Test 2 (final examination)
May 2008

Family Name:													
First Name:													
ID:													

- **IMPORTANT** – your **answers have to be** on the **ANSWER SHEET !!!**
  Information you give / check in the questions **DO NOT count** as valid answers!
- All quizzes and tests are **closed book** exams, so no material is permitted except for ***one* formula sheet** per person (ONE page 8 1/2 X 11 with own selection of formula, no text). All formula sheets must be turned in.
  Also a calculator is permitted --- **mobile phones are strictly forbidden**!!
- Take care of your **time management**! You can achieve **60** points, the question have different (point-) weights. So please make sure you do not spend too much time with single (minor) questions.
- The exam paper has to **remain stapled** – please do not use any own paper - use the rear pages of this exam for your calculation.
  Fill your **NAME** on the **first** page ***and*** on the **ANSWER SHEET !!!**

I Theoretical Questions

(only **one answer is correct**) (1 point each ⇒ Σ **31** points)

1. The finite population correction factor has to be used if ...
   a. $n > 0.5N$
   b. $n/N > 0.05$
   c. $N > 0.5n$
   d. $N/n > 0.05$

2. The Central Limit Theorem says:
   a. time is the central limit of everything
   b. all samples are normally distributed
   c. for $n \geq 30$ the population of all possible sample means is approximately normally distributed
   d. all population means are approximately normally distributed

3. The critical z value for a (2-sided) confidence interval with $1-\alpha = .85$ is
   a. 1.64
   b. 1.96
   c. 1.44
   d. 1.28

4. The margin of error
   a. is subtracted from the population mean to find the confidence interval
   b. measures the error type I
   c. is the same as the confidence level
   d. is calculated as $z_{\alpha/2} * \sigma_{\overline{X}}$

5. $\overline{X}$ is ...
   a. a point estimate for the population mean
   b. the population mean
   c. a point estimate for the sample mean
   d. the middle of the test interval.

6. When σ is unknown ...
   a. we have to use the Binomial distribution
   b. we have to use the t-distribution
   c. we have to use the Normal distribution
   d. we can't use the t-distribution

7. With 15 observations and $\alpha = 0.05$, the (critical) t-value ($t_{\alpha/2}$) is
   a. 2.093
   b. 1.960
   c. 2.145
   d. 1.729

8. With 17 degrees of freedom and $\alpha = 0.01$, the (critical) t-value ($t_{\alpha/2}$) is
   a. 2.576
   b. 2.898
   c. 2.787
   d. 2.797

9. For the interval estimation of μ when σ is unknown and the sample is small, the proper distribution to use is
   a. the normal distribution with n degrees of freedom
   b. the normal distribution with n - 1 degrees of freedom
   c. the t distribution with n degrees of freedom
   d. the t distribution with n - 1 degrees of freedom

10. A 95% confidence interval for a population mean is determined to be 101.4 to 118.6. If the number of observations is increased, the interval for μ
   a. becomes narrower
   b. becomes wider
   c. does not change
   d. becomes σ * root(n)

11. The level of significance in hypothesis testing is the probability of
    a. rejecting a true Ho
    b. accepting a true Ho
    c. accepting a false Ho
    d. rejecting a false Ho

12. The confidence level
    a. is (1 + level of significance)
    b. can be any value between 1 and 2
    c. is (1 – level of significance)
    d. can be any value between -1 to 1

13. In hypothesis testing if the null hypothesis was correct and has been rejected
    a. the correct decision has been made
    b. a Type I error has been committed
    c. a Type II error has been committed
    d. both errors (Type I and Type II) have been committed (severe error)

14. If a hypothesis is rejected at the 5 % level of significance, it
    a. will also be rejected at the 10 % level
    b. will not be rejected at the 10 % level
    c. will sometimes be rejected at the 10 % level
    d. the hypothesis has to be changed

