

**STAT 1220
Common Final Exam**

**SPRING 2014
May 1, 2014**

PLEASE PRINT THE FOLLOWING INFORMATION:

Name: _____ Instructor: _____

Student ID #: _____ Section/Time: _____

THIS EXAM HAS TWO PARTS.

PART I.

Part I consists of 30 multiple choice questions. Each correct answer is scored 2 points; each incorrect (or blank) answer is scored 0, so there is no penalty for guessing. You may do calculations on the test paper, but your answers must be marked on the OPSCAN sheet with a soft lead pencil (HB or No. 2 lead). Any question with more than one choice marked will be counted as incorrect. If more than one choice seems correct, chose the one that is most complete or most accurate. Make sure that your name and ID number are written and correctly bubbled on the OPSCAN sheet.

PART II.

Part II consists of 3 free response questions, with values as indicated. You must show all work in the space provided or elsewhere on the exam paper in a place that you clearly indicate. Work on loose sheets will not be graded.

FOR DEPARTMENT USE ONLY:

Part II.

Question	1	2	3
Score			

Part I	Part II	TOTAL

Part I

Problems 1 and 2 pertain to the following sample data:

5, 2, 5, 4, -3, -5, 0, 3, 1

1. The sample mean of this data set is about

- (a) 0.8 (b) 12 (c) 1.3 (d) 1.5 (e) 3.1

2. The sample standard deviation of this data set is about

- (a) 3.5 (b) 12.3 (c) 3.1 (d) 1.3 (e) 3.3

Problems 3–5 pertain to the data set of 80 measurements represented by the following stem and leaf diagram:

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

3. The sample median is about

- (a) 73 (b) 72 (c) 73.5 (d) 74.5 (e) 74

4. The sample range is about

- (a) 97 (b) 100 (c) 80 (d) 43 (e) 51

5. The percentile rank of the measurement 93 is about

- (a) 90 (b) 95 (c) 87 (d) 91 (e) 93

6. The distribution of the times between when the renewal notice for an automobile insurance policy is issued and the policy is renewed is roughly bell-shaped with mean 23 and standard deviation 2 days. The proportion of policies that are renewed within three weeks (21 days) is about

- (a) .84 (b) .68 (c) .32 (d) .50 (e) .16

7. An economist wishes to estimate the proportion of all businesses in the state that employ at most 15 workers. To do so, he examined 100 randomly selected businesses. The *population* of interest to the economist is:
- (a) All businesses in the state except the 100 businesses in the sample.
 - (b) The businesses in the sample that employ at most 15 workers.
 - (c) All businesses in the state that employ at most 15 workers.
 - (d) The 100 businesses in the sample.
 - (e) All businesses in the state.
8. The *standard deviation* of a numerical data set measures the _____ of the data.
- (a) range
 - (b) average
 - (c) most frequent value
 - (d) variability
 - (e) size

Problems 9 and 10 pertain to the information in the following two-way contingency table, relating the make of a new light vehicle and the age of the person buying it:

	18-34	35-64	65 and older
American	0.06	0.31	0.10
Asian	0.05	0.30	0.07
European	0.01	0.05	0.05

9. The probability that a randomly selected new light vehicle is a European make is about
- (a) 0.01 (b) 0.23 (c) 0.05 (d) 0.11 (e) 0.18
10. The probability that a randomly selected new light vehicle is a European make, given that the purchaser is 65 or older, is about
- (a) 0.45 (b) 0.23 (c) 0.11 (d) 0.32 (e) 0.18

Problems 11 and 12 are based on the following information: the probability that a randomly selected adult owns an e-reader is 0.26, the probability that he owns a tablet computer is 0.31, and that he owns both kinds of device is 0.17.

11. The probability that a randomly selected adult owns either an e-reader or a tablet computer is about
- (a) 0.17 (b) 0.57 (c) 0.05 (d) 0.40 (e) impossible to tell (insufficient information)
12. The events E : a randomly selected adult owns an e-reader and T : a randomly selected adult owns a tablet computer are
- (a) Independent because $P(E) \cdot P(T) = P(E \cap T)$
(b) Independent because $P(E) \cdot P(T) \neq P(E \cap T)$
(c) Dependent because $P(E) \cdot P(T) = P(E \cap T)$
(d) Dependent because $P(E) \cdot P(T) \neq P(E \cap T)$
(e) impossible to tell if independent or not (insufficient information)

Problems 13–15 pertain to the probability distribution of the number X of sales made on a randomly selected workday by an inside salesman for an electrical equipment wholesaler:

x	0	1	2	3	4
$P(x)$	p	0.38	0.34	0.06	0.01

13. The missing entry p is about
- (a) 0.30 (b) 0.00 (c) 0.21 (d) 0.12 (e) 0.31
14. The probability that the inside salesman will make at least two sales on a randomly selected day is about
- (a) 0.07 (b) 0.41 (c) 0.34 (d) 0.93 (e) 0.59
15. The average number of sales that the inside salesman makes per day is about
- (a) 2.00 (b) 10.0 (c) 0.20 (d) 1.28 (e) 1.47

