

**STAT 1220
Common Final Exam**

**Spring 2008
May 1, 2008**

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, choose 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 through 3 pertain to the following sample data:

10, -5, 13, 22, 4, 8, 12, -1, 0

1. The mean of this data set is about:

- (a) 8.3 (b) 8.4 (c) 9.0 (d) 7.0 (e) 8.0

2. The median of this data set is about:

- (a) 4.0 (b) 3.94 (c) 8.0 (d) 7.04 (e) 9.13

3. The sample standard deviation of this data set is about:

- (a) 8.4 (b) 7.9 (c) 5.7 (d) 70.3 (e) 62.4

4. Weights of three year old girls have a mound-shaped and symmetric distribution, with mean 14 kg and standard deviation 1 kg. The proportion of all three year old girls who weigh at least 16 kg is about:

- (a) 7.5% (b) 2.5% (c) 5.0% (d) 95.0% (e) 97.5%

5. Scores of 50 students on a college exam are:

75	83	92	68	74	66	94	80	78	86
67	94	77	78	85	65	73	77	81	69
82	74	80	63	78	86	97	74	72	64
73	74	88	90	76	82	69	65	79	88
63	83	77	75	84	68	76	85	70	93

The percentile rank of the score 78 is about:

- (a) 58 (b) 83 (c) 26 (d) 78 (e) 52

6. A driver on his way to work passes through a certain intersection twenty times per month. The traffic light is green for his direction of travel 65% of the time. The average number of times per month that the light is green for his direction of travel when he reaches the intersection is about:

- (a) 12 (b) 15 (c) 13 (d) 7
(e) impossible to tell from the information given

7. The standard deviation of a data set measures the _____ of the data set.

- (a) most frequent value
- (b) variability
- (c) size
- (d) range
- (e) average

Problems 8 and 9 pertain to the following situation:

To set a schedule for a new bus route the transit authority repeatedly times the trip between two points; the time x in minutes is found to have the probability distribution shown.

x	20	21	22	23	24	25
$P(x)$	.07	.19	.36	.24	.10	.04

8. The probability that a randomly selected trip will take at least 24 minutes is about:

- (a) .14
- (b) .10
- (c) .23
- (d) .04
- (e) .86

9. If the trip is made over and over, the average time it takes in minutes is about:

- (a) 22.5
- (b) 22.2
- (c) 21.9
- (d) 22.0
- (e) 23.0

10. According to the U. S. Center for Health Statistics the probability that a randomly selected twenty year old will live to age 65 is 80%. A club has twenty members aged twenty. What are the chances that at least one fourth of them will die before their 65th birthdays?

- (a) 59%
- (b) 63%
- (c) 20%
- (d) 80%
- (e) 37%

11. Which tables give valid probability distributions of a discrete random variable x ?

I.

x	-1	0	2	3	4
$P(x)$	.3	.2	.1	.3	.1

II.

x	5	7	9	11	13
$P(x)$	-.2	.4	.2	.3	.3

III.

x	0	1	2	3	4
$P(x)$	.2	.1	.2	.3	.3

IV.

x	$\frac{1}{2}$	1	$\frac{3}{2}$	2	$\frac{5}{2}$
$P(x)$	.4	.1	.3	.1	.1

- (a) I, II, and IV
- (b) I, III, and IV
- (c) I and II
- (d) I and IV
- (e) III and IV

12. Only 10% of American adults can name the capital of the Czech Republic. On a television game show the three randomly selected contestants are given the question "What is the capital of the Czech Republic?" The probability that none of them will know the answer is about:

- (a) 73% (b) 70% (c) 27% (d) 30% (e) 52%

In problems 13 and 14 z denotes the standard normal random variable.

13. $P(z \leq 1.26)$ is about:

- (a) .7924 (b) .3962 (c) .1038 (d) .6038 (e) .8962

14. $P(-.54 < z \leq .78)$ is about:

- (a) .2054 (b) .0769 (c) .4877 (d) .2823 (e) .6877

Problems 15 and 16 pertain to the following information:

The amount of time x in hours spent each week watching television by children under twelve is normally distributed with mean 24.5 hours and standard deviation 6.23 hours.

