

STA261 Exam II (Fall 2001)

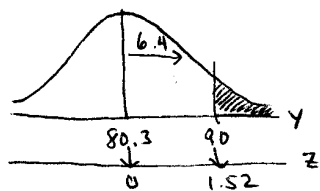
Name key Row: _____

Instructions: You must show all work to receive full credit, except in cases where calculator stat functions are used. Be sure your answers are in the context of the problems. Completeness and conciseness will benefit you. Point values in <>.

1. The historical percentage grade distribution in STA261 at Miami University over the years 1985-2000 follows an approximate normal distribution with mean $\mu = 80.3\%$ and SD $\sigma = 6.4\%$

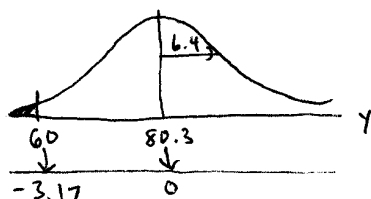
- a) Based on this empirical information, what is the probability that a randomly selected student currently enrolled in STA261 will:

- 1) receive an A (i.e. a score of at least 90.0%)? <8>



$$\begin{aligned} \Pr\{Y \geq 90\} &= \Pr\left\{\frac{Y-\mu}{\sigma} \geq \frac{90-80.3}{6.4}\right\} \\ &= \Pr\{Z \geq 1.52\} \\ &= 1 - 0.9357 = \underline{\underline{0.0643}} \end{aligned}$$

- 2) receive an F (i.e. a score less than 60.0%)? <8>



$$\begin{aligned} \Pr\{Y \leq 60\} &= \Pr\left\{\frac{Y-\mu}{\sigma} \leq \frac{60-80.3}{6.4}\right\} \\ &= \Pr\{Z \leq -3.17\} \\ &= \underline{\underline{0.0008}} \end{aligned}$$

- b) Twelve people sit in the front row of our class in 102 Bachelor. If they may be considered a random sample of all currently enrolled students in STA261, what is the probability that at most one of them will get an A in the class? <8>

Let $Y = \#$ out of 12 who receive A's. $Y \sim B(n=12, p=.0643)$

$$\begin{aligned} \Pr\{\text{at most one A}\} &= \Pr\{Y \leq 1\} = \Pr\{Y=0\} + \Pr\{Y=1\} \\ &= \frac{12!}{0!12!} (.0643)^0 (1-.0643)^{12} + \frac{12!}{1!11!} (.0643)^1 (1-.0643)^{11} \\ &= .4504 + .3714 = \underline{\underline{.8218}} \end{aligned}$$

2. A certain drug causes kidney damage in 1% of patients. Suppose the drug is to be tested on 50 patients. Find the probability that

- a) none of the patients will experience kidney damage. <8>

$Y = \#$ who experience kidney damage out of 50. $Y \sim B(n=50, p=.01)$

$$\Pr\{Y=0\} = \frac{50!}{0!50!} (.01)^0 (.99)^{50} = (.99)^{50} = \underline{\underline{0.605}}$$

- b) one or more of the patients will experience kidney damage. (Hint: use part a) to answer part b). <8>

$$\begin{aligned} \Pr\{Y \geq 1\} &= 1 - \Pr\{Y=0\} \\ &= 1 - 0.605 \\ &= \underline{\underline{.395}} \end{aligned}$$

3. The activity of a certain enzyme is measured by counting emissions from a radioactively labeled molecule. For a given tissue specimen, the counts in consecutive 10-sec time periods may be regarded as repeated independent observations from a normal distribution. Suppose the mean 10-sec count for a certain tissue specimen is $\mu = 1,200$ and the SD is $\sigma = 35$. For that specimen, define the following:

Y = a single 10-sec count

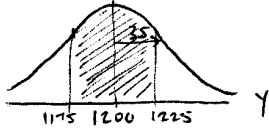
\bar{Y} = the mean of a sample of six 10-sec counts

a) Find $\Pr\{1,175 < Y < 1,225\}$. <10>

$$= \Pr\left\{\frac{1175 - 1200}{35} \leq \frac{Y - \mu}{\sigma} \leq \frac{1225 - 1200}{35}\right\}$$

$$= \Pr\{-0.71 \leq Z \leq 0.71\}$$

$$= .7611 - .2389 = \underline{.5222}$$

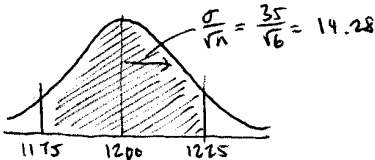


b) Find $\Pr\{1,175 < \bar{Y} < 1,225\}$. <10>

$$= \Pr\left\{\frac{1175 - 1200}{14.28} \leq \frac{\bar{Y} - \mu}{\sigma/\sqrt{n}} \leq \frac{1225 - 1200}{14.28}\right\}$$

$$= \Pr\{-1.75 \leq Z \leq 1.75\}$$

$$= .9599 - .0401 = \underline{.9198}$$



- c) Compare your answers from parts a) and b). Does the comparison indicate that counting for one minute and dividing by six would tend to give a more precise result than merely counting for a single 10-sec time period? How? <6>

Yes; because we increase the chance of estimating μ to within ± 25 from 52.22% to 91.98% by doing so.

