MATH 2300
Fall 2015 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.

MULTIPLE CHOICE (40 Questions)

1. _____ At one hospital in 1992, 674 women were diagnosed with breast cancer. Five years later, 88% of the Caucasian women and 83% of the African American women were still alive. Identify this study as an observational study or a designed experiment.
A) Designed experiment B) Observational study

2. _____ The finalists in an essay competition are Lisa (L), Melina (M), Ben (B), Danny (D), Eric (E), and Joan (J). Consider these finalists to be the population of interest. The possible samples (without replacement) of size two that can be obtained from this population of six finalists are as follows:
LM, LB, LD, LE, LJ, MB, MD, ME, MJ, BD, BE, BJ, DE, DJ, EJ
If a simple random sampling method is used to obtain a sample of two of the finalists, what are the chances of selecting Lisa and Danny?
A) 1/6 B) 1/3 C) 2/15 D) 1/15

3. _____ A large record company reported the following sales figures for various music media last year.

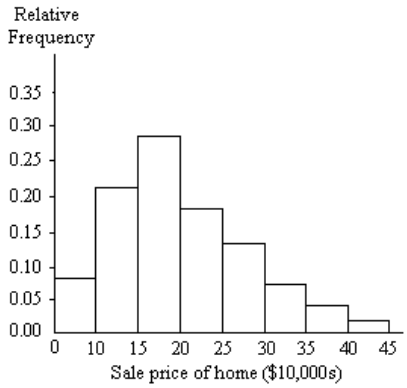
Media	**Sales ($ Millions)**
Digital Download	1477.3
CD	256.7
Internet Streaming	137.5
Internet Video	532.0
Other (Vinyl, etc.)	92.1

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

4. _____ The number of cars passing a busy intersection between 4:30 PM and 6:30 PM on a Friday is 374. Classify the data as either discrete or continuous.
A) Discrete B) Continuous

5. _____ The grocery expenses for six families were $67.43, $69.68, $50.54, $58.42, $43.00, and $65.59. Compute the mean grocery bill. Round your answer to the nearest cent.
A) $79.93 B) $59.11 C) $88.67 D) $58.93

6. _____ A relative frequency histogram for the sale prices of homes sold in one city during 2006 is shown below. State whether the distribution is (roughly) symmetric, right skewed, or left skewed.



A) Left skewed B) Right skewed C) Symmetric

7. _____ The weights (in ounces) of 21 cookies are given below. Find the median.

0.47 0.56 0.61 0.61 0.68 0.68 0.68
0.68 0.70 0.73 0.99 1.07 1.07 1.19
1.19 1.28 1.28 1.41 1.53 1.62 1.72

A) 1.07oz B) 0.84oz C) 0.70oz D) 0.99oz

8. _____ Rich is currently taking Chemistry 101. On the five laboratory assignments for the quarter, he got the following scores: 21 35 20 48 58.
Find the range.

A) 58 B) 20 C) 14 D) 38

9. _____ To get the best deal on a new pair of headphones, Tom visited the websites of eight retailers that carry them and noted the cost of a specific model. The prices he found are:

$410 $377 $395 $114 $293 $169 $140 $224

Find the sample standard deviation (rounded to 1 decimal place).

A) $663,436.00 B) $119.90 C) $562,860.50 D) $258.50

10. _____ Which is better, a score of 92 on a test with a mean of 71 and a standard deviation of 15, or a score of 688 on a test with a mean of 493 and a standard deviation of 150? (Assume that the distributions being compared have approximately the same shape.)

A) A score of 92 B) A score of 688 C) Both scores have the same relative position

11. _____ 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

Where the toss's outcomes are listed in the order they occur. The events A and B are defined as:

A = event exactly two tails are tossed
B = event the first and last tosses are the same.

List the outcomes that comprise the event (A & B)

A) HHTT, HTHT, HTTH, THHT, THTH, TTHH
B) HHHH, HHTH, HHTT, HTHH, HTHT, HTTH, THHT, THTH, THTT, TTHH, TTHT, TTTT
C) HTTH, THHT
D) HHHH, HHTH, HTHH, HTTH, THHT, THTT, TTHT, TTTT

12. _____ The distribution of B.A. degrees conferred by a local college is listed below, by major:

Major	Frequency
English	2073
Mathematics	2164
Chemistry	318
Physics	856
Liberal Arts	1358
Business	1676
Engineering	868
	9313

What is the probability that a randomly selected degree is in English or Mathematics (assuming no dual majors)?

