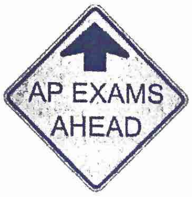
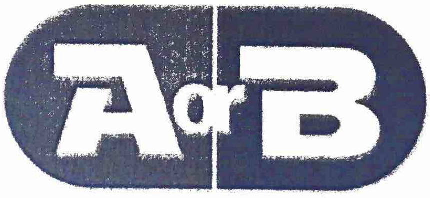
Lesson 10.2: Day 1: Is one form of the AP exam harder?





Last year, East Kentwood High School had 30 students take the AP Statistics exam. We were informed later that the College Board gave two forms of the exam, which were randomly assigned to the students. Here are the results:

Form A	3	3	3	3	4	4	4	4	5	5	5	5	5	5	5
Form B	2	2	3	3	4	4	4	4	4	5	5	5	5	5	5

Mean score Form A ($\bar{x}_A$) ? 4.20 Mean score Form B ($\bar{x}_B$) ? 4.00

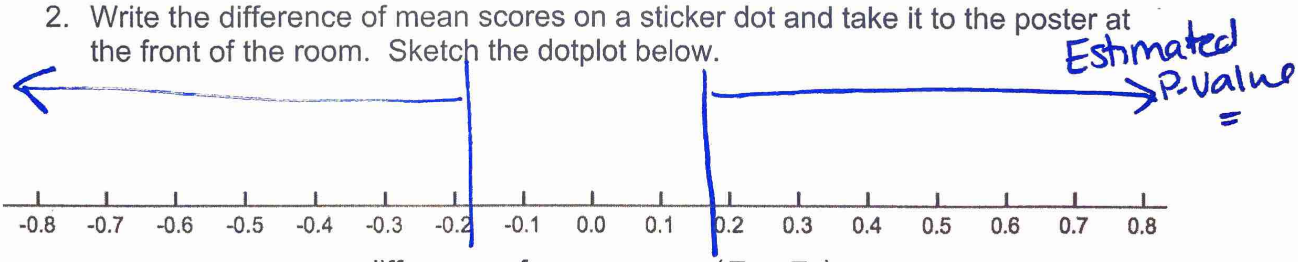
What is the difference in means $\bar{x}_A - \bar{x}_B$? 4.20-4.00 = 0.20

Assume the two forms are the same difficulty, so if Doug scored a 5 on Form A, he would also score a 5 on Form B. In other words, Doug is a 5 no matter which form he is randomly assigned.

1. The 30 AP scores from the class are written on 30 cards. Randomly assign half of the students to get Form A and the other half to get Form B. What is the difference in mean scores for this random assignment?

$\bar{x}_A$ = 3.95 $\bar{x}_B$ = 4.25 $\bar{x}_A - \bar{x}_B$ = -.30

2. Write the difference of mean scores on a sticker dot and take it to the poster at the front of the room. Sketch the dotplot below.



difference of mean scores ($\bar{x}_A - \bar{x}_B$)

3. East Kentwood had a difference of mean scores of 4.20 – 4.0 = 0.2. Is this outcome surprising if we assume both forms are the same difficulty? Explain.

No, assuming both forms are the same difficulty there is about a ____ probability of getting a difference of sample means of 0.2 or greater purely by chance.

4. Based on the simulation, do we have convincing evidence that one form of the exam is harder? Explain.

No, this result is not surprising (more than 5%) so we do not have convincing evidence that one form was harder.

Lesson 10.2 Day 1: Sampling Distribution for a Difference in Means

Important ideas:

LT#1 Shape center & spread of Sampling dist. of $\bar{x}_1 - \bar{x}_2$

Shape: Both samples meet:
Normal: ① Pop is Normal
② $n \geq 30$ CLT
③ No strong skew or outliers

Center:
$\mu_{\bar{x}_1-\bar{x}_2} = \mu_1 - \mu_2$

Spread:
$\sigma_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$

Check Your Understanding

How tall? The heights of young men follow a Normal distribution with mean $\mu_m = 69.3$ inches and standard deviation $\sigma_m = 2.8$ inches. The heights of young women follow a Normal distribution with mean $\mu_w = 64.5$ inches and standard deviation $\sigma_w = 2.5$ inches. Suppose we select independent SRSs of 16 young men and 9 young women and calculate the sample mean heights $\bar{x}_m$ and $\bar{x}_w$.

(a) What is the shape of the sampling distribution of $\bar{x}_m - \bar{x}_w$? Why?

Apporoximatcly normal. Both the men & women populations are approximately normal.

(b) Find the mean of the sampling distribution of $\bar{x}_m - \bar{x}_w$.

$\mu_{\bar{x}_1-\bar{x}_2} = \mu_1 - \mu_2 = 69.3 - 64.5 = 4.8$

(c) Calculate and interpret the standard deviation of the sampling distribution of $\bar{x}_m - \bar{x}_w$.

$\sigma_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} = \sqrt{\frac{2.8^2}{16} + \frac{2.5^2}{9}} = 1.088$

The difference in sample means typically varies by 1.088 from the true difference in means of 4.8.