STA 200 Fall 2009 Name____________________

Lab 9 Section____________________

The purpose of this activity is for you to identify what information is given and what you need to find, and then to compute certain quantities for a normally distributed variable.

For questions 1 to 5 and 7 to 9,

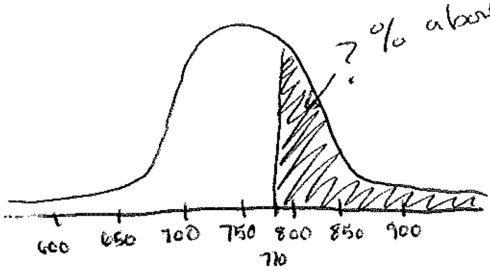
- draw a normal curve,
- label the information given and shade in the area of interest, and
- use Table B in your textbook to find the answer.

Use the following situation to answer questions 1 to 6.

$SS = \frac{\text{value} - \text{mean}}{\text{stdev}}$

Suppose that a state Board of Education has decided to classify elementary schools according to how well their students do on a new Best Educational Achievement Test. The test will be given to all students in grades 2 through 5. Previous data suggests that the mean for all schools that take the BEAT is 750 with a standard deviation of 50.

1. What percent of the schools will score above 770 on the test?



step1: we need a standard score for 770

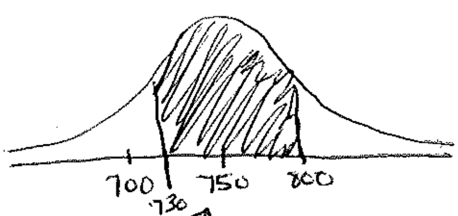
$SS = \frac{770 - 750}{50} = \frac{20}{50} = .4$

step2: we need percentile for our standard score according to Table B

SS = .4 means 65.54% below 770

step3: if 65.54% below 770, then 100 − 65.54% = $\boxed{34.46\% \text{ above } 770}$

2. What percent of the schools will score between 730 and 800 on the test?

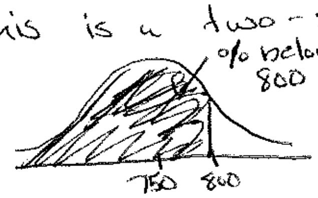


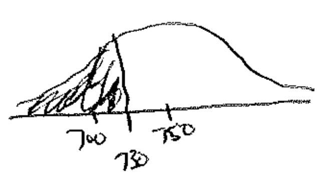
84.13% below 800

minus 34.46% below 730

equals 49.67% between 730 & 800

This is a two-stage problem





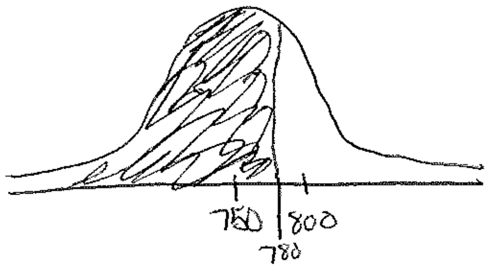
$SS = \frac{800 - 750}{50} = 1$

Table B says SS = 1 means 84.13% below 800

$SS = \frac{730 - 750}{50} = \frac{-20}{50} = -.4$

Table B says SS = −.4 means 34.46% below 730

3. If your school scores 780 on the test, your school did better than what percent of all schools taking the test?

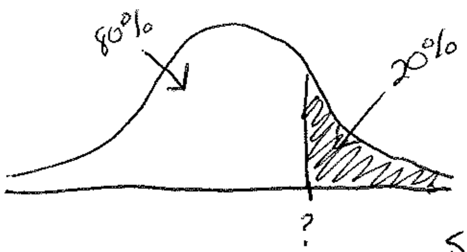


$$SS = \frac{780 - 750}{50} = \frac{30}{50} = .6$$

$\Rightarrow$ 72.58% below 780

so your school did better than 72.58% of the other schools

4. Schools that score in the top 20% are labeled excellent. What score does a school need to be labeled excellent?

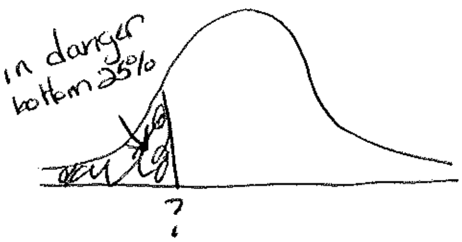


We're looking for a score that separate to top 20% from the bottom 80%. Bottom 80% just means 80% of scores are less than the unknown (?) score. In table B, 80% below is close to 78.81% below

