

STAT 1222

Common Final Exam

Spring 2012
May 3, 2012

Please print the following information:

Name: _____

Instructor: _____

Student ID #: _____

Section/Time: _____

THIS EXAM HAS TWO PARTS

PART I. Consists of 30 multiple choice questions worth a total of 60 points. Read all questions carefully. You may do calculations on the test paper. Mark the number of the opscan sheet corresponding to the test question number with a Number 2 pencil or a mechanical pencil with HB lead. Mark only one answer; otherwise the answer will be counted as incorrect. In case there is more than one answer, mark the best answer. Please make sure that your name appears on the opscan sheet in the spaces provided.

PART II. This part consists of 3 questions (40 points in total). You **MUST** show all work for each question in the space provided to receive full credit for that question. If you write your explanations in another part of the test, please indicate accordingly.

At the end of the examination, you MUST hand in this test booklet, your answer sheet and all scratch paper.

FOR DEPARTMENTAL USE ONLY:

PART II:

Questions	1	2	3
Maximum	18	12	10
Score			

Part I

Part II

Total

Use the following sample data for questions 1, 2 and 3.

$-5, 3, -1, 2, 8$

1. Find the sample mean of the data.
(a) 2 (b) 1.4 (c) 3 (d) 1.75 (e) 0
2. The sample standard deviation of the data is closest to
(a) 4.317 (b) 23.3 (c) 4.827 (d) 6.92 (e) 2
3. Find the median of the data.
(a) 2 (b) 1.4 (c) -1 (d) 3 (e) 0
4. The standard deviation of a data set measures the _____ of the data set.
(a) most frequent value
(b) variability
(c) size
(d) position
(e) center

The mean rate for cable television from a sample of households was \$30 per month, with a standard deviation of \$2.5 per month. Assume that the data set has bell-shaped distribution.

Use **Empirical Rule** to answer questions 5 to 6.

5. Between what two values do about 99.7% of the data fall?
(a) \$27.5 and \$32.5
(b) \$25.0 and \$35.0
(c) \$27.5 and \$32.5
(d) \$22.5 and \$35.0
(e) \$22.5 and \$37.5
6. Estimate the percent of cable television rates between \$27.5 and \$35?
(a) 84% (b) 95% (c) 81.5% (d) 99% (e) 68%

Use the following information to answer questions 7, 8 and 9.

To determine whether its service is satisfactory to its customers, a hotel surveyed 100 guests and the result is summarized in the table below. A guest is randomly selected from these 100 people.

	Satisfied	Unsatisfied	Total
Female	42	2	
Males	40	16	
Total			

7. What is the probability that this guest is unsatisfied?

- (a) 0.88 (b) 0.18 (c) 0.82 (d) 0.16 (e) 0.44

8. What is the probability that this guest is a male and is also satisfied with the service?

- (a) 0.42 (b) 0.18 (c) 0.82 (d) 0.56 (e) 0.40

9. What is the probability that this guest is a female or is satisfied with the service?

- (a) 0.84 (b) 0.82 (c) 0.44 (d) 0.56 (e) None of the above

The following table denotes the probability distribution for a discrete random variable X .

Use this information to answer questions 10-12.

X	-2	0	1	2	9
$P(X)$	0.1	0.3	0.2	0.3	0.1

10. Find $P(X > 0)$.

- (a) 0.2 (b) 0.9 (c) 0.7 (d) 0.6 (e) 0.3

11. Find the expected value (mean) of X .

- (a) 2.0 (b) 2.4 (c) -2.0 (d) 1.3 (e) 1.5

12. The standard deviation of X is closest to

- (a) 7.65
(b) 2.77
(c) 17.50
(d) 4.18
(e) None of the above

Use the following information to answer questions 13, 14 and 15.

A study indicates that the weights of adults are normally distributed with a mean μ of 140 lbs and a standard deviation σ of 25 lbs.

13. What is the probability that a randomly selected adult weighs between 120 and 165 lbs?

- (a) .8413
- (b) .2119
- (c) .6294
- (d) .9545
- (e) None of the above

14. If 200 adults are randomly selected from this population, approximately how many of them will weigh more than 170 lbs?

- (a) 136
- (b) 190
- (c) 177
- (d) 23
- (e) 10

15. Find a value of weight x such that only 20% of adults weigh less than that.

- (a) 119
- (b) 161
- (c) 177
- (d) 143
- (e) 148

Use the following information to answer questions 16 and 17.

The average sales price of a single-family house in the United States is \$240,000 with a standard deviation of \$42,000. A random sample of 36 single-family houses is selected. Let \bar{x} represent the mean sales price of the sample.