4. Empty seats on flights cause airlines to lose revenue. Delta Airlines wants to estimate its average number of occupied seats per flight on its Boeing 727 aircraft used on a particular Cincinnati to Buffalo route. The eventual goal is to see if it is economically feasible to continue to offer this route; so, Delta checks the passenger records of 10 randomly chosen Cincinnati to Buffalo Delta flights over the past six months. The number of occupied seats is noted for each of the sampled flights and are given below:

121 109 143 119 98 152 143 128 130 162

- a) Estimate the true mean number of occupied seats on this particular Cincinnati to Buffalo Delta route, using a 95% confidence level. Interpret the CI in context. <10>

$$\bar{y} \pm t_{.025} \left(\frac{s}{\sqrt{n}}\right) \rightarrow 130.5 \pm 2.262 \left(\frac{19.76}{\sqrt{10}}\right) \rightarrow 130.5 \pm 14.13$$

$$\rightarrow (116.36, 144.6)$$

We can be 95% confident that the true mean # of occupied seats on this Delta route is between 116.36 to 144.6 seats.

- b) A Boeing 727 has a seating capacity of 168 passengers. In order to justify the continued offering of the Cincinnati to Buffalo route, management requires that the average occupancy on a flight be at least 60% of capacity. Based on your CI, can you confidently recommend that the route continue to be offered? Why or why not? <6>

Yes; because we are confident that at least 116 seats, or 69%, are occupied on avg.

Instructions: Clearly write the letter corresponding to the most appropriate response in the space provided. Each problem is worth 3 points.

- C 5. A national sample survey in July 1994 examined public opinion in the period before the 1994 elections. The survey interviewed 3,800 people age 18 and older nationwide by telephone. One question asked was whether they agreed with this statement: "Some people say we should have a third major political party in this country in addition to the Democrats and Republicans." 56% of the people surveyed agreed that we should have a third party. The number 56% is a
- a] parameter. b] margin of error. c] statistic. d] mean.
- C 6. Refer to problem 5. The news article that reports the poll results says, "The margin of error is plus or minus two percentage points." This means that the pollsters can be:
- a] absolutely sure that between 54% and 58% of all Americans think we should have a third party.
 b] reasonably confident that 53% of all Americans think we should have a third party.
 c] reasonably confident that between 54% and 58% of all Americans think we should have a third party.
 d] reasonably confident that between 54% and 58% of the 3,800 people interviewed think we should have a third party.
- B 7. "Congress recently passed a ban on the sale of assault weapons. Now there is a move to repeal that ban. Do you agree that the ban on sale of assault weapons should be repealed?" You ask that question to a random sample of 1000 adults in Texas (population 18 million people) and to a separate random sample of 1000 adults in Indiana (population 5.7 million people). You make two statements of equally high confidence about the percents of all adults in both states that agree. Your margin of error for Indiana is:
- a] smaller than in Texas, because there are fewer people in Indiana.
 b] the same as in Texas, because the two samples are the same size.
 c] the same as in Texas, because the confidence levels for the two statements were equal.
 d] may be either smaller or larger than in Texas, because the sample result varies due to chance.
 e] smaller, because everything is bigger in Texas.
- C 8. Consider the binomial distribution example we did in class, where we measure $Y =$ the number of correct answers on a 5-question, 4-choice multiple choice test, where a test taker randomly guesses on every question. Which one of the following changes would destroy the binomial setting for this problem?
- a] Make all the questions 3-choice instead of 4-choice.
 b] Measure the number of incorrect answers instead of the number of correct answers.
 c] Make some of the questions 3-choice, but leave some of them as 4-choice.
 d] Add more 4-choice questions.
 e] Measure the proportion of correct answers instead of the actual count of correct answers.
- B 9. The Central Limit Theorem essentially states that:
- a] sample means will be in the center of the distribution, as long as the distribution is normal.
 b] sample means will behave according to an approximate normal distribution, as long a n is large enough.
 c] the sample size n will behave according to an approximate normal distribution, as long a y -bar is large enough.
 d] sample means will always behave according to an approximate normal distribution, because the Central Limit Theorem is a mathematical rule and there are no exceptions.
- B 10. The report of a sample survey of 1,014 adults reported in the November 28, 1997 *New York Times* says, "With 95% confidence, between 9% and 15% of all Americans expect to spend more money on gifts this year than last year." The phrase "95% confidence" means:
- a] 95% of all Americans will spend between 9% and 15% of what they spent last year.
 b] the method used to get this particular result would, over repeated sampling, produce results which capture the true percentage 95% of the time.
 c] between 9% to 15% of all Americans will spend 95% of what they spent last year.
 d] there is a 95% chance that the percent who expect to spend more is between 9% and 15%.