STT 315 Practice Problems for Comprehensive Exam
Fall 2002

Answers are given at the end of this problem set. Use these problems *in addition to* the previous four exams, the CAPA homework, and the assigned exercises to study for the comprehensive exam during finals week.

1. Five percent of a company's accounts are in error. An auditor selects 10 of the accounts at random from the large set of accounts. What is the probability that at least one of the sample accounts will be in error?
   (a) .7689   (b) .4013   (c) .6415   (d) .3585   (e) .5987

2. Suppose that in a given area, 50% of the population is exposed to a Ford television commercial and 30% is exposed to a Ford radio commercial. Suppose that 20% of the population is exposed to both. What percentage of the population is exposed to neither commercial?
   (a) 50%   (b) 35%   (c) 40%   (d) 45%   (e) none of these

3. Suppose that a $100 bet on the number 7 in roulette has a 1/38 chance of winning. If you win, you get back your $100 plus another $3500 for a profit of $3500. If you lose, you lose your $100 for a profit of -$100. What is the expected profit from a $100 bet on the number 7?
   (a) 0   (b) -$3.55   (c) -$10.04   (d) -$5.26   (e) none of these

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Next two problems A chemical plant has a emergency alarm system for a given batch reaction. When an emergency situation exists, the alarm sounds with probability 0.90. When an emergency situation does not exist, the alarm system sounds with probability 0.08. Based on investigations and records, an emergency situation with the batch reaction is a rare event; it has probability 0.01.

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4. What is the probability that the alarm sounds for a batch reaction?
   (a) .01   (b) .03348   (c) .0534   (d) .0882   (e) none of these

5. Given that the alarm has just sounded, what is the probability that an emergency situation exists?
   (a) .1020   (b) .5000   (c) .1601   (d) .0225   (e) none of these

6. A carton of seven eggs has 5 good eggs and 2 bad eggs. If three eggs are selected at random to make a three-egg omelet, what is the probability that the sample has 2 good eggs and 1 bad egg?
   (a) 10/35   (b) 20/35   (c) .445   (d) 1/2   (e) none of these

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Next two problems Suppose that Z is a random variable with a standard normal distribution.

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7. $P(-1.32 < Z < -0.94) =$
   (a) 0.0802   (b) 0.2185   (c) 0.1632   (d) 0.1359   (e) none of these

8. For what value z is $P(-z < Z < z) = 0.2510$?
   (a) 0.25   (b) 0.42   (c) 0.68   (d) 0.32   (e) none of these

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Next three problems Security First Network Bank is the world's first Internet only bank. Market research firms are studying the operations of this bank to determine how the Internet banking industry of the future will affect the banking industry as a whole. Based on one study, it is believed that the total value of world banking activity on the Internet in the year 2002 can be modeled as a normal random variable with mean $200 billion and a standard deviation of $40 billion. Use this model to answer the following questions.

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9. What is the probability that total worldwide Internet banking volume in year 2002 will exceed $130 billion?
   (a) .4599   (b) .0401   (c) .5401   (d) .9599   (e) none of these

10. What is the probability that total worldwide Internet banking volume in year 2002 will be less than $180 billion?
    (a) .3085   (b) .8085   (c) .6344   (d) .1915   (e) none of these

11. What is the 95th percentile of this normal distribution in billions?
    (a) $247   (b) $281   (c) $266   (d) $259   (e) $276

12. For a normal random variable with mean 19,500 and standard deviation 400, find a point of the distribution such that the probability that the random variable will exceed this value is 0.02.
    (a) 16,100   (b) 20,300   (c) 18,700   (d) 21,400   (e) 22,500

13. Suppose a random sample of size $n = 400$ is to be selected from a large population that has mean 50 and standard deviation 10. What is the approximate probability that the sample mean will be between 49 and 50.5?
    (a) .95   (b) .68   (c) .99   (d) .92   (e) .82

14. Suppose a random sample of size $n = 100$ is to be selected from a dichotomous population with population proportion $p = 0.20$. What is the approximate probability that the sample proportion will be at least 0.18?
    (a) .48   (b) .95   (c) .88   (d) .80   (e) .69

Next two problems Below is a stem-and-leaf display of the ages in months of 51 children ranging in ages from 1 month to 38 months.

