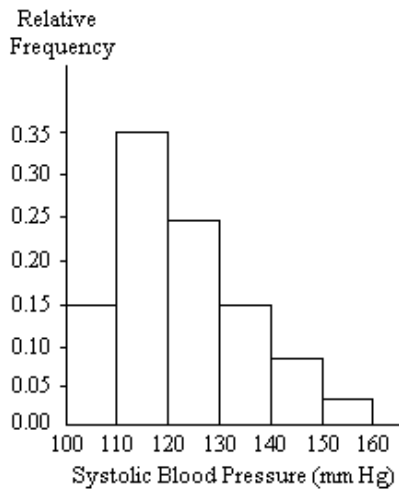
A) 35   B) 8   C) 22   D) 11

7. _____   A frequency histogram is given below for the weights of a sample of college students. Which of the following best describes the overall shape of the distribution?

Frequency

Weight (pounds)
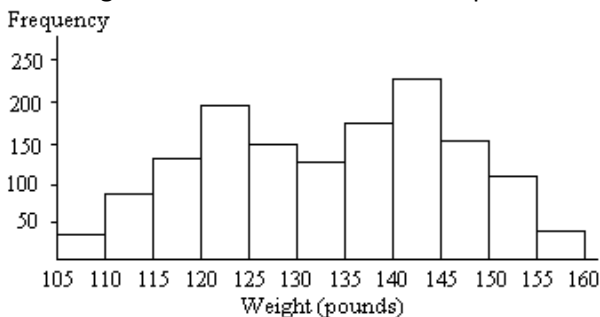
A) Bimodal   B) Multimodal   C) Bell-shaped   D) Uniform

8. _____   For the same frequency histogram given above in #7, which of the following best describes the skew of the distribution?
A) Left skewed   B) Symmetric   C) Right skewed

9. _____   Bill kept track of the number of hours he spent exercising each week. The results for four months are shown below. Find the mean number of hours Bill spent exercising per week.

        6.6, 7.3, 7.5, 7.5, 7.9, 8.1, 8.1, 8.1, 8.3
        8.3, 8.6, 8.6, 8.6, 8.6, 8.7, 8.7, 8.7, 8.7

A) 8.39 hr   B) 8.64 hr   C) 7.73 hr   D) 8.16 hr

10. _____ For the same data given above in #9, find the median number of hours Bill spent exercising per week.
A) 8.1 hr   B) 8.2 hr   C) 8.3 hr   D) 8.45 hr

11. _____ Christine is currently taking college astronomy. The instructor often gives quizzes. On the past seven quizzes, Christine got the following scores. Find the sample standard deviation.
        52, 15, 48, 27, 12, 42, 68
A) 9956.6   B) 20.6   C) 48   D) 12,494

12. _____ Here are 3 boxplots of weekly gas prices at a local service station (price in $ per gallon). Compare the distributions of prices over the three years, and select the best description.
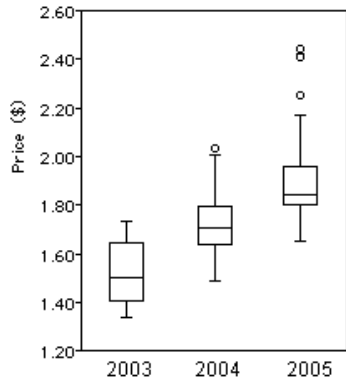

A) Gas prices have been increasing on average over the 3-year period, and the variation overall has been increasing as well. The distribution has been right-skewed.

B) Gas prices have been decreasing on average over the 3-year period, but the variation in the middle 50% has been increasing while the variation for the entire distribution has decreased. The distribution has been right-skewed.

C) Gas prices have been increasing on average over the 3-year period, but the variation in the middle 50% has decreased while the variation for the entire distribution has increasing. The distribution has been left-skewed.

13. _____ The mean of a data set is 126.02 and its standard deviation is 89.34. Find the z-score for a value of 386.67.