16. Twelve percent of reservations for rooms in a lodge at a resort area are “no shows” (the person does not arrive to claim his room). The owner overbooks his 30-room lodge by taking 32 reservations for each night. The chance of more than 30 people with reservations on a particular night showing up to claim them is about
- (a) 0.12 (b) 0.09 (c) 0.01 (d) .24 (e) 0.00 (zero to two decimal places)
17. Computer chips are shipped in cases holding 15,000 chips each. There is a two percent chance that a randomly selected chip will be unusable for some reason. The average number of unusable chips per case is about
- (a) 30 (b) 15 (c) 200 (d) 2 (e) 300
18. The number of shares traded per day on a certain stock exchange is normally distributed with mean 275 million shares and standard deviation 62 million shares. The probability that on a randomly selected day fewer than 200 million shares will be traded is about
- (a) 0.26 (b) -0.11 (c) 0.08 (d) 0.11 (e) 0.88
19. Heights of adult males in the U. S. are normally distributed with mean 70.2 and standard deviation 2.73 inches. Designers of various products size them so as to accommodate the middle 97% of adult men. The shortest interval, symmetric about the mean, that contains 97% of heights of adult men (the “middle 97%”) is about
- (a) [67.5, 72.9] (b) [63.4, 77.0] (c) [64.3, 76.1] (d) [64.8, 75.6] (e) [65.1, 75.3]
20. A weight loss program claims that after three months in the program participants lose an average of 8.3 lb, with standard deviation 1.9 lb. A sample of the records of 35 randomly selected participants showed weight reductions with mean 7.7 lb. If the population mean reduction is actually 8.3 pounds, with standard deviation 1.9 lb, then the probability of obtaining a sample mean as low as 7.7 lb is about
- (a) 0.03 (b) 0.01 (c) 0.08 (d) 0.37 (e) 0.05
21. A university’s four-year graduation rate is 0.282 (i.e., 28.2% of entering freshman graduate within four years). Four hundred entering freshmen are selected at random. The probability that at least one-fourth of them will graduate within four years is about
- (a) 0.92 (b) 0.83 (c) 0.95 (d) 0.08 (e) 0.17

22. A sample of the job tenures (number of years on the same job) of 100 non-managerial full-time workers had mean 5.6 and standard deviation 2.4 years. A 90% confidence interval for the mean job tenure of all non-managerial full-time workers is about
- (a) [5.13, 6.07] (b) [5.29, 5.91] (c) [5.40, 5.80] (d) [5.21, 5.99] (e) [5.04, 6.16]
23. In a certain region biologists inspected 481 deer taken by hunters; 117 of the deer carried ticks that tested positive for Lyme disease. A 99% confidence interval for the proportion of all deer that carry ticks that carry Lyme disease is about
- (a) 0.243 ± 0.050 (b) 0.243 ± 0.025 (c) 0.243 ± 0.0556 (d) 0.243 ± 0.046 (e) 0.243 ± 0.032
24. The measured gestation period of six wild boars in Britain yield sample data (in days):
- 114, 117, 122, 113, 114, 126
- Assuming that the population of gestation periods is normally distributed, an 80% confidence interval for the mean gestation period in days of wild boars is about
- (a) 117.7 ± 2.0 (b) 117.7 ± 2.7 (c) 117.7 ± 4.3 (d) 117.7 ± 3.1 (e) 117.7 ± 3.2
25. A corporation wishes to estimate, with 95% confidence and to within three percentage points, the proportion of all adults who recognize its company logo. The minimum estimated sample size needed to meet these objectives is about
- (a) 1844 (b) 1068 (c) 457 (d) 752 (e) 1503
26. In a test of hypotheses of the form $H_0 : \mu = 0$ versus $H_a : \mu > 0$ using $\alpha = .005$, when the sample size is 22 and the population is normally distributed but of unknown standard deviation the rejection region will be the interval
- (a) $[2.576, \infty)$ (b) $[2.807, \infty)$ (c) $[2.831, \infty)$ (d) $[3.135, \infty)$ (e) $[2.819, \infty)$