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0 | 1122334445556677888999
1 | 000122445566899
2 | 0123445567
3 | 1348
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15. What is the median age?
    (a) 12 months   (b) 10 months   (c) 9 months   (d) 11 months   (e) none of these

16. Find the 75th percentile of the data.
    (a) 21 months   (b) 20.75 months   (c) 19 months   (d) 20.25 months   (e) none of these

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Next two problems A random sample of size $n = 3$ is drawn from a normal distribution for the purpose of estimating the mean μ. Suppose that the sample values are 1, 2, 6.

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17. The sample standard deviation is
    (a) 4.01   (b) 4.36   (c) 3.32   (d) 2.65   (e) none of these

18. The 80% CI estimate of μ is
    (a) [0.50, 5.50]   (b) [0.12, 5.88]   (c) [0.27, 5.73]   (d) [-0.44, 6.44]   (e) none of these

19. A researcher carries out a study of a normal population and uses the z-interval estimate $\overline{X} \pm 1.17\sigma/\sqrt{n}$ to estimate the population mean μ. What is the confidence level of this interval?
    (a) 75.8%   (b) 65.8%   (c) 50.0%   (d) 71.4%   (e) none of these

20. If of 200 people, randomly selected from those with unusual names, 60 believe their name might have been a factor in career choice, give the 90% confidence interval for the population proportion who believe their name might have been a factor in career choice.
    (a) [.290, .310]   (b) [.204, .396]   (c) [.230, .370]   (d) [.247, .353]   (e) none of these

21. How many test runs of an automobile are required for determining its average miles-per-gallon (mpg) rating on the highway to within ±0.5 mpg with 95% confidence? The standard deviation of the population of miles per gallon is $\sigma = 5$
    (a) 144   (b) 225   (c) 322   (d) 97   (e) 385

22. Consider testing $H_0: p = 0.20$ vs $H_1: p \neq 0.20$. Suppose that the population proportion p is 0.25 and the random sample leads to the decision to Reject H_0. Then a
    (a) type I error has been made   (b) type II error has been made   (c) correct decision has been made

23. Consider testing $H_0: \mu = 100$ vs $H_1: \mu < 100$ in a normal population with unknown standard deviation. Suppose that a random sample of size $n = 9$ is drawn and the test statistic (t-statistic) is computed to be -1.598. The p-value is
(a) between .10 and .20   (b) between .05 and .10   (c) between .02 and .05   (d) between .01 and .02
(e) less than .01

24. Consider testing $H_0: \mu = 100$ vs $H_1: \mu \neq 100$ in a normal population with unknown standard deviation. Suppose that a random sample of size $n = 15$ is drawn and the test statistic is computed to be -2.507. The p-value is
(a) between .10 and .20   (b) between .05 and .10   (c) between .02 and .05   (d) between .01 and .02
(e) less than .01

25. Consider testing $H_0: p = 0.50$ vs $H_1: p \neq 0.50$. Suppose that a random sample of size $n = 400$ is drawn and the test statistic is computed to be 1.74. The p-value is
(a) .9591   (b) .4591   (c) .0818   (d) .0409   (e) .0500

26. Consider testing $H_0: p = 0.50$ vs $H_1: p < 0.50$. Suppose that a random sample of size $n = 200$ is drawn and the test statistic is 0.45. The p-value is
(a) .3264   (b) .1736   (c) .55   (d) .6736   (e) less than .001

27. A z-test is to be carried out at level $\alpha = .05$. If the p-value is 0.076, then H_0 is not rejected.
(a) True   (b) False

Next three problems Mellon Bank Corporation recently hired a team to analyze computer cathode ray tube (CRT) systems to see if the new choice of a CRT system would **increase** productivity. Suppose that the average production level at the bank, measured on a scale of 0 to 100, was known to be 80. The team tested a random sample of 25 employees using the new CRT and found that the mean productivity level in the sample was 81.0 and the sample standard deviation was 10.0. Using $\alpha = 0.05$, conduct the appropriate one-sided hypothesis test. (Assume the sample is from a normal population.)

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28. The value of the appropriate test statistic is
(a) 1.68   (b) 1.72   (c) 0.50   (d) 2.50   (e) none of these

29. The p-value is
(a) more than .10   (b) between .05 and .10   (c) between .025 and .05   (d) between .01 and .025   (e) between .005 and .01

Answers: 1(b); 2(c); 3(d); 4(d); 5(a); 6(b); 7(a); 8(d); 9(d); 10(a); 11(c); 12(b); 13(e); 14(e); 15(d); 16(a); 17(d); 18(b); 19(a); 20(d); 21(e); 22(c); 23(b); 24(c); 25(c); 26(d); 27(a); 28(c); 29(a).