15. The probability that a randomly selected child spends at least 30 hours each week watching television is about:

- (a) 31% (b) 19% (c) 88% (d) 70% (e) 81%

16. Five children under twelve are selected at random. The probability that the average number of hours that they spend each week watching television is at least 30 is about:

- (a) 32% (b) 48% (c) 98% (d) 20% (e) 2%

17. The advertising department of a nationally circulated magazine wishes to estimate the mean age of its subscribers to within 1/2 year with 90% confidence. If they estimate that the standard deviation of the ages of their subscribers is about 5 years, what is the minimum size of the sample they must take?

- (a) 17 (b) 165 (c) 45 (d) 271 (e) 13

18. To monitor the percentage fat in hot dogs produced at a food processing plant a quality control technician randomly selects ten hot dogs and measures the percentage fat of each. The sample data yield mean 22.1 percent and standard deviation .8 percent. On the assumption that the fat content has a normal distribution a 95% confidence interval for the true mean percentage fat for all hot dogs currently being produced is about:

(a) $22.1 \pm .57$ (b) $22.1 \pm .56$ (c) $22.1 \pm .42$ (d) $22.1 \pm .46$ (e) $22.1 \pm .50$

19. In order to estimate the proportion of all credit card holders who pay all their credit card bills in full each month a credit counseling bureau took a random sample of 450 credit card holders and found that 127 pay all their credit card bills in full each month. A 99% confidence interval for the proportion of all credit card holders who pay all their credit card bills in full each month is:

(a) $.282 \pm .050$ (b) $.282 \pm .027$ (c) $.282 \pm .042$ (d) $.282 \pm .035$ (e) $.282 \pm .055$

20. A study to compare the driving habits of high school age boys and girls obtained the information shown on the number x of miles per hour the driver of a vehicle was traveling above the posted speed limit at a point 1/2 mile from a high school. We may assume that the populations of speeds are normally distributed with approximately equal standard deviations.

	n	\bar{x}	s
male	25	1.46	.74
female	25	.64	.46

The correct formula to employ to use these data to construct a 90% confidence interval for the difference in mean speed above the posted speed limit between boys and girls is:

(a) $(\bar{x}_1 - \bar{x}_2) \pm t \sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$

(b) $(\bar{x}_1 - \bar{x}_2) \pm z \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

(c) $\bar{d} \pm t \frac{s_d}{\sqrt{n}}$

(d) $\bar{x} \pm z \frac{s}{\sqrt{n}}$

(e) $\bar{x} \pm t \frac{s}{\sqrt{n}}$

Problems 21 through 23 pertain to the following situation:

The wrist extension in degrees was measured for each of 36 randomly selected individuals as they used a prototype of a new computer mouse. The results were $\bar{x} = 20.4$ and $s = 1.5$. The researchers wish to test $H_0 : \mu = 20$ versus $H_a : \mu > 20$ at the 10% level of significance. (Extension of more than 20° is known to increase the risk of injury under repeated use.)

21. The rejection region for the test is:

- (a) $[1.645, \infty)$ (b) $[2.326, \infty)$ (c) $[1.282, \infty)$ (d) $(-\infty, -1.282] \cup [1.282, \infty)$
(e) $(-\infty, -1.645] \cup [1.645, \infty)$

22. The correct decision and justification are:

- (a) Reject H_0 because $n \geq 30$.
(b) Reject H_0 because $20.4 > 20$.
(c) Reject H_0 because the test statistic falls in the rejection region.
(d) Do not reject H_0 because the test statistic does not fall in the rejection region.
(e) Do not reject H_0 because the observed significance is greater than .10.

23. The observed significance (the p -value) of the test is about:

- (a) .055 (b) .020 (c) .445 (d) .110 (e) .010

24. Results of a study on the effect of employment on college student performance as indicated by the student's GPA x are:

	n	\bar{x}	s
Employed	184	3.12	.485
Not employed	116	3.23	.524

A 90% confidence interval for the difference in mean GPA of students who do not work and of those who do is:

- (a) $(-.01, .23)$ (b) $(.01, .21)$ (c) $(0, .22)$ (d) $(.03, .19)$ (e) $(-.03, .25)$

Problems 25 through 27 pertain to the following situation.