A) 2.92   B) 3.22   C) 3.21   D) 2.63

14. _____ Determine which scatterplot shows the strongest linear correlation.
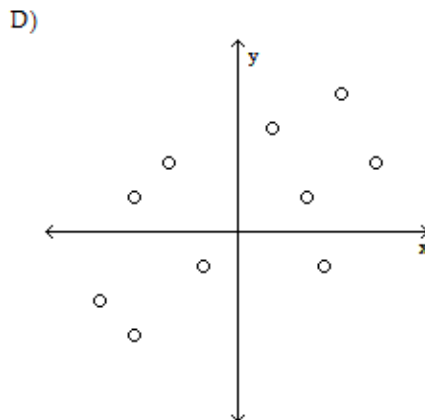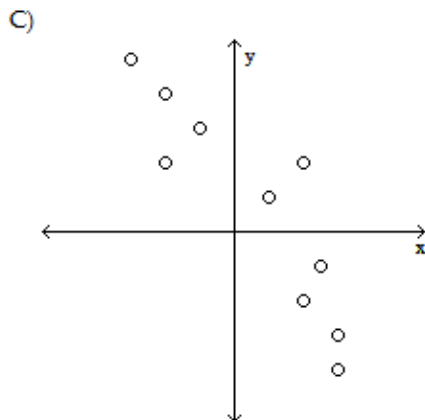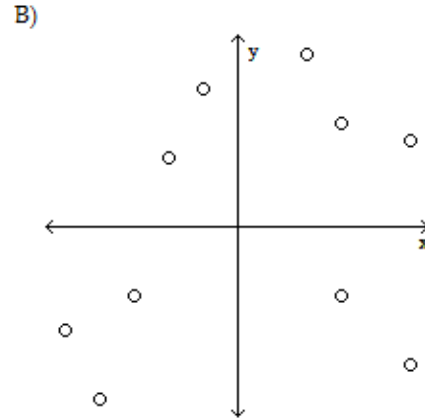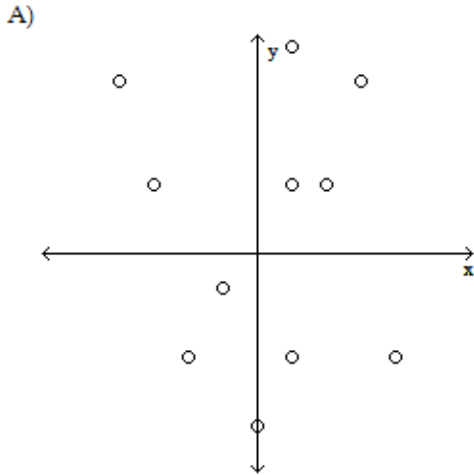
15. _____   A frequency distribution on employment information from Alpha Corporation follows. Find the probability that a randomly chosen employee has been with the company 10 years or less.

Years Employed	No. of Employees
1-5	5
6-10	30
11-15	25
16-20	10
21-25	5
26-30	3

A) 0.294   B) 0.735   C) 0.551   D) 0.449

16. _____   For a randomly selected student in a particular high school, let Y denote the number of living grandparents of the student. What are the possible values of the random variable Y?

A) 1, 2, 3, 4   B) 0, 1, 2, 3, 4   C) 4   D) 0, 1, 2

17. _____   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.

x	1	2	3	4	5	6
P(X=x)	0.16	0.11	0.13	0.13	0.10	0.37

A) 3.50   B) 0.17   C) 4.01   D) 3.88

18. _____   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 = 0.6, P(X=2).

A) 0.360   B) 0.300   C) 0.230   D) 0.346

19. _____   Dave drives to work each morning at about the same time. His commute time is normally distributed with a mean of 51 minutes and a standard deviation of 5 min. The percentage of time that his commute time exceeds 58 minutes is equal to the area under the standard normal curve that lies to the _____ of _____.

