

## Answer on Question #76898 – Math – Statistics and Probability

### Question

Find the nearest neighbor statistic when  $n$  points are equidistant from one another on the circumference of a circle with a radius  $r$ , and there is one additional point located at the center of the circle. Assume that travel between neighboring points on the circumference can only occur along the circumference. Note that you can break the solution into two parts - one where the distance between neighboring points along the circumference is less than  $r$ , and the other where the distance is greater than or equal to  $r$ .

### Solution

The nearest neighbor statistic:

$$c = \frac{\bar{d}_0 - \bar{d}_E}{SE}$$

where  $\bar{d}_0$  is mean of observed nearest neighbor distances:

$$\bar{d}_0 = \frac{\sum dist}{n} = \frac{2\pi r}{n}$$

$\bar{d}_E$  is expected mean of nearest neighbor distances:

$$\bar{d}_E = \frac{0.5}{\sqrt{n/A}} = \frac{0.5}{\sqrt{n/\pi r^2}} = \frac{0.5r\sqrt{\pi}}{\sqrt{n}}$$

$SE$  is the standard error of the mean of nearest neighbor distances:

$$SE = \frac{0.26136}{\sqrt{n^2/A}} = \frac{0.26136r\sqrt{\pi}}{n}$$

Then:

$$c = \frac{\frac{2\pi r}{n} - \frac{0.5r\sqrt{\pi}}{\sqrt{n}}}{\frac{0.26136r\sqrt{\pi}}{n}} = \frac{2\sqrt{\pi}}{0.26136} - \frac{0.5\sqrt{n}}{0.26136} = 13.56 - 1.91\sqrt{n}$$

If the distance between neighboring points along the circumference is less than  $r$ :

$$n = 2 \div 6$$

$$c = 10.86 \div 8.88$$

If the distance between neighboring points along the circumference is greater than or equal to  $r$ :

$$n > 6$$

$$c < 8.88$$