$SS = .8 = \frac{? - 750}{50}$ OR $? = 750 + (.8) \times 50 = 790$

$\boxed{\text{790 or above a school is excellent}}$

5. Schools in the bottom 25% are labeled "in danger". What score does a school need to be labeled "in danger"?

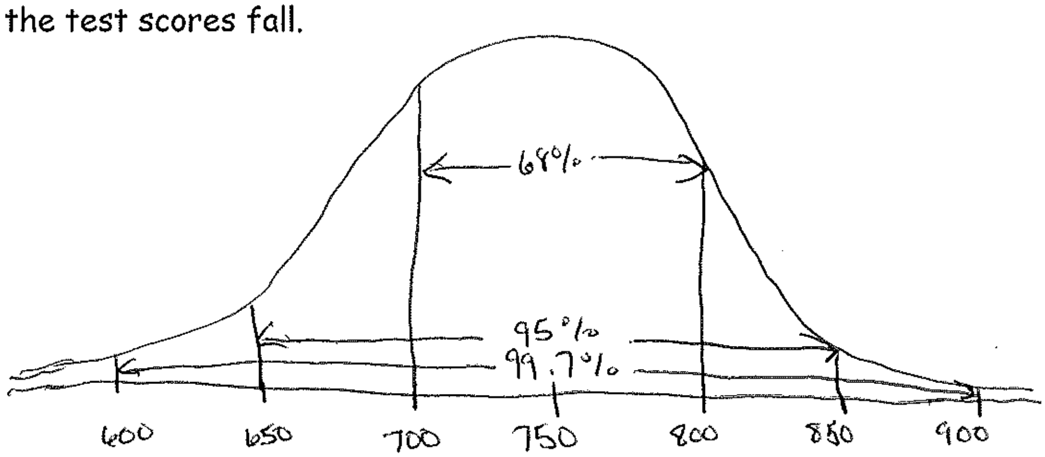


25% below a score is close to 24.20% below. This is $SS = -.7$

$? = 750 + (-.7) \times 50 = 750 - 35 = 715$

$\boxed{\text{a school below 715 is in danger}}$

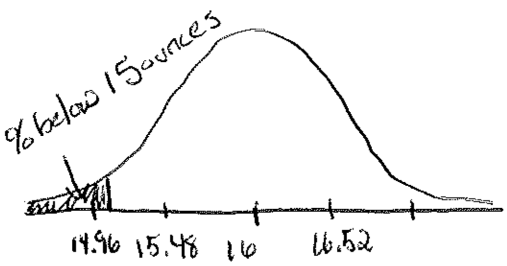
6. The Board of Education wants a nice graphic to use when explaining these test scores to the public. They'd like a picture that would show people where there school scored in relation to other schools. Draw a normal curve that shows the intervals of test scores into which 68%, 95%, and 99.7% of the test scores fall.



Use the following situation to answer questions 7 to 9.

A machine at a factory fills "16-ounce" cans of coffee. The fill amounts (in ounces) are approximately normally distribution with a standard deviation of 0.52 ounces. The supervisor chooses the mean fill level and can change that amount at any time.

7. Suppose the fill level is set so that the average can holds 16 ounces. In one day 4,000 cans are filled. How many of those cans hold less than 15 ounces?

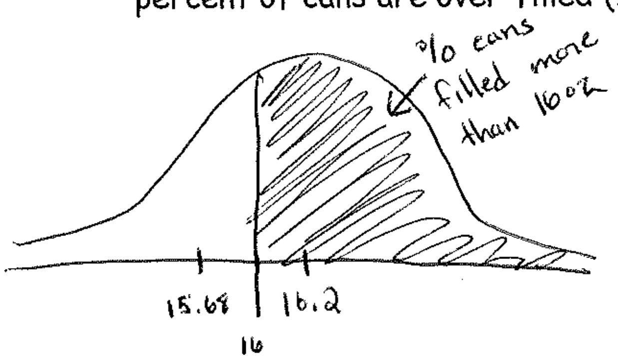


$SS = \frac{15-16}{.52} = -1.92 \approx -1.9$ (look up in Table B)

$\boxed{\text{so } 2.87\% \text{ of cans hold less than } 15 \text{ oz}}$

$\boxed{2.87\% \text{ of } 4000 \text{ is } .0287 \times 4000 = 115 \text{ so } 115 \text{ cans of } 4000 \text{ have } 15 \text{ oz or less}}$

8. Suppose the fill level is set so that the average can holds 16.2 ounces. What percent of cans are over-filled (hold more than 16 ounces)?

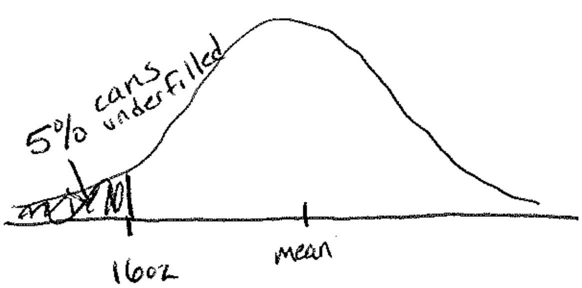


$SS = \frac{16-16.2}{.52} = -.38$ close to $-.4$

$\Rightarrow$ Table B says 34.46% would be less than 16 oz

$\boxed{\Rightarrow 100 - 34.46 = 65.54\% \text{ would hold more than } 16 \text{ oz}}$

9. At what level should the mean fill amount be set, so that only 5% of the cans are under-filled (have less than 16 ounces)?



5% underfilled has ~~std~~ score of -1.6 in Table B (goes with 5.48% below)

$SS = \frac{16 - \text{mean}}{.52} = -1.6$

OR

$16 = \text{mean} + (-1.6) \times .52 = \text{mean} - .832$

$\boxed{\Rightarrow \text{mean} = 16 + .832 = 16.832}$

Use the following situation to answer questions 10 to 12.

According to the data about U.S. Presidents' ages at inauguration, the mean age at inauguration is 54.8 with a standard deviation of 6.2.

10. Assuming that this data is normally distributed, use the empirical rule to find the interval into which we expect 95% of the ages to fall.

+/- 2 standard deviations

$54.8 - 2 \times 6.2$ to $54.8 + 2 \times 6.2$

42.4 to 67.2

11. List the inauguration ages for any president beyond 2 standard deviations from the mean (in either direction). Identify these presidents by name (see list on the next page).

42, 68, 69

12. a) How many presidents' inauguration ages fall within 2 standard deviations of the mean?

40

b) What percent of the inauguration ages are within 2 standard deviations of the mean?

93%

c) Is this close to what you would expect based on the empirical rule?

yes 93% is close to 95%