A) left, 1.4   B) right, 1.4   C) right, 7   D) left, 1

20. _____   Use a table of areas to find the specified area under the standard normal curve: the area that lies between -0.73 and 2.27.

A) 0.2211   B) 0.7557   C) 0.4884   D) 1.54

21. _____   Find the z-score having area 0.86 to its right under the standard normal curve; that is, find $z_{0.86}$.

A) 1.08   B) -1.08   C) 0.8051   D) 0.5557

22. _____   The diameters of bolts produced by a certain machine are normally distributed with a mean of 0.30 inches and a standard deviation of 0.01 inches. What percentage of bolts will have a diameter greater than 0.32 inches?

A) 97.72%   B) 47.72%   C) 37.45%   D) 2.28%

23. _____   What generally happens to the sampling distribution of the sample mean as the sample size is decreased?
A) It becomes less tightly concentrated around the population mean.
B) It is unaffected.
C) It becomes more tightly concentrated around the population mean.
D) None of the above.

24. _____ The National Weather Service keeps records of snowfall in mountain ranges. Records indicate that in a certain range, the annual snowfall has a mean of 106 inches and a standard deviation of 10 inches. Suppose the snowfalls are sample during randomly picked years. For samples of size 25, determine the mean and standard deviation of $\bar{x}$.
A) $\mu_{\bar{x}} = 2$; $\sigma_{\bar{x}} = 106$ B) $\mu_{\bar{x}} = 10$; $\sigma_{\bar{x}} = 106$ C) $\mu_{\bar{x}} = 106$; $\sigma_{\bar{x}} = 2$ D) $\mu_{\bar{x}} = 106$; $\sigma_{\bar{x}} = 10$

25. _____ The mean height for a population is 65 inches. Let $\bar{x}$ denote the mean height for a sample of people picked randomly from the population. True or False, the standard deviation of $\bar{x}$ for samples of size 30 is smaller than the standard deviation, σ, of the population?
A) True   B) False

26. _____ Let x represent the number that shows up when a balanced six-sided die is rolled. Then x is a random variable with a mean of 3.5 and a standard deviation of 1.71. Let $\bar{x}$ denote the mean of the numbers obtained when the die is rolled 40 times. Determine the sampling distribution of $\bar{x}$.
A) Approximately normal, mean = 3.5, standard deviation = 1.71.
B) Approximately normal, mean = 3.5, standard deviation = 0.27.
C) Normal, mean = 3.5, standard deviation = 0.27.
D) Normal, mean = 3.5, standard deviation = 0.04

27. _____ The amount of coffee that a filling machine puts into an 8-ounce jar is normally distributed with a mean of 8.2 ounces and a standard deviation of 0.18 ounce. What is the probability that the sampling error made in estimating the mean amount of coffee for all 8-ounce jars by the mean of a random sample of 100 jars will be at most 0.02 ounce?
A) 0.7330   B) 0.8665   C) 0.0938   D) 0.0876

28. _____ In stating a confidence-interval estimate of a population mean, the level of confidence increases as the size of the interval _____.
A) increases   B) decreases

29. _____ The monthly earnings of a group of business students are normally distributed with a standard deviation of approximately 545 dollars. A researcher wants to estimate the mean monthly earnings of all business students. Find the sample size needed to have a confidence level of 95% and a margin of error of 128 dollars.
A) 5   B) 2   C) 61   D) 70

30. _____ For a t-curve with df=24, find $t_{0.005}$.
A) 1.711   B) 2.807   C) 2.797   D) 2.492

31. _____ A sociologist develops a test to measure attitudes about public transportation, and 27 randomly selected subjects are given the test. Their mean score is 76.2 and their standard deviation is 21.4. Construct the 95% confidence interval for the mean score of all such subjects. Assume that the population is normally distributed.
A) 69.2 to 83.2   B) 67.7 to 84.7   C) 64.2 to 88.2   D) 74.6 to 77.8

32. _____ Determine the critical value(s) for a one-mean z-test if it is a left-tailed test with $\alpha = 0.04$.
A) -1.75   B) -2.05   C) 2.05   D) 1.75