27. In a test of hypotheses $H_0 : \mu = 88$ versus $H_a : \mu > 88$ in a normally distributed population, the rejection region is the interval $[2.797, \infty)$, the value of the sample mean computed from a sample of size 25 is $\bar{x} = 96$, and the value of the test statistic is $t = 3.077$. The correct decision and justification are:
- (a) Do not reject H_0 because the sample is small.
 - (b) Do not reject H_0 because $2.797 < 3.077$.
 - (c) Reject H_0 because 96 is larger than 88.
 - (d) Reject H_0 because 96 lies in the rejection region.
 - (e) Reject H_0 because $3.077 > 2.797$.
28. In a test of hypotheses $H_0 : \mu = 50$ vs. $H_a : \mu < 50$ a sample of size 64 produced the test statistic $z = -1.321$. The p -value (the observed significance) of the test is about
- (a) 0.07
 - (b) 0.09
 - (c) 0.81
 - (d) -0.09
 - (e) 0.05
29. A researcher wishes to test whether a dietary supplement has any effect on blood pressure against the default that it has no effect. The blood pressure of 25 volunteers are taken both before and after two months on the supplement. The setup of the null and alternative hypotheses for this test is
- (a) $H_0 : \bar{x}_1 - \bar{x}_2 = 0$ vs. $H_a : \bar{x}_1 - \bar{x}_2 < 0$
 - (b) $H_0 : \bar{x}_1 - \bar{x}_2 = 0$ vs. $H_a : \bar{x}_1 - \bar{x}_2 \neq 0$
 - (c) $H_0 : \mu_1 - \mu_2 = 0$ vs. $H_a : \mu_1 - \mu_2 < 0$
 - (d) $H_0 : \mu_d = 0$ vs. $H_a : \mu_d \neq 0$
 - (e) $H_0 : \mu_1 - \mu_2 = 0$ vs. $H_a : \mu_1 - \mu_2 \neq 0$
30. A study investigating the relationship between weight x (in hundreds of pounds) and the fuel economy y (in miles per gallon) of 50 randomly selected new light vehicles yielded $r = -0.87$, $s_e = 1.642$, and the regression equation $\hat{y} = -0.82x + 48.7$. For each additional 100 pounds in weight the average fuel economy
- (a) decreases by about 0.87
 - (b) decreases by about 1.6
 - (c) decreases by about 0.82
 - (d) decreases by about 0.16
 - (e) changes by an amount that cannot be determined from the information given

Part II

1. When hybrid vehicles were introduced the mean time required for savings from increased fuel economy to recover the additional initial cost was 4.2 years. To test whether it is now less an economist performed a study of 12 hybrid vehicles. The mean time cost recovery time was 3.9 years with sample standard deviation 0.6 years. The test is performed at the 1% level of significance. Assume that the population of recovery times is normally distributed.

(a) State the null and alternative hypotheses for the test. [2 points]

(b) State the formula for the test statistic and compute its value. Justify your answer. [4 points]

(c) Construct the rejection region and make a decision. [4 points]

(d) State a conclusion about the mean recovery time of all hybrid vehicles, based on the test you performed. [2 points]

2. The natural assumption is that the content of a television program has no bearing on the effectiveness of ads placed with that program. An ad agency asserts that, on the contrary, ads placed with television shows with sexual content are less effective than those placed with neutral content. In a controlled study subjects watched one or the other type program in which nine ads were interspersed and were later asked the number of brands they could recall, with the following results:

neutral content	$n_1 = 108$	$\bar{x}_1 = 3.17$	$s_1 = 1.79$
sexual content	$n_2 = 108$	$\bar{x}_2 = 2.48$	$s_2 = 1.87$

Perform the relevant test of hypotheses, at the 1% level of significance, in the following series of steps.

- State the null and alternative hypotheses for the test. [2 points]
- State the formula for the test statistic and compute its value. Justify your answer. [4 points]
- Construct the rejection region and make a decision. [4 points]
- State a conclusion about the ad agency's claim based on the test you performed. [2 points]
- Compute the p -value (the observed significance) of the test and state what it means in the context of this problem. [2 points]

3. The total assets x of equity funds and y of bond and income funds in the U. S. were each recorded in each of nine randomly selected recent years, in units of billions of dollars. Summary information is:

$$35.9 \leq x \leq 1269 \quad 13.1 \leq y \leq 798.3 \quad \bar{x} = 347.8\bar{1} \quad \bar{y} = 308.5\bar{7}$$

$$SS_{xx} = 1,369,257.789 \quad SS_{xy} = 943,713.6022 \quad SS_{yy} = 741,772.7156$$

- (a) Describe the strength and direction of the linear relationship between the total assets x of equity funds and y of bond and income funds in the U. S. [2 points]
- (b) Find the proportion of the variability in assets of bond and income funds that is accounted for by the level of assets in equity funds. [4 points]
- (c) Find the regression line for predicting y from x . [4 points]
- (d) For any year in which total assets in equity funds is \$900 billion find the total assets in bond and income funds predicted by the regression equation found in part (c). [2 points]
- (e) State whether or not the same computation as in part (d) but for a year in which total assets in equity funds is \$1400 billion is valid, and why. [2 points]