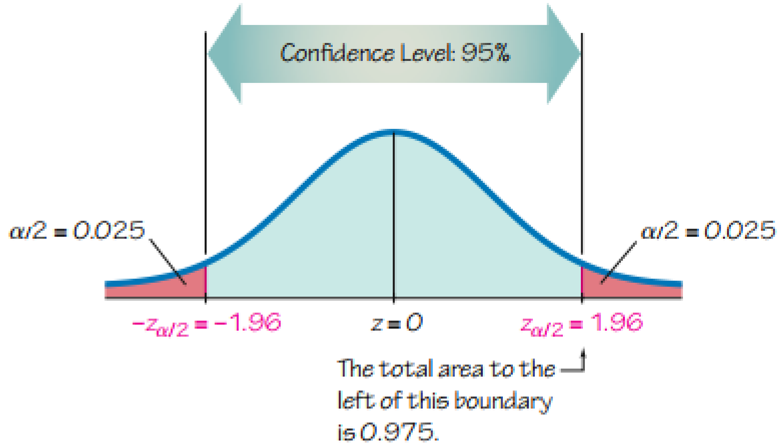

Figure 7-3 Finding $z_{\alpha/2}$ for a 95% Confidence Level

Example 2 showed that a 95% confidence level results in a critical value of $z_{\alpha/2} = 1.96$. This is the most common critical value, and it is listed with two other common values in the table that follows.

Confidence Level	α	Critical Value, $z_{\alpha/2}$
90%	0.10	1.645
95%	0.05	1.96
99%	0.01	2.575

Margin of Error

When we collect sample data that result in a sample proportion, such as the Pew Research Center poll given in Example 1, we can identify the sample proportion $\hat{p}$. Because of random variation in samples, the sample proportion $\hat{p}$ is typically different from the population proportion p. The difference between the sample proportion and the population proportion can be thought of as an error. We now define the *margin of error E* as follows.

DEFINITION When data from a simple random sample are used to estimate a population proportion p, the **margin of error,** denoted by ***E,*** is the maximum likely difference (with probability $1 - \alpha$, such as 0.95) between the observed sample proportion $\hat{p}$ and the true value of the population proportion p. The margin of error E is also called the *maximum error of the estimate* and can be found by multiplying the critical value and the standard deviation of sample proportions, as shown in Formula 7-1.

Formula 7-1 $$E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$ margin of error for proportions

For a 95% confidence level, $\alpha = 0.05$, so there is a probability of 0.05 that the sample proportion will be in error by more than E. This property is generalized in the following box.