15. If a hypothesis test leads to not rejecting the null hypothesis
    a. a Type I error may have been committed
    b. a Type I error must have been committed
    c. a Type II error must have been committed
    d. a Type II error may have been committed

16. The critical z value for a (2-sided) hypotheses test with $1-\alpha = .9$ is
    a. 1.64
    b. 1.96
    c. 1.44
    d. 1.28

17. In hypothesis testing if the null hypothesis has been rejected
    a. we have proven Ha
    b. we have proven that Ho is wrong
    c. Ho might still be correct
    d. Ha is to be rejected as well

18. A regression analysis between costs (Y in $) and units produced (X) resulted in the following equation

$\hat{Y} = 10{,}000 + 400\ X$

The above equation implies that an

a. increase of 6 units is associated with an increase of $ 4,000 in costs
b. increase of U units is associated with an increase of $ U*400 in costs
c. increase of 10 units is associated with an increase of $ 40,000 in costs
d. increase of 5 units is associated with an increase of $ 500 in costs

19. A regression analysis between costs (Y in $) and units produced (X) resulted in the following equation

$\hat{Y} = 10{,}000 + 400\ X$

a. the value 400 represents the fixed costs
b. the value 400 represents the variable costs
c. the value 400 represents the correlation
d. the value 400 represents the MSE

20. In a simple regression analysis (where Y is a dependent and X an independent variable), if b_1 is positive, then

a. there is a positive correlation between X and Y
b. if X is increased, Y may also increase
c. if Y is increased, X must decrease
d. None of these alternatives is correct.

21. The regression function is used to determine

a. the equation of the correlation
b. the strength of the relationship between the dependent and the independent variables
c. a specific value of the dependent variable for a given value of the independent variable
d. None of these alternatives is correct.

22. In a regression and correlation analysis if r = 1, then

a. SSE can also be equal to one
b. SSE must be equal to zero
c. SSE can be any positive value
d. SSE can be negative

23. In a regression analysis if SSE = 125 and SST = 150, then the coefficient of determination is

a. 0.6667
b. 0.8333
c. 0.1667
d. 1.5000

24. In a linear regression $y^\wedge = bo + b_1 * x$
   a. if $b_o > 1 \Rightarrow r > 1$
   b. if $b_o > 0 \Rightarrow r > 0$
   c. if $b_o < 1 \Rightarrow r^2 < 1$
   d. none of the above

25. In a regression and correlation analysis if $r^2 = 1$, then
   a. SSE = MSE
   b. SSE = 1
   c. SSR = SST
   d. SSE = SST

26. If the coefficient of determination is equal to 64%, then the coefficient of correlation
   a. must also be equal to 0.64
   b. can be either -.8 or +.8
   c. can be any value between -1 to +1
   d. can be either -.64 or +.64

27. SSE can never be
   a. larger than SST
   b. smaller than SSY
   c. equal to 1
   d. larger SSXY

28. When r = -.49
   a. r^2 must also be negative
   b. r^2 is bigger than 0
   c. $r^2 = .7$
   d. SSE may be = 0

29. You measure a correlation coefficient of 0.22
   a. the (x;y) values are located closely around a negatively sloped line
   b. the (x;y) values are located closely around a positively sloped line
   c. the (x;y) values are located loosely around a negatively sloped line
   d. the (x;y) values are located loosely around a positively sloped line

30. You measure a correlation coefficient of 0.95
   a. The relation between x and y is nearly linear
   b. x and y are more or less identical
   c. if x double, y also nearly doubles
   d. as $r \neq 1$ there is no relation between x and y

31. In a linear regression $y^\wedge = bo + b_1 * x$
   a. if $b_1 > 1 \Rightarrow r > 1$
   b. if $b_1 > 0 \Rightarrow r > 0$
   c. if $b_1 < 1 \Rightarrow r^2 < 1$
   d. if $b_1 > 0 \Rightarrow r > 1$

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II Applied Problems: confidence intervals and regression analyses