16. Find the mean and standard deviation of \bar{x} , i.e., $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$.

- (a) $\mu_{\bar{x}} = 40,000, \quad \sigma_{\bar{x}} = 42,000$
- (b) $\mu_{\bar{x}} = 40,000, \quad \sigma_{\bar{x}} = 7,000$
- (c) $\mu_{\bar{x}} = 240,000, \quad \sigma_{\bar{x}} = 42,000$
- (d) $\mu_{\bar{x}} = 240,000, \quad \sigma_{\bar{x}} = 36$
- (e) $\mu_{\bar{x}} = 240,000, \quad \sigma_{\bar{x}} = 7,000$

17. What is the probability that the sample mean sales price \bar{x} is between \$235,800 and \$252,600?

- (a) .2743
- (b) .9641
- (c) .1577
- (d) .6898
- (e) .6179

Use the following information for questions 18 and 19.

The manager of the dairy section of a large supermarket chose a random sample of 250 egg cartons and found that 30 cartons had at least one broken egg. let p denote the proportion of all cartons which have at least one broken egg.

18. Find a point estimate for p and also construct a 90% confidence interval for p .

- (a) 30, (0.086, 0.154)
- (b) 30, (29.966, 30.034)
- (c) 0.12, (0.067, 0.173)
- (d) 0.88, (0.846, 0.914)
- (e) 0.12, (0.086, 0.154)

19. Based on the preliminary estimate for p from the above sample, find the minimum sample size needed to estimate the population proportion p with 85% confidence. The estimate must be accurate to within .02 of p .

- (a) 286 (b) 548 (c) 1296 (d) 170 (e) 676

20. In a random sample of 16 DVD players brought in for repairs, the average repair cost was \$50 and the standard deviation was \$10. Assume that the repair costs are normally distributed. Construct a 95% confidence interval for μ , where μ represents the average repair cost for DVD players.

- (a) (45.10, 54.90)
- (b) (44.67, 55.33)
- (c) (48.67, 51.33)
- (d) (45.89, 54.11)
- (e) (40.00, 50.00)

Use the following information to answer questions 21–23.

A direct mailing company sells computers and computer parts by mail. The company claims that at least 90% of all orders are mailed within 72 hours after they are received. The quality control department at the company often takes samples to check if this claim is valid. A recently taken random sample of 150 orders showed that 129 of them were mailed within 72 hours.

21. Set up the null and alternative hypotheses to test whether the company's claim is true?

- (a) $H_0 : p = .90$ versus $H_a : p \neq .90$
- (b) $H_0 : p > .90$ versus $H_a : p \leq .90$
- (c) $H_0 : p \leq .90$ versus $H_a : p > .90$
- (d) $H_0 : p \geq .90$ versus $H_a : p < .90$
- (e) $H_0 : p \neq .90$ versus $H_a : p = .90$

22. The standardized test statistic is closest to

- (a) -1.41 (b) 1.41 (c) -1.63 (d) 1.63 (e) -3.55

23. Find the rejection region and state your conclusion at $\alpha = 0.025$.

- (a) Rejection region: $z < -1.96$ or $z > 1.96$; Decision: Reject H_0 .
- (b) Rejection region: $z < 1.96$; Decision: Reject H_0 .
- (c) Rejection region: $z < -1.96$; Decision: Fail to reject H_0 .
- (d) Rejection region: $z > 1.645$; Decision: Fail to reject H_0 .
- (e) Rejection region: $z < -1.96$; Decision: Reject H_0 .

Use the following information for questions 24 to 26.

A car dealer claims that on average, the age of cars owned by professors is less than the age of cars owned by students. Random samples of 40 faculty cars and 36 student cars are taken and their ages are measured. The data was shown in the following table.

ages for faculty cars	ages for student cars
$n_1 = 40$	$n_2 = 36$
$\bar{x}_1 = 5.9$	$\bar{x}_2 = 7.1$
$s_1 = 1.6$	$s_2 = 1.8$

24. Choose the correct hypothesis to test the claim.

- (a) $H_0 : \mu_1 \geq \mu_2$ vs. $H_a : \mu_1 < \mu_2$
- (b) $H_0 : \bar{x}_1 \leq \bar{x}_2$ vs. $H_a : \bar{x}_1 > \bar{x}_2$
- (c) $H_0 : \mu_1 \leq \mu_2$ vs. $H_a : \mu_1 > \mu_2$
- (d) $H_0 : \bar{x}_1 \geq \bar{x}_2$ vs. $H_a : \bar{x}_1 < \bar{x}_2$
- (e) $H_0 : \mu_1 = \mu_2$ vs. $H_a : \mu_1 \neq \mu_2$

25. Find the value of the standardized test statistic.

- (a) 1.20
- (b) -1.20
- (c) 2.575
- (d) 3.52
- (e) -3.06

26. Find the P-value of this test and state your conclusion at $\alpha = .05$.

- (a) P-value: 0.9989; Decision: Reject H_0 .
- (b) P-value: 0.9989; Decision: Fail to reject H_0 .
- (c) P-value: 0.0011; Decision: Reject H_0 .
- (d) P-value: 0.0011; Decision: Fail to reject H_0 .
- (e) P-value: 0.05; Decision: Fail to reject H_0 .