An investigation into the relationship between an adolescent mother's age x in years and the birth weight y of her baby in grams yielded the regression equation $\hat{y} = -1163.45 + 245.15x$ as well as $r = .88369$, $r^2 = .78091$, $SSE = 337\,212.45$, and $s = 205.30844$.

25. The predicted birth weight for a baby born to a 17 year old woman is about:

- (a) 2885 g (b) 2640 g (c) 2200 g (d) 2450 g (e) 3000 g

26. The proportion of the variability in the weights of babies born to adolescent mothers that is accounted for by the mother's age is about:

- (a) 94% (b) 22% (c) 10% (d) 78% (e) 88%

27. For every additional year in the mother's age the mean birth weight of the baby:

- (a) increases by about 245 g;
(b) decreases by about 245 g;
(c) increases by about 1163 g;
(d) increases by about 1163 g;
(e) changes by an amount that cannot be determined from the information given.

Problems 28 and 29 pertain to the following situation.

At the beginning of his turn in a board game a player rolls a fair six-sided die with faces numbered from one to six and draws a card from a special deck that comprises forty cards, ten blue, ten green, ten red, and ten yellow.

28. The probability that the player rolls a number less than four and draws a blue card is about:

- (a) .500 (b) .750 (c) .250 (d) .125 (e) .625

29. The probability that the player rolls a number less than four or draws a blue card is about:

- (a) .125 (b) .125 (c) .750 (d) .250 (e) .625

30. Scores on an entrance exam for a firefighter's academy are normally distributed with mean 76 and standard deviation 8. To be admitted to the first level of training an applicant must achieve a score that ranks in the top twelve percent of all exam scores. The minimum score that does so is about:

- (a) 90 (b) 85 (c) 77 (d) 88 (e) 95

Part II

1. The Health Department in a certain state investigated the difference in cost-to-charge ratio (the percentage of billed charges that are actual costs to the hospital) between inpatients and outpatients among hospitals in the state. Results are shown in the table. Test the null hypothesis that the mean of the difference in ratios for all hospitals in the state is zero versus the alternative that the mean of the difference is not zero, as indicated below. Use $\alpha = .01$. Assume a normal distribution of differences.

Hospital	Inpatient Ratio	Outpatient Ratio
1	68	54
2	100	75
3	71	53
4	74	56
5	100	74
6	83	71

- (a) State the null and alternative hypotheses for the test. [2 points]
- (b) State the correct formula for the test statistic. Justify your answer. [2 points]
- (c) Construct the rejection region. [2 points]
- (d) Compute the value of the test statistic, and make a decision. [4 points]
- (e) State a conclusion, in the context of the problem, about the mean of the difference in ratios for all hospitals, based on the test you performed. [2 points]

2. Advertising share x and market share y for a particular brand of cigarettes were sampled at ten randomly selected years. Summary information is:

$$n = 10, \Sigma x = .688, \Sigma x^2 = .050072, \Sigma y = .835, \Sigma y^2 = .079491, \Sigma xy = .060861$$

- (a) Compute SS_{xx} , SS_{xy} , and SS_{yy} . [2 points]
- (b) Compute the least squares regression line. [4 points]
- (c) Find the coefficient of determination r^2 and explain what it means in the context of this problem. [2 points]
- (d) Compute a 90% prediction interval for market share when advertising share is .07 (7%). [4 points]

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3. A certain type of fiber optic cable produced by the usual process acceptably transmits light a mean distance of 58 km. A research team wishes to investigate if a modification in the manufacturing process will change the mean acceptable transmission distance. A sample of twenty batches of the cable produced under the new process are tested. The sample mean is 60.3 km with sample standard deviation 2.31 km. Assume the population is normally distributed.
- (a) State the null and alternative hypotheses for the test. [2 points]
- (b) State the correct formula for the test statistic. Justify your answer. [2 points]
- (c) Construct the rejection region for $\alpha = .05$. [4 points]
- (d) Compute the value of the test statistic, and make a decision. [4 points]
- (e) State a conclusion about the mean acceptable transmission distance of all cable produced by the new process, based on the test you performed. [2 points]
- (f) Compute a 95% confidence interval for the mean acceptable transmission distance of all cable produced by the new process. [2 points]