Statistics 1000 – Exam # 3 – Version 1

Fall 2009 – Jeff Stratton
November 19, 2009
9:30 – 10:45

Name______________________________

Section_____________________________

Peoplesoft Number___________________

This is a multiple-choice test. Circle the response that best answers the question. Then, bubble that answer in on your answer sheet.

This is Test 3: Version #1. Go to your test sheet and bubble in “1” in Column K. Make sure you have bubbled in your section # in columns L&M.

Bubble in your 7-digit Peoplesoft Number as the Identification Number starting in Column A. (If your number is six digits, start with a zero.)

This test will be returned to you. To verify your work and that the test was scored correctly, make sure that you have circled all your answers on the test itself.

A normal table and a t-table are attached at the back of the test.

Please raise your hand if you have any questions, and someone will be by to assist you.
Good Luck!

1. Suppose we are studying the lengths of worms that turned up on the UCONN sidewalks during the last day of rain. We take a random sample of 50 worms and calculate the average length of the worms. We do not know anything about the distribution of the lengths of worms. What does the central limit theorem tell us about the shape of the sampling distribution of $\bar{x}$?

   a. The sampling distribution is skewed to the right.
   b. The sampling distribution is approximately normal in shape.
   c. All sampling distributions are uniform in shape.
   d. The sampling distribution is skewed to the left.
   e. The sampling distribution is exactly normal in shape.

2. A publishing company is studying the sales of various franchises in their chain of stores. They draw a random sample of 75 stores in the chain, and measure the average daily sales. They find that $\bar{x} = \$5,670$ and $s = \$1,750$. Calculate a 90% confidence interval for μ, the mean daily sales of their stores.

   a. (\$2791.3 , \$8548.8)
   b. (\$5337.6 , \$6002.4)
   c. (\$5149.5 , \$6190.5)
   d. (\$5410.9 , \$5929.1)
   e. (\$3920.0 , \$7420.0)

3. Suppose the researchers in question 2 wish to decrease the width of the confidence interval for μ. What are two ways in which this can be accomplished?

   a. Decrease the sample size and decrease the confidence level
   b. Do all the calculations in scientific notation and use a value from the t-table in place of a value from the z-table.
   c. Increase the sample size and decrease the confidence level.
   d. Increase the sample size and increase the confidence level.
   e. Decrease the sample size and increase the confidence level.

4. An insurance company checks records on 582 accidents selected at random and notes that teenagers were at the wheel in 91 of them. Construct a 95% confidence interval for the proportion of all auto accidents that involve teenage drivers.

   a. (12.7% , 18.6%)
   b. (10.3% , 17.2%)
   c. (10.6% , 18.2%)
   d. (11.7% , 19.5%)
   e. (13.9% , 18.9%)

5. In a study of sleep patterns of eleven 6-month-old infants, a researcher reported the following results from 11 randomly selected infants: (The data is the number of hours out of every 24 hours that each infant slept).

13.3	12.8	12.6	14.3	13.3	12.6	12.8	12.2	12.7	12.7	12.2

Construct a 99% confidence interval estimate of the true mean number of hours in a 24-hour-period that 6-month-old infants sleep. We will assume that the data is normally distributed.

a. (12.5, 13.3)
b. (12.0, 13.5)
c. (12.3, 13.4)
d. (12.8, 13.9)
e. (12.1, 14.0)

6. What assumptions are needed to use a T-interval?

a. We can replace the population standard deviation σ by the sample standard deviation s.
b. The data follow a uniform distribution.
c. We have a random sample, and the data come from a normally distributed population.
d. The sample size is large.
e. There are no assumptions needed.

7. The Connecticut Department of Education would like to determine the proportion of families in the Greater New Haven area where English is not the language spoken at home. They would like their result to be accurate to within 2% with 99 % confidence. How many households should be surveyed?

a. 4148
b. 3383
c. 1692
d. 664
e. 2401

8. How would a 95% Z-interval compare to a 95% T-interval?

a. The Z-interval would be wider than the T-interval.
b. The Z-interval would be narrower than the T-interval.
c. Both intervals are identical.
d. The middle of the Z-interval is greater than the middle of the T-interval.
e. We can't compare them. The T-interval is used for a proportion, while the Z-interval is used for a mean.

