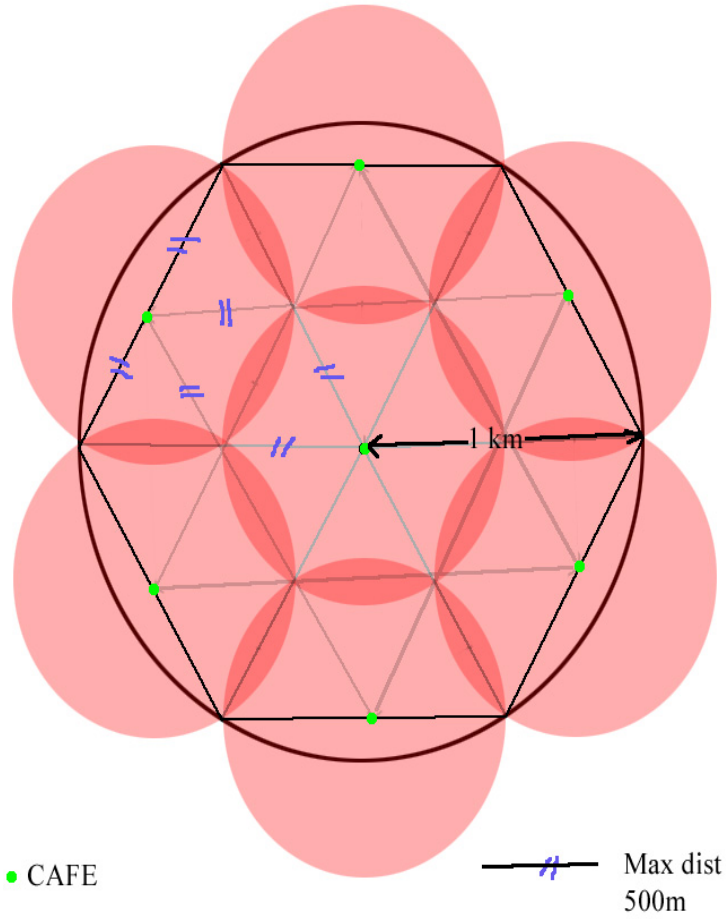
The new campus of Watermellon University is a perfect disk of radius 1km. The Moonshinebucks Co. plans to open 7 coffee shops. Where do they have to be placed in order to minimize the maximum (straight-line) distance that a person anywhere on the campus has to walk to get a regular dose of caffeine?

Solution The minimum solution is to place the 7 coffee shops as indicated in the diagram below. In which case the maximum distance to a shop is .5km.



We must now show that one cannot do better than .5km. Suppose that we can cover the unit disk with 7 disks of radius r where $r < 1/2$. Observe first that a disk of radius r can only cover $2\sin^{-1} r$ of the circumference of the disk. But $r < 1/2$ implies that $\sin^{-1} r < \pi/6$ and therefore all 7 of the small disks must touch the boundary of the unit disk. But then the center is not covered, contradiction.

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