Suppose that a recent study found that in 293 randomly selected cases in which the defendant was sentenced to death and the sentence was not later reduced to life without parole it was found that 12 of these cases were eventually overturned due to the defendant being exonerated (shown to be innocent). Construct a 95% confidence interval for the true proportion of all such cases in which the defendant would eventually be shown to be innocent. (Values based on the paper *Rate of false conviction of criminal defendants who are sentenced to death* by Samuel R. Gross, et.al. in the Proceedings of the National Academy of the Sciences of the United States of America, May 2014.) Please keep all work on the front of the quiz.

1) **Parameter**: p is the proportion of all defendants sentenced to death that would eventually be shown to be innocent

2) **Conditions**: We have independent, random observations from a binomial experiment, and there are enough trials for us to use the Central Limit Theorem. Since $n \cdot p \approx 12 \geq 5$ and $n \cdot (1 - p) \approx 281 \geq 5$ we are ok with the number of trials. The other assumptions seem reasonable.

3) **Point Estimate**:
$$\hat{p} = \frac{12}{293} = 0.04096$$

4) **Margin of Error**:
$$Z \cdot \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}} = 1.960 \cdot \sqrt{\frac{0.04096(1 - .04096)}{293}} = 0.0226944988$$

5) **Confidence Interval**:
$$0.04096 \pm 0.0226944988 = (0.0636544988, 0.0182655012)$$

6) **Conclusion**: We are 95% confident that the proportion of all defendants sentenced to death that would eventually be shown to be innocent is between 0.0183 and 0.0637.