# SNS COLLEGE OF TECHNOLOGY

**Coimbatore-35.**

**An Autonomous Institution**

**COURSE NAME : 19ITB201 DESIGN AND ANALYSIS OF ALGORITHMS**

**II YEAR/ IV SEMESTER**

**UNIT – IV FLOW NETWORKS AND STRING MATCHING**

# The Maximum-Flow Problem

- In this we consider the important problem of maximizing the flow of a material through a transportation network.
- Represented by a connected weighted digraph with *n* vertices numbered from 1 to
  *n* and a set of edges *E*, with the following properties:
- It contains exactly one vertex with no entering edges; this vertex is called the
  **source** and assumed to be numbered 1.
- It contains exactly one vertex with no leaving edges; this vertex is called the **sink**
  and assumed to be numbered *n*.
- The weight *uij* of each directed edge *(i, j )* is a positive integer, called the edge
  **capacity.**

# The Maximum-Flow Problem

- A digraph satisfying these properties is called a ***flow network*** or simply a ***network***.
- It is assumed that the source and the sink are the only source and destination and all the other vertices are the points where a flow can be redirected without consuming or adding any amount of the material.
- In other words, the total amount of the material entering an intermediate vertex must be equal to the total amount of the material leaving the vertex. This condition is called the ***flow-conservation requirement***.
- the flow-conservation requirement can be expressed by the following equality
  constraint:

# The Maximum-Flow Problem

**for** every edge from $j$ to $i$ **do** //backward edges
    **if** $j$ is unlabeled
        **if** $x_{ji} > 0$
            $l_j \leftarrow \min\{l_i, x_{ji}\}$; label $j$ with $l_j, i^-$
            $Enqueue(Q, j)$
**if** the sink has been labeled
    //augment along the augmenting path found
    $j \leftarrow n$ //start at the sink and move backwards using second labels
    **while** $j \neq 1$ //the source hasn't been reached
        **if** the second label of vertex $j$ is $i^+$
            $x_{ij} \leftarrow x_{ij} + l_n$
        **else** //the second label of vertex $j$ is $i^-$
            $x_{ji} \leftarrow x_{ji} - l_n$
        $j \leftarrow i$; $i \leftarrow$ the vertex indicated by $i$'s second label
    erase all vertex labels except the ones of the source
    reinitialize $Q$ with the source
**return** $x$ //the current flow is maximum