The following information is used for questions 27 to 29.

Six randomly selected students took an IQ test A, and the next day they took a very similar IQ test B. Their scores are shown in the table below.

Student	1	2	3	4	5	6
Test A	121	93	71	119	104	100
Test B	121	91	72	122	108	100

Let $d = \text{Test A score} - \text{Test B score}$ and denote by μ_d the mean of the differences. It was already calculated from the above table that $\bar{d} = -1$ and $s_d = 2.19$. Assume that the scores in Test A and B are normally distributed.

27. On average, do people score better on the second test than in the first test they take? Choose the appropriate hypotheses to test the claim.

- (a) $H_0 : \mu_d = 0$ versus $H_a : \mu_d \neq 0$
- (b) $H_0 : \bar{d} \leq 0$ versus $H_a : \bar{d} > 0$
- (c) $H_0 : \mu_d \leq 0$ versus $H_a : \mu_d > 0$
- (d) $H_0 : \mu_d \geq 0$ versus $H_a : \mu_d < 0$.
- (e) $H_0 : \mu_d < 0$ versus $H_a : \mu_d \geq 0$.

28. The standardized test statistic is closest to

- (a) -1
- (b) 1.237
- (c) -1.118
- (d) 1.118
- (e) -1.237

29. Find the rejection region and state your decision at $\alpha = .05$.

- (a) Rejection Region: $z > 1.645$; Decision: Reject H_0 .
- (b) Rejection Region: $z < -1.645$; Decision: Fail to reject H_0 .
- (c) Rejection Region: $t > 2.015$; Decision: Reject H_0 .
- (d) Rejection Region: $t < -2.015$; Decision: Reject H_0 .
- (e) Rejection Region: $t < -2.015$; Decision: Fail to reject H_0 .

The following is used for question 30.

The amounts of 6 restaurant bills x (in dollars) and the corresponding amounts of the tips y (in dollars) are given in the below.

Bill	32.98	49.72	70.29	97.34	43.58	52.44
Tip	4.50	5.28	10.00	16.00	5.50	7.00

The regression equation is $\hat{y} = 0.19x - 2.73$, and the coefficient of determination is $r^2 = 0.97$.

30. Predict the amount of the tip if the bill is $x = \$50$.

- (a) The predicted amount of tip is \$10.25
- (b) The predicted amount of tip is \$8.56
- (c) The predicted amount of tip is \$6.77
- (d) The predicted amount of tip is \$4.35
- (e) The amount of tip cannot be predicted

End of Multiple Choice Section

1. The table below reports the ages (in years) and the number of hours of sleep in one night by seven adults.

Ages, x	Hours of sleep, y
35	7
20	9
59	5
42	6
68	5
38	8
75	4

$$n = 7, \quad \sum x = 337, \quad \sum y = 44, \quad \sum x^2 = 18563, \quad \sum y^2 = 196, \quad \sum xy = 1916.$$

- (a). (4 pts.) Find the correlation coefficient between x and y and interpret its meaning in the context of the problem.

- (b). (6 pts.) At $\alpha = .05$, test for the significance of the correlation coefficient.

(c). (5 pts.) Find the equation of the regression line between y and x .

(d). (3 pts.) Can you use the equation in part (c) to predict y when $x = 10$? Why or why not?

2. In the past, a company used to produce 40 tons of a certain food per day on average. Now, using a new technology, the mean daily yield of the food for a random sample of 25 days of production is 45 tons with a standard deviation of 5 tons. Assume that the daily yield of this food is normally distributed.

(a). (3 pts.) Set up the null and alternative hypotheses to test whether the new technology has **increased** the mean daily yield.

H_0 :

H_a :

(b). (3 pts.) In the context of the problem, explain Type I error.

(c). (3 pts.) Find the value of the standardized test statistic.

(d). (3 pts.) Find the rejection region and state your decision at $\alpha = 0.01$.

3. The following is the time in seconds for each of 12 rats to run through a maze.

30 31 25 35 27 33 40 35 28 29 32 33

(a). (4 pts.) Find the five-number summaries, *i.e.*, (Minimum, First Quartile, Second Quartile, Third Quartile, Maximum).

(b). (3 pts.) Find the inter-quartile range.

(c). (3 pts.) Draw a stem-and-leaf plot.