A) 0.517 B) 0.010 C) 0.424 D) 0.455

13. _____ For the same distribution of B.A. degrees given in the previous problem, what is the probability that a randomly selected degree is not in Mathematics?

A) 0.303 B) 0.768 C) 0.232 D) 0.682

14. _____ 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)	0.16	0.11	0.13	0.13	0.10	0.37

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

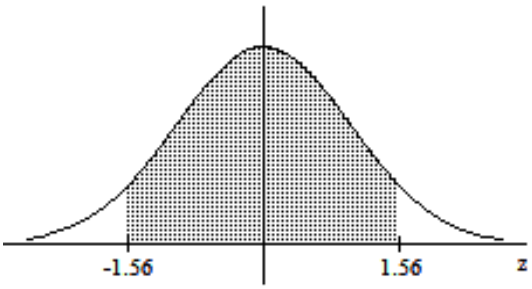
15. _____ The amount of time that customers wait in line during peak hours at one bank is normally distributed with a mean of 13 minutes and a standard deviation of 3 minutes. The percentage of the time that the waiting time lies between 11 and 13 minutes is equal to the area under the standard normal curve between ____ and ____.

A) 0.62, 0.77 B) -0.67, 0.67 C) -0.67, 0 D) -2, 0

16. _____ For a standard normal curve, find the area that lies to the right of -1.82.

A) 0.9656 B) 0.0344 C) -0.0344 D) 0.4656

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



A) 0.8812 B) 0.0594 C) 0.1188 D) 0.9406

18. _____ A bank's loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a standard deviation of 50. If an applicant is randomly selected, find the probability of a rating that is between 200 and 275.

A) 0.9332 B) 0.4332 C) 0.5 D) 0.0668

19. _____ The weights of certain machine components are normally distributed with a mean of 8.98g and a standard deviation of 0.05g. Find the 97^{th} percentile.
A) 9.12g B) 9.00g C) 9.07g D) 8.99g

20. _____ The systolic blood pressure of 18-year-old women is normally distributed with a mean of 120 mmHg and a standard deviation of 12 mmHg. What percentage of 18-year-old women have a systolic blood pressure between 96 mmHg and 144 mmHg? (Hint: Use the empirical rule.)
A) 99.74% B) 68.26% C) 99.99% D) 95.44%

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

22. _____ 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 of the population σ.
A) True B) False

23. _____ Let x represent the number that shows up when a balanced 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) Normal, mean = 3.5, standard deviation = 0.27
B) Normal, mean = 3.5, standard deviation = 0.04
C) Approximately normal, mean = 3.5, standard deviation = 0.27
D) Approximately normal, mean = 3.5, standard deviation = 1.71

24. _____ Scores on a chemistry final exam are normally distributed with a mean of 280 and a standard deviation of 50. Determine the percentage of samples of size 4 that will have mean scores within 35 points of the population mean score of 280.
A) 91.92% B) 83.84% C) 99.48% D) 51.60%

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

26. _____ A confidence interval for a population mean μ has length 86. Find the margin of error.
A) 43 B) 1849 C) 86 D) 21.5

27. _____ For a t-curve with df=18, find the t-value having area 0.05 to its right.
A) 1.734 B) 2.878 C) 1.740 D) 2.101

28. _____ 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 a 95% confidence interval for the mean score of all such subjects. Assume a normal population.
A) 64.2 to 88.2 B) 67.7 to 84.7 C) 74.6 to 77.8 D) 69.2 to 83.2

29. _____ A manufacturer claims that the mean amount of juice in its 16 ounce bottles is 16.1 ounces. A consumer advocacy group wants to perform a hypothesis test to determine whether the mean amount is actually less than this. Classify the hypothesis test appropriately.
A) Two-tailed B) Left-tailed C) Right-tailed

30. _____ A psychologist has designed a test to measure stress levels in adults. She has determined that nationwide the mean score on her test is 20. A hypothesis test is to be conducted to determine whether the mean score for trial lawyers exceeds the national mean score. Determine the null and alternative hypotheses.
A) H_0: $\mu > 20$ H_a: $\mu \leq 20$
B) H_0: $\mu < 20$ H_a: $\mu > 20$
C) H_0: $\mu = 20$ H_a: $\mu > 20$
D) H_0: $\mu = 20$ H_a: $\mu \geq 20$

