## Problem

Define *UCYCLE* = { $\langle G \rangle$ | G is an undirected graph that contains a simple cycle}. Show that *UCYCLE* ? L. (Note: G may be a graph that is not connected.)

## Step-by-step solution

**Step 1** of 3

The class $L$: L is the class of languages that are decidable in logarithmic space on a deterministic truing machine.

That is, $L = SPACE(\log n)$

Given language is

$UCYCLE = \{ \langle G \rangle \mid G$ is an undirected graph that contains a simple cycle}

We have to show that $UCYCLE \in L$.

Comment

**Step 2** of 3

Let *M* be the deterministic Turing machine that decides $UCYCLE$ the construction of $M$ is as follows:

$M =$ "On input $\langle G \rangle$ ( *G* is an undirected graph):

1. Select a vertex *u* as starting vertex

2. Select an edge $(u,v)$ from *u*.

3. Start traversal through $(u,v)$, if we come back to *u* through an edge different that $(u,v)$, then accept.

4. Otherwise, reject"

Comment

**Step 3** of 3

• If we come back to the starting vertex through an edge different than the one we started on, we declare that the graph contain a cycle.

• Since all the vertices and all the edges are enumerated in logspace *M* decides $UCYCLE$ in logarithmic space.

• Therefore, $UCYCLE \in L$.

Comment