Describe an algorithm to accept as input a positive integer $\lambda \geq 3$ and an adjacency array $E$ of a directed graph,

$$E[i, j] = \begin{cases} 1, & \text{if } v_i v_j \in E \\ 0, & \text{if } v_i v_j \notin E \end{cases}$$

which will return the number of cycles of length exactly $\lambda$ in the graph. Your algorithm should work in time $O\left(\lambda n^3\right)$. So, for example, your algorithm would return 2 for $\lambda = 4$ and digraph

SOLUTION: 

$$A \leftarrow I \quad O\left(n^2\right)$$

$$\text{for } i \leftarrow 1 \text{ to } \lambda \text{ do } A \leftarrow A^* E \quad O\left(\lambda n^3\right)$$

$$\text{NumCycles} \leftarrow 0 \quad O\left(1\right)$$

$$\text{for } i \leftarrow 1 \text{ to } n \text{ do}$$

$$\text{NumCycles} \leftarrow \text{NumCycles} + A[i, i] \quad \Theta\left(n\right)$$

$$\text{return } \text{NumCycles} / \lambda \quad O\left(1\right)$$

We note that each cycle is counted $\lambda$ times, once for starting at each vertex on the cycle.