9. An ad for ARCO graphite motor oil says “Based on a 95% confidence level, our tests achieved between 1% and 8.7% mileage improvement” as compared to conventional motor oils. What does 95% confidence level mean in the above statement

   a. ARCO graphite oil performs better than 95% of the conventional motor oils.
   b. The interval from 1% to 8.7% covers 95 % of the mileage improvements observed in the tests.
   c. ARCO estimates that the true improvement will be in the interval from 1% to 8.7% with 95% confidence.
   d. The tests include 95% of all oil brands on the market.
   e. A mistake has been made because 95% + 8.7% is more that 100%.

10. A confidence interval for the mean height of 625 pine trees is (59.608 , 60.392). Suppose we know that the sample standard deviation is s = 5 feet.

    What is the confidence level of this confidence interval?

    a. 75% Confidence
    b. 80% Confidence
    c. 90% Confidence
    d. 95% Confidence
    e. 99% Confidence

11. A high-tech company wants to estimate the mean number of years of college education its employees have completed. A good estimate of the standard deviation for the number of years of college is $\sigma = 1.6$. How large a sample needs to be taken to estimate the mean number of college years to within ± 0.5 years with 95% confidence?

    a. 28
    b. 27
    c. 39
    d. 40
    e. 14

12. A researcher wants to calculate a 95% confidence interval for the unknown true proportion of defective resistors off an assembly line. They take a random sample of 50 resistors, and find that 2 of them are defective. Are the needed assumptions for the confidence interval satisfied?

    a. Yes, because the sample size is larger than 30.
    b. No, because the sample size is still too small.
    c. Yes, because they took a random sample.
    d. No, because they should be using a T-Interval.
    e. Yes, because the confidence level is above 90%.

13. It costs you $10 to draw a sample of size $n = 1$ and measure the thickness of a drive shaft. You have a budget of $950. Do you have sufficient funds to estimate the mean drive shaft thickness for this factory with a 95% confidence interval 5 units in width. A reasonable guess for the standard deviation is $\sigma = 12.5$ mm.

   a. We can't tell if we'll have enough funding.
   b. Yes, there's enough funding.
   c. No, we don't have enough funding.
   d. We need to know $\bar{X}$ from a sample to answer this.
   e. We should be using a 99% confidence interval, not a 95% confidence interval.

14. A race director for a local 10 kilometer "fun run" is trying to estimate the mean time it will take runners to complete the race. He told the chief of police that the mean time to finish the course should be under 60 minutes. The police chief was skeptical of this estimate. He randomly sampled 15 runners from the previous year's race and calculated a 95% confidence interval of (35 , 55) minutes based on their times.

   Does the confidence interval support the race director's claim?

   a. Yes, because the entire confidence interval falls below 60 as the director claims.
   b. No, the data don't support his claim. A minimum sample size of 30 is needed.
   c. Yes, because 95% of the runners will finish between 35 and 55 minutes.
   d. No, because the confidence interval is not centered at 60 minutes.
   e. No, because the confidence interval should be a 90% confidence interval.

15. The rates of return on 7 natural resources mutual funds are given below:

   14.75 15.01 16.95 18.07 14.81 15.59 17.86

   Calculate a 99% confidence interval for μ, the mean rate of return of natural resources mutual funds.

   a. (14.74 , 17.56)
   b. (14.23 , 18.07)
   c. (14.31 , 17.99)
   d. (14.12 , 18.18)
   e. (15.36 , 16.94)

16. Wildlife biologists conduct a pilot study of 153 deer taken by hunters and find 32 of them carrying ticks that test positive for Lyme disease. They want to create a 98% confidence interval to estimate the proportion of all deer that may carry such ticks. The sampling error (*SE*) in their confidence interval was 0.076. If they want to cut the sampling error in half, how many deer must they inspect?

   a. 589
   b. 674
   c. 620
   d. 593
   e. 634

17. You are studying the lengths of drool strings coming off of the jowls of St. Bernard dogs. Let μ be the mean length (in cm) of drool strings. You would like to test whether the mean length of the drool strings is longer than 5 inches.

   Which set of hypotheses listed below are you testing?

   a. H_0: $\mu = 5$ versus H_a: $\mu < 5$
   b. H_0: $\mu = 5$ versus H_a: $\mu \neq 5$
   c. H_0: $\mu > 5$ versus H_a: $\mu = 5$
   d. H_0: $\mu = 5$ versus H_a: $\mu > 5$
   e. H_0: $\mu \neq 5$ versus H_a: $\mu > 5$

18. A machine shop manager tracking daily sales would like to see if the mean daily sales (μ) at the shop is more than the $1250 needed to break even. They test the hypotheses

$$H_0: \mu = \$1,250$$
$$H_a: \mu > \$1,250$$

   After gathering the sample and making their conclusion, the manager decides to reject the null hypothesis and accept the alternative. Which statement below states the correct conclusion?

   a. We conclude that the mean daily sales is equal to the $1,250 needed to break even.
   b. We conclude that we've made a Type II error.
   c. We conclude that the mean daily sales is less than the $1,250 needed to break even.
   d. We conclude that we need a larger sample.
   e. We conclude that the mean daily sales is more than the $1,250 needed to break even.

