

# CS345A: Algorithms -II

## Users Online : 134



### Quiz 3

Submitted on 31/10/2021 08:56

#### Instructions

- Exam opens at: 31/10/2021 08:00
- You are given an extra 10 minutes after due time to submit your exam.
- However, please note that any submissions made after the due time are marked as late submissions.

#### Quiz 3

##### Question:

Attempt exactly one of the following questions.

##### 1. Semi-connected graph (marks=3)

A directed graph  $G = (V, E)$  is called semi-connected if for each  $u, v \in V$ , there is a path from  $u$  to  $v$  or there is a path from  $v$  to  $u$ . Design an  $O(|E|)$  time algorithm to determine if a directed graph is semi-connected.

##### 2. Strange graph (marks=10)

Let  $G=(V,E)$  be an undirected, unweighted, and connected graph on  $n=|V|$  vertices. We wish to compute a subgraph  $S=(V,H)$ ,  $H \subseteq E$  such that for each pair of vertices  $u,v \in V$ , the distance between them in  $S$  is **at most** 3 times the distance between them in  $G$ . To achieve this objective, it suffices if we can achieve the following goal:

For each pair  $(u,v)$  such that  $(u,v) \in E$  and  $(u,v) \notin H$ , there exists a path of **at most** 3 edges between  $u$  and  $v$  in  $S$ .

The following is the skeleton of an algorithm that accomplishes the above goal in  $O(|E|)$  time and computes such a subgraph  $S$  of  $O(n^{3/2})$  edges. All you have to do is to just fill in the blanks appropriately.

$H \leftarrow \emptyset;$

While( \_\_\_\_\_ )

{ Pick any vertex, say  $v$ , arbitrarily from  $V$ .

If (degree of  $v$  is less than  $\sqrt{n}$ )

{ Insert all edges incident on  $v$  to  $H$ ;

Remove  $v$  from  $V$  and remove all edges incident on  $v$  from  $E$ .

}

Else

{ \_\_\_\_\_ ;

## CS345A: Algorithms -II

### Users Online : 134

---

Note: Though the condition of the While loop has to be a single Boolean statement, you may write pseudocode of any length in the **Else** part of the If-statement. Please note that you will get no marks for this question if your algorithm is not correct. So avoid doing guess work.

Hint: Try to understand the logic underlying the **then** part of the If-statement. Having understood it, try to generalize it for the **Else** part of the If-statement. Remember that our goal is to select  $O(n^{3/2})$  edges only.

#### Uploaded Files:

[180771\\_Quiz3\\_easy.pdf](#)

#### Grades:

**Marks:** Not graded