31. _____ Determine the critical values for a one-mean z-test that is a two-tailed test with $\alpha = 0.1$.
A) ±1.4805 B) ±2.052 C) ±1.645 D) ±2.33

32. _____ A one-sample z-test for a population mean is performed. Suppose that the P-value for the test is 0.04. For what significance levels (values of α) can the null hypothesis be rejected?
A) For all values of $\alpha \geq 0.04$
B) For $\alpha = 0.05, 0.10$
C) For all values of $\alpha < 0.04$
D) For $\alpha = 0.04$

33. _____ A sample mean, sample standard deviation, and sample size are given. Use the one-mean t-test to perform the required hypothesis test about the population mean μ using the P-value approach. Select the appropriate conclusion.
$\bar{x} = 226{,}760$, $s = 11{,}500$, $n=23$, H_0: $\mu = 220{,}000$, H_a: $\mu > 220{,}000$, $\alpha = 0.01$
A) Test statistic t = 2.819, P-value = 0.005. Reject the null hypothesis.
B) Test statistic t = 0.56, P-value = 0.2877. Do not reject the null hypothesis.
C) Test statistic t = 2.819, P-value = 0.995. Do not reject the null hypothesis.
D) Test statistic t = 2.819, P-value = 0.01. Reject the null hypothesis.

34. _____ A 98% confidence interval for the difference $\mu_1 - \mu_2$ between two population means is from 204 to 289. Interpret the confidence interval.
A) We can be 98% confident that $\mu_1 - \mu_2$ lies somewhere between 204 and 289. Equivalently, we can be 98% confident that μ_1 is somewhere between 204 and 289 greater than μ_2.
B) We can be 98% confident that $\mu_2 - \mu_1$ lies somewhere between 204 and 289. Equivalently, we can be 98% confident that μ_2 is somewhere between 204 and 289 greater than μ_1.
C) We can be 98% confident that $\mu_1 - \mu_2$ lies somewhere between 204 and 289. Equivalently, we can be 98% confident that μ_1 is somewhere between 204 and 289 less than μ_2.
D) We can be 98% confident that $\mu_1 - \mu_2$ both lie somewhere between 204 and 289.

35. _____ Summary statistics are given for independent simple random samples from two population. Use the nonpooled t-test to conduct a right-tailed hypothesis test using a significance level of $\alpha = 0.05$.
$\bar{x}_1 = 73.7$, $s_1 = 10.9$, $n_1 = 16$, $\bar{x}_2 = 69.9$, $s_2 = 7.2$, $n_2 = 12$
A) Test statistic t = 2.635, critical value = 1.706, reject H_0.
B) Test statistic t = 2.635, critical value = 1.708, reject H_0.
C) Test statistic t = 1.109, critical value = 1.708, do not reject H_0.
D) Test statistic t = 1.109, critical value = 1.706, do not reject H_0.

36. _____ For the same statistics given in the previous problem, use the non-pooled t-interval procedure to find a 95% confidence interval for $\mu_1 - \mu_2$.
A) -2.05 to 9.65 B) -2.03 to 9.67 C) -3.15 to 10.30 D) -3.26 to 10.86

37. _____ A researcher wants to use a paired sample to determine whether the mean number of hours spent exercising per week for married men differs from the mean number of hours spent exercising per week for married women. Identify the paired-difference variable for the proposed hypothesis test.
A) Difference between mean hours of weekly exercise of married men and mean hours of weekly exercise of married women.
B) Difference between hours of weekly exercise for a married man and hours of weekly exercise before he was married.
C) Difference between hours of weekly exercise of a randomly selected married man and hours of weekly exercise of a randomly selected married woman.
D) Difference between hours of weekly exercise for a married man and hours of weekly exercise of his wife.

