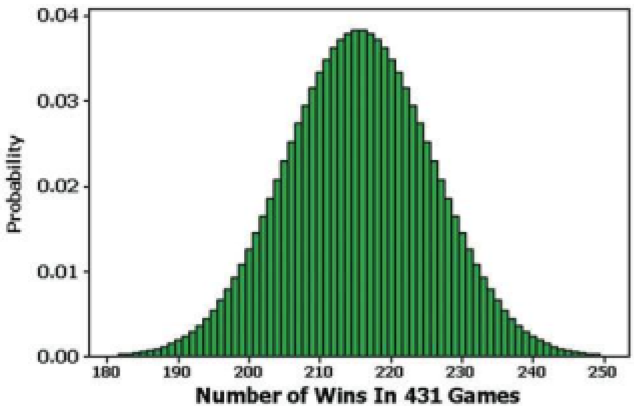
distribution that is graphed in the accompanying Minitab display. The graph shows the probability for each number of wins from 180 to 250. (The other possible numbers of wins have probabilities that are very close to 0.) See how the graph of the binomial probabilities is close to being a normal distribution. This graph suggests that we can use a normal distribution to approximate the binomial distribution.

MINITAB



Normal Distribution as an Approximation to the Binomial Distribution

Requirements

1. The sample is a simple random sample of size n from a population in which the proportion of successes is p, or the sample is the result of conducting n independent trials of a binomial experiment in which the probability of success is p.
2. $np \geq 5$ and $nq \geq 5$.

Normal Approximation

If the above requirements are satisfied, then the probability distribution of the random variable x can be approximated by a normal distribution with these parameters:

- $\mu = np$
- $\sigma = \sqrt{npq}$

Continuity Correction

When using the normal approximation, adjust the discrete whole number x by using a *continuity correction* so that x is represented by the interval from $x - 0.5$ to $x + 0.5$.

Note that the requirements include verification of $np \geq 5$ and $nq \geq 5$. The minimum value of 5 is common, but it isn't an absolutely rigid value, and a few textbooks use 10 instead. This requirement is included in the following procedure for using a normal approximation to a binomial distribution.

Procedure for Using a Normal Distribution to Approximate a Binomial Distribution

1. Verify the two preceding requirements. (If these requirements are not both satisfied, then you must use computer software, or a calculator, or Table A-1, or calculations using the binomial probability formula.)