(only **one answer is correct**) (**2** points each $\Rightarrow \Sigma$ **20** points)

32. From a population with a variance of 36, a sample of 144 items is selected. At 90% confidence, the margin of error is ~
   a. 1.64
   b. 1.96
   c. 1.44
   d. 0.82

33. A population has a standard deviation of 4.4. A random sample of 121 items from this population is selected. The sample mean is determined to be 49.7. At 99 % confidence, the margin of error is approximately
   a. 24.44
   b. 9.876
   c. 1.030
   d. 2.576

34. A random sample of 196 statistics examinations was taken. The average score, in the sample, was 95 with a variance of 49. The 80,64 % confidence interval for the average examination score of the population of the examinations is
   a. 94.35 to 95.65
   b. 94.00 to 96.00
   c. 94.53 to 95.47
   d. 94.01 to 95.99

Scenario 1

x_i	y_i	
1	5	
2	9	
3	3	
4	2	
5	1	

35. Refer to scenario 1. The estimate of the Y intercept is
    a. 10
    b. 9.5
    c. 8.5
    d. 6.6

36. Refer to scenario 1. The estimate of the slope is
    a. –3
    b. –1.5
    c. –1
    d. 0.5

37. Refer to scenario 1. The coefficient of correlation is
    a. –1
    b. –.75
    c. 0
    d. .85

Scenario 2 You have analyzed the relation between the number of friends you visited X and the gallons of gasoline you needed for the tour Y.

x_i	y_i	
1	4	
2	6	
3	8	
4	12	
5	10	

38. Refer to scenario 2 According to the regression: How much gas would you use if you do not visit a friend (but just drive around a bit)?
    a. 0
    b. 1.3
    c. 2.6
    d. 5

39. Refer to scenario 2 If you visit one more friend, how much more gas do you expect to need?
    a. .8
    b. 10
    c. 1.2
    d. 1.8

40. Refer to scenario 2 If you visited 10 friends. How much gas do you expect to use according to the regression model?
    a. 20
    b. 18.3
    c. 23.1
    d. 20.6

41. Refer to scenario 2 The critical t value for testing the significance of the slope at 95% confidence is
    a. 3.182
    b. 2.353
    c. 2.999
    d. 2.571

III Applied Problems: Hypothesis Tests

(only **one answer is correct**) (**3** points each ⇒ Σ **9** points)

42. The producer of breakfast cereals states that the sugar weight in his products is normally distributed with a mean of 10 and a standard deviation of 2. You can only use the cereals for your diet if the sugar weight is within the tolerance (not smaller or bigger). You eat a sample of 36 packages and (after recovering from the stomach ache) compute a mean of 10.25. What is the result of a test with a level of significance of $\alpha = 0.05$?

    a. $1.5 > 1.28 \rightarrow$ reject Ho
    b. $1.5 < 1.96 \rightarrow$ not reject Ho
    c. $0.75 < 1.28 \rightarrow$ not reject Ho
    d. $0.75 < 1.96 \rightarrow$ not reject Ho

43. The average price of bread has been \$2.20. It is believed that there has been a change in the average price. In order to test this belief, we randomly selected a sample of 36 of the company branches and determined that the average price in the sample was \$2.3. Assume that the standard deviation of the population is \$0.24. Test Ho: $\mu = 2.2$ [Ho: $\mu \neq 2.2$] with $\alpha = .10$

    a. $1.35 < 1.711 \rightarrow$ not reject Ho
    b. $2.5 > 1.645 \rightarrow$ reject Ho
    c. $2.5 > 2.054 \rightarrow$ reject Ho
    d. $1.5 > 2.054 \rightarrow$ reject Ho

44. The producer of rolls states that the length of his products is normally distributed with a mean of 6. A customer can only use the rolls if the length is within the tolerance (not smaller or bigger). He takes a sample of 16 rolls and finds a mean of 6.6 and a sample standard deviation of 2. What is the result of a test with a level of significance of $\alpha = 0.20$?