38. _____ The number of successes and the sample size are given for a simple random sample from a population. Use the one-proportion z-interval procedure to find a 90% confidence interval for the true population proportion. x = 14, n=50
A) 0.156 to 0.404 B) 0.191 to 0.369 C) 0.199 to 0.361 D) 0.176 to 0.384

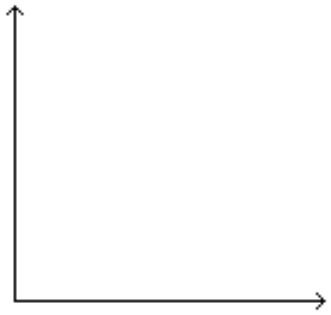
39. _____ The number of successes and the sample size for a simple random sample from a population are given. Decide whether using the one-proportion z-test is appropriate. x = 16, n = 30, H_0: p = 0.9, H_a: p ≠ 0.9.
A) Not appropriate B) Appropriate

40. _____ The numbers of successes and the sample sizes are given for independent simple random samples from two populations. Use the two-proportions z-interval procedure to obtain a 95% confidence interval for $p_1 - p_2$. $x_1 = 44$, $n_1 = 67$, $x_2 = 50$, $n_2 = 79$
A) -0.161 to 0.842 B) -0.132 to 0.179 C) 0.501 to 0.813 D) 0.471 to 0.842

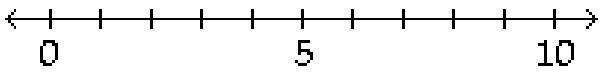
SHORT ANSWER (10 Questions)

41. Construct a bar graph for the relative frequencies given. (Be sure it is well-labeled.)

Blood type	Frequency	Relative Frequency
O	22	0.44
A	19	0.38
B	6	0.12
AB	3	0.06



42. A manufacturer records the number of errors each work station makes during the week. The data are as follows: 6 3 2 3 5 2 0 2 5 4 2 0 1. Construct a dotplot. (Be sure it is well-labeled.)

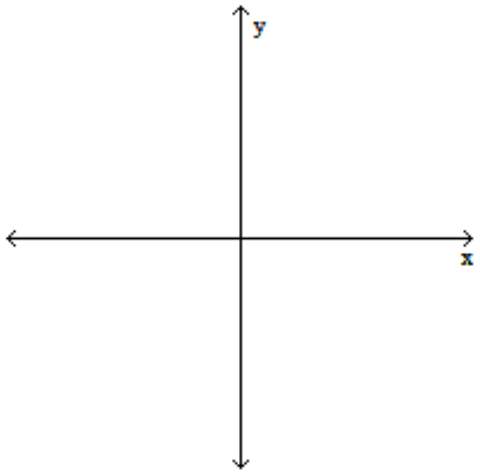


43. The test scores of 16 students are listed below.

40 45 50 56 58 63 67 70 74 77 85 87 90 94 95 99

Find the first quartile, Q_1: Show work:

44. Draw an example of a scatterplot that represents a strong negative linear correlation. (Note: Draw at least 8 points on the scatterplot.)



45. A frequency distribution on employment information from Alpha Corporation follows. Find the probability that an 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

Probability:

Show work:

46. Find the z-score for having area 0.09 to its right under the standard normal curve, that is, find $z_{0.09}$.

$z_{0.09}$ Show work:

47. 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 sampled during randomly picked years. For samples of size 25, determine the mean and standard deviation of $\bar{x}$.

$\mu_{\bar{x}}$ = Show work:

$\sigma_{\bar{x}}$ =

48. A weekly earnings of students in one age group are normally distributed with a standard deviation of 10 dollars. A researcher wishes to estimate the mean weekly earnings of students in this age group. Find the sample size needed to assure with 95% confidence that the sample mean will not differ from the population mean by more than 2 dollars.

n = [ ] Show work:

49. The significance level and P-value of a hypothesis test are given. Decide whether the null hypothesis should be rejected or not and give your rationale for your conclusion.
$\alpha = 0.01$, P-value = 0.002

Decision:

Rationale: [ ]

50. A sample mean, sample standard deviation, and sample size are given. Use the one-mean t-test to perform the hypothesis test of $H_0: \mu = 18.7$ versus $H_a: \mu \neq 18.7$ with $\alpha = 0.05$. Assume the population is normal, and use either the critical-value or P-value approach and give an appropriate conclusion.
$\bar{x} = 20.5$, $s = 7.0$, $n = 11$.

Test statistic: [ ]

Critical value or P-value: [ ]

Conclusion: [ ]