STATISTICS 2023 **NAME IN PRINT**_____

FINAL EXAM **SIGNATURE IN INK**_____

FALL 2014 **CWID IN INK**_____

FILL IN THE BLANK. Write the word or phrase from the list on the right that belongs in the blank.
(Each blank 2 points each)

The words or phrases in the box may be used more than once, or not at all.

standard error test statistic null hypothesis alternative hypothesis parameter sample statistic confidence interval point estimate bound of error population sample statistical inference alpha p-value rejection region

1. A _____ is a single number calculated from observed data that is used to estimate a population parameter.

2. The _____ is the observed risk of error when the null hypothesis is rejected and the conclusion is that the data supports the alternative hypothesis.

3. The _____ associated with a statistical point estimate is the typical mistake made by the point estimate when it is used to estimate a population parameter.

4. The _____ is half the width of the confidence interval.

5. A _____ is a way to construct an interval estimate so that there is a certain degree of accuracy associated with the estimator.

6. The _____ of a hypothesis test identifies the unlikely values of the test statistic for which the null hypothesis will be rejected at the alpha significance level.

7. The statement stated as true that is tested by a hypothesis test is the _____.

8. The process of _____ involves forming conclusions about population parameters based on observed data.

9. If the sample size is small, then the _____ for the point estimator increases in magnitude.

10. In a hypothesis test, the null hypothesis is rejected if the value of the _____ is an unlikely value in the distribution that it has if the null hypothesis is true.

11. The _____ is the only hypothesis that can be supported by the data in a hypothesis test.

Z and t table questions (2 points each)

_____ 12. What is z_o, such that $P(Z< z_o)=0.9370$?

_____ 13. What does $P(-0.85 < Z < -0.57)$ equal?

_____ 14. What does $P(Z > - 0.68)$ equal?

_____ 15. What is the $P(t > 1.345)$ in the t with df=14?

_____ 16. What is the value of t_o if $P(t < t_o) = .01$, when df=20?

_____ 17. What is the $P (0 < t < 1.771)$, if df=13?

STATE THE ANSWER. Write the answer on the line. (3 points each)

_____ 18. What is the p-value of a two-tail hypothesis test based on a large sample if the test statistic value is -0.37?

_____ 19. If a 92% confidence interval to estimate a population mean is (3, 8) what is the value of the point estimate for the population mean?

_____ 20. What is the positive value of the test statistic if the p-value in a two-tail hypothesis test based on a Z test statistic is equal to 0.1646?

_____ 21. Consider a 98% confidence interval to estimate a population mean based on a sample of 9 observations with a sample mean of 4,325 and a sample variance of 225. How wide is this interval? Round to two digits past the decimal.

_____ 22. If a sample of 8 observations has the values of 8, -2, 5, 3, 9, -4, 7, -8, what is the value of the point estimate for the population variance? Round your answer to one digit past the decimal.

_____ 23. If the rejection region in a two-tail hypothesis test based on a large sample is above 1.645 and below -1.645, what is the maximum error rate of rejecting a true null hypothesis that this researcher will tolerate?

_____ 24. If the alternative hypothesis to compare two population means is H_a: $\mu_2-\mu_1 < -24$, then what would be the equivalent alternative hypothesis if the statement was written for the parameter $\mu_1-\mu_2$?

_____ 25. In a right-tail hypothesis test based on a small sample of 15 observations the value of the test statistic must exceed what number for the researcher to reject the null hypothesis with only a 0.001 error rate?

State the answer on the line. (3 points each)

Eye-level grocery store shelves, referred to as middle shelves, are believed to result in higher numbers of product sales than lower-level shelves. A local retail grocery store has collected data to test this idea. The following data, which are total numbers of weekly sales of a certain type of product, were recorded for middle and lower shelves for eight weeks. Use this data to answer the questions on this page.

MIDDLE:	68	63	59	82	74	60	94	83
LOWER:	53	60	39	59	48	46	62	53

_____ 26. State the point estimate for the mean of the population of weekly sales from the lower shelves. State your answer with one digit past the decimal.

_____ 27. State the point estimate for the standard deviation for the population of sales from the middle shelves. Round your answer to one digit past the decimal.

_____ 28. State the point estimate for the variance of the population of sales from the lower shelves. State your answer as a whole number with no digits to the right of the decimal.

_____ 29. State the point estimate for the difference between the mean number of sales from the middle shelves and the mean number of sales from the lower shelves.

_____ 30. What is the pooled variance estimate that would result from these two samples? Round your answer to one digit past the decimal.

_____ 31. How many degree of freedom are associated with the pooled variance estimate from these two samples?

_____ 32. If the estimated standard error of the difference between the sample means is 5, then what is the value of the test statistic to test whether the mean of the population of sales from the middle shelves is equal to the mean of the population of sales from the lower shelves? State your answer with three digits past the decimal.

_____ 33. What is the value of the bound of error that would be used to construct a 95% confidence interval to estimate the difference between the mean of the population of sales from the middle shelves and the mean of the population of sales from the lower shelves if the estimated standard error for the difference between the sample means is 5? Assume equal population variances. State your answer with three digits past the decimal.

LINEAR REGRESSION QUESTIONS. Write the answer on the line. (3 point each)

Last year oil production in the United States was growing faster than anywhere else in the world. The number of active drilling rigs in the US is related to the price of a barrel of oil. The following bivariate data are X=price per barrel of oil and Y=number of active drilling rigs in the US. The questions on this page are associated with fitting a simple linear regression equation to the bivariate data to estimate the number of active drilling rigs in the US based on the price of a barrel of oil.

X=price per barrel of oil	55	58	42	85	80	75	98	95
Y=number of active drilling rigs	990	1080	912	1670	1550	1470	1920	1880

_____34. What is the sum of the cross product for the price per barrel of oil and the number of active drilling rigs data provided above?

_____35. What is the corrected sum of squares for the x-variable based on the price per barrel of oil and the number of active drilling rigs data provided above?

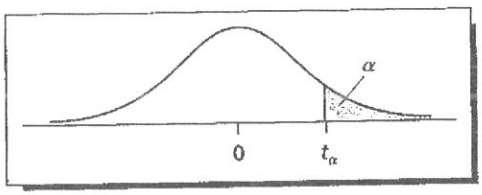
_____36. What is the least squares estimate of the slope in the linear regression equation to estimate the number of active drilling rigs based on the price of a barrel of oil? Round your answer to one digit past the decimal.

_____37. If the least squares estimate of the slope is 20, what is the least squares estimate of the y-intercept in the linear regression equation to estimate the number of active drilling rigs based on the price of a barrel of oil? This answer is a negative number.

_____38. If the estimated regression equation is y-hat = -40 + 20 x, what is the least squares estimate of the number of active drilling rigs based on a price of a barrel of oil of $88?

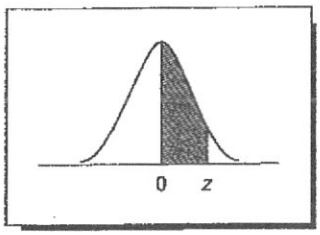
_____39. What is the numerical value of the estimated linear correlation between the price of a barrel of oil and the number of active drilling rigs? Round your answer to two digits past the decimal.

A *t* Table



df	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.01}$	$t_{.005}$	$t_{.001}$	$t_{.0005}$
1	3.078	6.314	12.706	31.821	63.657	318.31	636.62
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

TABLE A.19 A Table of Areas under the Standard Normal Curve



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.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	.4633
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

Source: A. Hald, *Statistical Tables and Formulas* (New York: Wiley, 1952), abridged from Table 1. Reproduced by permission of the publisher.