33. _____ The significance level of a hypothesis test is $\alpha = 0.01$, and the p-value is calculated to be p-value = 0.002. Decide whether the null hypothesis should be rejected.
A) Reject the null hypothesis   B) Do not reject the null hypothesis

34. _____ The mean credit card debt among household in one state is $8400. A hypothesis test is to be performed to decide whether the mean credit card debt for household in the formerly affluent town of Rich-No-More differs from the mean credit card debt for the state. The hypotheses are

H_0: μ = $8400 H_a: μ ≠ $8400

Where μ is the mean credit card debt for all household in Rich-No-More. Explain the meaning of a correct decision.

A) A correct decision would occur if, in fact, μ = $8400, and the results of the sampling do not lead to rejection of that fact; or if, in fact, μ ≠ $8400 and the results of the sampling lead to that conclusion.

B) A correct decision would occur if, in fact, μ = $8400, and the results of the sampling do not lead to rejection of that fact; or if, in fact, μ ≠ $8400 and the results of the sampling do not lead to rejection of the null hypothesis that μ = $8400.

C) A correct decision would occur if, in fact, μ = $8400, but the results of the sampling lead to the conclusion that μ ≠ $8400; or if, in fact, μ ≠ $8400 and the results of the sampling lead to that conclusion.

D) A correct decision would occur if, in fact, μ ≠ $8400, and the results of the sampling do not lead to rejection of the null hypothesis that μ = $8400.

35. _____ Use a table of t-values to estimate the p-value for the specified one-mean t-test: left-tailed test, n = 15, t = -2.671.

A) 0.005 < P < 0.01   B) 0.01 < P < 0.025   C) P < 0.005   D) P > 0.005

36. _____ A researcher wants to perform a hypothesis test to determine whether the mean credit card debt for credit card holders aged 18-35 is greater than the mean credit card debt for credit card holders aged over 35. Determine the appropriate null and alternative hypothesis for this proposed hypothesis test. Let $\bar{x}_1$ and $\bar{x}_2$ denote the sample mean credit card debt for credit card holders aged 18-35 and over 35, respectively. Let μ_1 and μ_2 denote the population mean credit card debt for credit card holders aged 18-35 and over 35, respectively.

A) H_0: $\bar{x}_1 = \bar{x}_2$ and H_a: $\bar{x}_1 > \bar{x}_2$ B) H_0: $\mu_1 > \mu_2$ and H_a: $\mu_1 < \mu_2$

C) H_0: $\mu_1 = \mu_2$ and H_a: $\mu_1 < \mu_2$ D) H_0: $\mu_1 = \mu_2$ and H_a: $\mu_1 > \mu_2$

37. _____ Summary statistics are given for independent random samples from two population. Use the nonpooled t-interval procedure to obtain a 95% confidence interval for $\mu_1 - \mu_2$.

$\bar{x}_1$ = 73.9, s_1 = 10.9, n_1 = 16, $\bar{x}_2$ = 68.5, s_2 = 8.2, n_2 = 12

A) -2.35 to 13.15   B) -2.33 to 13.13   C) -2.04 to 12.84   D) -2.24 to 13.04

38. _____ Suppose x is a variable on each of two population whose members can be paired and that a paired difference is the difference between the values of the variable x on the members of a pair. True or false: The mean of the paired differences equals the difference between the two population means?

A) True   B) False

39. _____ The number of successes and the sample size are given for a simple random sample from a population. Decide if using the one-proportion z-interval procedure is appropriate: x = 86, n = 90.

