Name KEY

Algebra 2: 11.5 Margin of Error – Guided Notes

* Gathering data for an *entire* population can be quite challenging (and expensive). s a result, studies often rely on samples to provide statistic (proportions, means, medians, etc.) that they can use to estimate corresponding population parameters.

Ex. Heights of High School Students

- Sample of 200 students finds the avg height to be 63 in.
- can use sample statistics to estimate pop. parameter

Ex. The table below contains sample data for a 6-sided die rolled 30 times.

4	1	6	4	2	6
6	1	6	6	2	2
4	4	5	5	2	1
4	5	2	1	3	2
3	6	6	3	1	1

sample finds 2 rolled $\frac{6}{30} = 20\%$

can estimate that any 6 sided die rolled 30 times yields a 2 20%.

* The accuracy of these estimates depends on the size of the sample and how well the sample represents the population. The greater the size of the sample, the closer the statistic should be to the population parameter being estimated.

Ex: Free Throw Accuracy (see textbook, pg. 584)

mpling Distribution:

A sampling distribution is a distribution made up of sample statistics (such as means or proportions) from different samples of the same population.

- As the number of samples increases, the shape of the sampling distribution begins to look like a normal distribution, and the distribution will more accurately reflect the population parameter.

* **Recall:** The Empirical Rule states that 95% % of the values in a normal distribution fall within 2 Standard deviations of the mean.

* So, it follows that 95 % of all sample results fall within 2 standard deviations of the population parameter being evaluated.

Margin of Error:

* The margin of error gives the maximum expected difference between the sample result and the population parameter.

$$MOE = \frac{\pm 2\sigma}{\sqrt{n}}$$

σ = population standard deviation
n = sample size

* We will be using MOE to identify a range of reasonable means.

* A "reasonable mean" is a sample mean that is within the range indicated by the MOE.

Ex. The College Board recently reported that the mean score on the SAT mathematics exam is 508, with standard deviation of 121. Washington High believes that its seniors score considerably higher than the national average, so the school randomly sampled scores from 200 seniors, finding a mean score of 550. Is Washington High correct in its belief?

a. Calculate the margin of error for the sample's SAT data.

$$MOE = \pm \frac{2(121)}{\sqrt{200}} = \pm 17.111$$

95% of all samples of size 200 will have means w/i 17 pts of 508

b. Find the range of reasonable means for SAT scores with samples of size 200.

$508 \pm 17 = 491$, 525

Its reasonable to have a

c. Is Washington High correct?

Yes their sample mean is above the range of reasonable means

d. Suppose the sample size was decreased by half. How does that affect the margin of error?

$$MOE = \pm \frac{2(121)}{\sqrt{100}} = \pm 24.2$$

MOE increased by $\sqrt{2}$ when sample size dec by 1/2

e. Suppose the sample size was decreased to a quarter. How does that affect the margin of error?

$$MOE = \pm \frac{2(121)}{\sqrt{50}} = 34.223$$

MOE increased by $\sqrt{4} = 2$ when sample size dec by 1/4

f. Suppose the sample size was doubled. How does that affect the margin of error?

$$MOE = \pm \frac{2(121)}{\sqrt{400}} = 12.1$$

MOE decreased by $\sqrt{1/2}$ when sample increased by 2

Ex. The mean distance all students live from Issaquah High School is 2.8 miles, with a standard deviation of 0.4 miles. A sample of 40 IHS students reports a mean distance of 1.3 miles.

a. Calculate the margin of error for the sample's distance data.

$$MOE = \pm \frac{2(0.4)}{\sqrt{40}} = \pm .126$$

b. Find the range of reasonable mean distances with samples of size 40.

$2.8 \pm 0.126 = 2.674$, 2.926

It is reasonable to expect a min dist of 2.674 & max of 2.926 miles from school

c. Does the sample accurately reflect the student body at IHS? Why or why not?

No b/c sample mean is a lot lower than reasonable mean