Shapiro - Wilk test for Normality

Rationale: Assess whether a sample has been generated by a normal distributio by comparing its distribution to a theoretical normal distribution.

Ex: $X_1, X_2, \dots, X_n$, a sample. The test statistic (W) is:

$$W := \left(\sum_{i=1}^{n} a_i X_i\right)^2 \Big/ \sum_{i=1}^{n} (X_i - \overline{X})^2$$

a_i: are coefficients (constants) derived from moments of the order statistics from the appropriate Normal distr.
X_i: are the ordered sample values $(X_{(1)}, X_{(2)}, \dots, X_{(n)})$
$\overline{X}$ is the sample mean

For large samples W becomes W' as:

$$W' := \frac{\left(\sum_{i=1}^{n} b_i X_i\right)^2}{\sum_{i=1}^{n} (X_i - \overline{X})^2 \Sigma' b_i^2}$$

with $b_i = \Phi^{-1}\left(\frac{i}{n+1}\right)$ Φ is the $N(0,1)$ distr. function

see: Shapiro and Francia, 1972