19. Suppose we are looking at the salary of bank employees. We let μ be the mean salary of a bank worker. We wish to test that the mean salary is above $55,000. That is, we test

$$H_0: \mu = \$55{,}000$$
$$H_a: \mu > \$55{,}000$$

Suppose we do the hypothesis test and decide not to reject the null hypothesis. What type of error could we have made?

a. A Type I Error
b. A Type II Error
c. A Type III Error
d. We could make either a Type I error or a Type II error
e. We've made a correct decision

20. According to New Scientist (Jan. 2, 2002), a new thermal imaging camera that detects small temperature changes is now being used as a polygraph device. The United States Department of Defense Polygraph Institute (DDPI) claims the camera can correctly detect liars 75% of the times by monitoring the temperatures of their faces.

You feel that the camera doesn't work that well, and plan to use a hypothesis test to check. Let p be the true proportion of correctly identified liars. Give the null hypothesis for your hypothesis test.

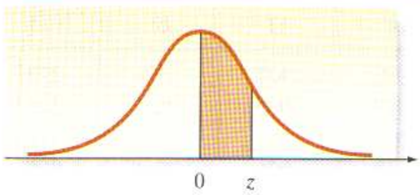
a. $H_0: p = 0.75$
b. $H_0: p < 0.75$
c. $H_0: \hat{p} = 0.75$
d. $H_0: \hat{p} < 0.75$
e. $H_0: p \neq 0.75$

21. **BONUS**. The following is a 98% confidence for p: (0.28,0.52). How large was the sample used to construct this interval?

a. n = 28
b. n = 77
c. n = 65
d. n = 34
e. n = 91

You have now completed Version 1 of Test #3.
Make sure that your NAME and SECTION NUMBER (columns L&M) are correctly bubbled in.
Check that the TEST VERSION is correct. You should have a "1" in Column K.
Finally, double-check that you bubbled in your answer sheet answers correctly.

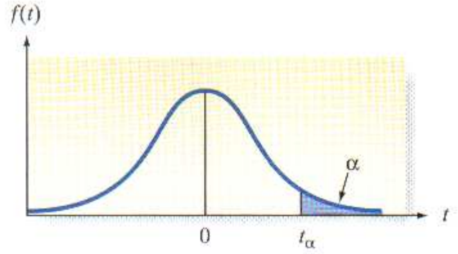
TABLE IV Normal Curve Areas



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	.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
3.1	.49903	.49906	.49910	.49913	.49916	.49918	.49921	.49924	.49926	.48829
3.2	.49931	.49934	.49936	.49938	.49940	.49942	.49944	.49946	.49948	.49950
3.3	.49952	.49953	.49955	.49957	.49958	.49960	.49961	.49962	.49964	.49965
3.4	.49966	.49968	.49969	.49970	.49971	.49972	.49973	.49974	.49975	.49976
3.5	.49977	.49978	.49978	.49979	.49980	.49981	.49981	.49982	.49983	.49983
3.6	.49984	.49985	.49985	.49986	.49986	.49987	.49987	.49988	.49988	.49989
3.7	.49989	.49990	.49990	.49990	.49991	.49991	.49992	.49992	.49992	.49992
3.8	.49993	.49993	.49993	.49994	.49994	.49994	.49994	.49995	.49995	.49995
3.9	.49995	.49995	.49996	.49996	.49996	.49996	.49996	.49996	.49997	.49997

Source: Abridged from Table I of A. Hald, *Statistical Tables and Formulas* (New York: Wiley), 1952. Reproduced by permission of A. Hald.

TABLE V Critical Values of *t*



Degrees of Freedom	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	$t_{.001}$	$t_{.0005}$
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

Source: This table is reproduced with the kind permission of the Trustees of Biometrika from E. S. Pearson and H. O. Hartley (eds.). *The Biometrika Tables for Statisticians,* Vol. 1, 3d ed., Biometrika, 1966.