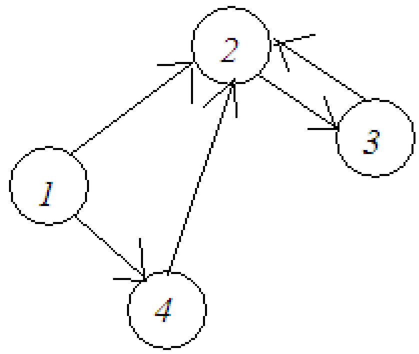
Quiz 9 Name________________________________

A *nontrivial cycle* is a cycle of at least two vertices. We want an algorithm to accept as input a digraph $G=(V,E)$ and a vertex $w \in V$. Your algorithm should decide whether *w* lies on a nontrivial cycle of *G*. So, for graph



if *w*=1 then your algorithm should return false, and if *w*=2 then your algorithm should return true. Your algorithm should work in worst-case time in $O(n^4)$.

<u>SOLUTION</u>: After computing array $E^+ = E \vee \ldots \vee E^{n-1}$, vertex v_i lies on a nontrivial cycle if and only if there is a nontrivial path to itself. That is, if $E^+[i,i]=1$.

for $i \leftarrow 2$ **to** *n*-1 **do**	
$E^i \leftarrow E * E^{i-1}$	$O(n^4)$
$E^+ \leftarrow E$	$O(n^2)$
for $i \leftarrow 2$ **to** *n*-1 **do**	
$E^+ \leftarrow E^+ \vee E^i$	$O(n^3)$
if $E^+[i,i]=1$ **then return** true **else return** false	$O(1)$

By the way, this problem can be solved in time in $O(m)$ using depth first search, which we did not cover in this class. You do a dfs from v_i and you return true **if there is a back edge to the root v_i, and** false **otherwise.**