A) Not appropriate   B) Appropriate

40. _____ The numbers of successes and the sample sizes are given for independent simple random samples from two population. Use the two-proportions z-test to conduct the two-tailed hypothesis test of H_0: $p_1 = p_2$ using the critical-value approach.

x_1 = 16, n_1 = 20, x_2 = 42, n_2 = 60, α = 0.05

A) z = 0.87, critical values = ±1.96, reject H_0 B) z = 0.87, critical values = ±1.96, do not reject H_0

C) z = 0.78, critical values = ±1.96, reject H_0 D) Two-proportions z-test is not appropriate

SHORT ANSWER (9 Questions)

41. The following table gives the distribution of land (in acres) for a county containing 86,000 acres. Construct a pie chart representing the data. (Be sure it is well-labeled.)

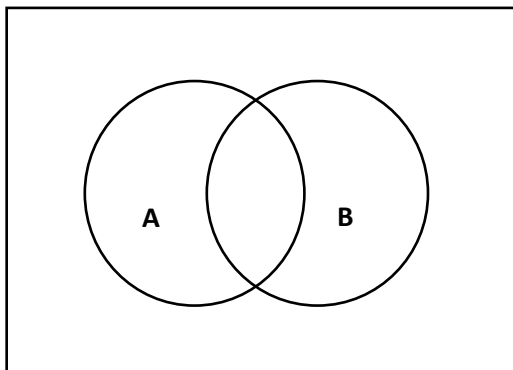| Land Use	Acres	Relative Frequency
Forest	12,900	0.15
Farm	8,600	0.10
Urban	64,500	0.75
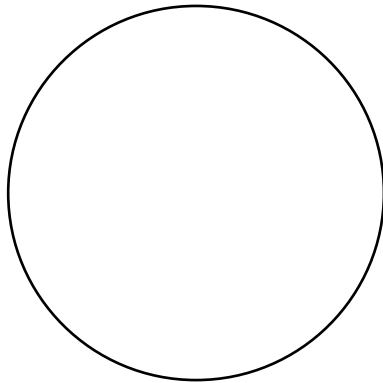
42. The test scores of 20 students are listed below. Find the third quartile, Q_3.

36, 45, 49, 53, 55, 56, 59, 61, 62, 65
69, 70, 74, 78, 84, 87, 89, 93, 98, 100

$Q_3 =$ [ ]   Show work:

43. From a finite sample, events A and B are non-mutually exclusive. In the Venn diagram below, shade the event "A and B".

A   B

44. In one city, 51.1% of adults are female, 10.2% of adults are left-handed, and 5.1% are left-handed females. For an adult selected at random from the city, let F = event the person is female, and L = event the person is left-handed. Find P(F or L). Round your answer to three decimal places.

P(F or L) = [ ]   Show work:

45.   The annual precipitation for one city is normally distributed with a mean of 340 inches and a standard
       deviation of 3.8 inches. In 95.44% of the years, the precipitation in this city is between

       | | and | | inches (assuming equal tail probabilities).

       Show work:

46.   Suppose a confidence interval is 9.65 < μ < 11.35. Find the sample mean $\bar{x}$ and the margin of error E.
       $\bar{x}$ = | | Show work:

       E = | |

47.   The value obtained for the test statistic in a one-mean two-tailed z-test is z = 1.31. Determine the P-value.
       P = | | Show work:

48.   A hypothesis test is to be performed for a population proportion. Out of 125 observations, 54% were

       successes. If H_0: p = 0.48 is to be tested, calculate the value of the test statistic $z = \dfrac{\hat{p}-p_0}{\sqrt{p_0(1-p_0)/n}}$.

       z = | | Show work:

49.   DuraBurn claims that the mean lifetime of its SuperGlow light bulbs is 904 hours. A researcher wants to
(4 Points)   perform a hypothesis test to determine whether the mean lifetime is actually less than this. A random
       sample of n = 10 DuraBurn SuperGlow bulbs exhibited an average lifetime $\bar{x} = 810$ with a standard
       deviation s = 158 hours. State the appropriate hypotheses, compute the value of the test statistic, find the
       p-value, and state your conclusion using a significance level of 0.05. Assume the population is normal.

       Hypotheses: | | Conclusion: | |

       Test statistic: | |

       P-value: | |

       Show work: