

EXAMPLE 27.2 The V test for circular uniformity under the alternative of nonuniformity and a specified mean direction.

H_0 : The population is uniformly distributed around the circle (i.e., $H_0: \rho = 0$).

H_A : The population is not uniformly distributed around the circle (i.e., $H_A: \rho \neq 0$), but has a mean of 90° .

| a_i (deg) | $\sin a_i$ | $\cos a_i$ |
|-------------|---------------------------|----------------------------|
| 66 | 0.91355 | 0.40674 |
| 75 | 0.96593 | 0.25882 |
| 86 | 0.99756 | 0.06976 |
| 88 | 0.99939 | 0.03490 |
| 88 | 0.99939 | 0.03490 |
| 93 | 0.99863 | 0.05234 |
| 97 | 0.99255 | 0.12187 |
| 101 | 0.98163 | 0.19081 |
| 118 | 0.88295 | 0.46947 |
| 130 | 0.76604 | 0.64279 |
| $n = 10$ | $\sum \sin a_i = 9.49762$ | $\sum \cos a_i = -0.67216$ |

$$Y = \frac{9.49762}{10} = 0.94976$$

$$X = -\frac{0.67216}{10} = -0.06722$$

$$r = \sqrt{(-0.06722)^2 + (0.94976)^2} = 0.95213$$

$$\sin \bar{a} = \frac{Y}{r} = 0.99751$$

EXAMPLE 27.2 (continued)

$$\cos \bar{a} = \frac{X}{r} = -0.07060$$

$$\bar{a} = 94^\circ.$$

$$R = (10)(0.95213) = 9.5213$$

$$V = R \cos(94^\circ - 90^\circ)$$

$$= 9.5213 \cos(4^\circ)$$

$$= (9.5213)(0.99756)$$

$$= 9.498$$

$$u = V \sqrt{\frac{2}{n}}$$

$$= (9.498) \sqrt{\frac{2}{10}}$$

$$= 4.248$$

Using Appendix Table B.35, $u_{0.05, 10} = 1.648$. Reject H_0 . $P < 0.0005$.