    a. $2.5 > 2.064 \rightarrow$ reject Ho
    b. $1.2 < 1.341 \rightarrow$ not reject Ho
    c. $1.8 > 1.341 \rightarrow$ reject Ho
    d. $2 > 1.282 \rightarrow$ reject Ho

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Standard Normal (Z) Distribution

Entries in the table give the area under the curve between the mean of 0 and Z standard deviations above the mean. For example, for Z = 2.15 the area under the curve between the mean of 0 and a positive Z value of 2.15 is .4842

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	:1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608"	.4616	.4625	.463
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846.	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946.	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

T - Distribution

This table provides the Probability t is greater than some positive number.

P(t ≥ positive number) = area

The positive values of t are the values in the cells of the table!

	The column headings are areas in the upper tail of the t distribution								
Degrees of Freedom	**0.3**	**0.25**	**0.2**	**0.1**	**0.05**	**0.025**	**0.02**	**0.01**	**0.005**
2	0.617	0.816	1.061	1.886	2.920	4.303	4.849	6.965	9.925
3	0.584	0.765	0.978	1.638	2.353	3.182	3.482	4.541	5.841
4	0.569	0.741	0.941	1.533	2.132	2.776	2.999	3.747	4.604
5	0.559	0.727	0.920	1.476	2.015	2.571	2.757	3.365	4.032
6	0.553	0.718	0.906	1.440	1.943	2.447	2.612	3.143	3.707
7	0.549	0.711	0.896	1.415	1.895	2.365	2.517	2.998	3.499
8	0.546	0.706	0.889	1.397	1.860	2.306	2.449	2.896	3.355
9	0.543	0.703	0.883	1.383	1.833	2.262	2.398	2.821	3.250
10	0.542	0.700	0.879	1.372	1.812	2.228	2.359	2.764	3.169
11	0.540	0.697	0.876	1.363	1.796	2.201	2.328	2.718	3.106
12	0.539	0.695	0.873	1.356	1.782	2.179	2.303	2.681	3.055
13	0.538	0.694	0.870	1.350	1.771	2.160	2.282	2.650	3.012
14	0.537	0.692	0.868	1.345	1.761	2.145	2.264	2.624	2.977
15	0.536	0.691	0.866	1.341	1.753	2.131	2.249	2.602	2.947
16	0.535	0.690	0.865	1.337	1.746	2.120	2.235	2.583	2.921
17	0.534	0.689	0.863	1.333	1.740	2.110	2.224	2.567	2.898
18	0.534	0.688	0.862	1.330	1.734	2.101	2.214	2.552	2.878
19	0.533	0.688	0.861	1.328	1.729	2.093	2.205	2.539	2.861
20	0.533	0.687	0.860	1.325	1.725	2.086	2.197	2.528	2.845
21	0.532	0.686	0.859	1.323	1.721	2.080	2.189	2.518	2.831
22	0.532	0.686	0.858	1.321	1.717	2.074	2.183	2.508	2.819
23	0.532	0.685	0.858	1.319	1.714	2.069	2.177	2.500	2.807
24	0.531	0.685	0.857	1.318	1.711	2.064	2.172	2.492	2.797
25	0.531	0.684	0.856	1.316	1.708	2.060	2.167	2.485	2.787
26	0.531	0.684	0.856	1.315	1.706	2.056	2.162	2.479	2.779
27	0.531	0.684	0.855	1.314	1.703	2.052	2.158	2.473	2.771
28	0.530	0.683	0.855	1.313	1.701	2.048	2.154	2.467	2.763
29	0.530	0.683	0.854	1.311	1.699	2.045	2.150	2.462	2.756
30	0.530	0.683	0.854	1.310	1.697	2.042	2.147	2.457	2.750
∞	0.524	0.674	0.842	1.282	1.645	1.960	2.054	2.326	2.576