



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35  
An Autonomous Institution**

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



## **DEPARTMENT OF INFORMATION TECHNOLOGY**

### **16IT302 – DESIGN AND ANALYSIS OF ALGORITHMS**

III YEAR V SEM

UNIT-IV-Iterative Improvement

TOPIC: Maximum flow problem

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# MAXIMUM FLOW PROBLEM



**Subject :Design and Analysis of Algorithm**

**Unit :IV**

**Presented by**

**T.Shanmugapriya**



# Traffic in a Road System





# Fluids In Pipes

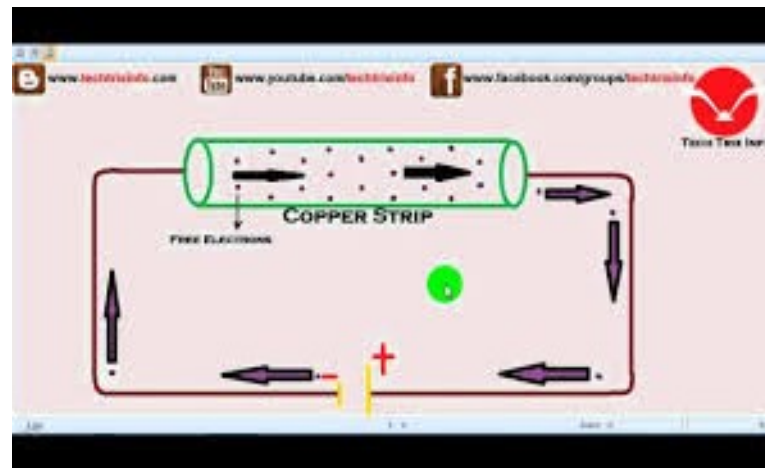


Maximum Flow Problem/16IT302-DAA/T.Shanmugapriya,AP/IT

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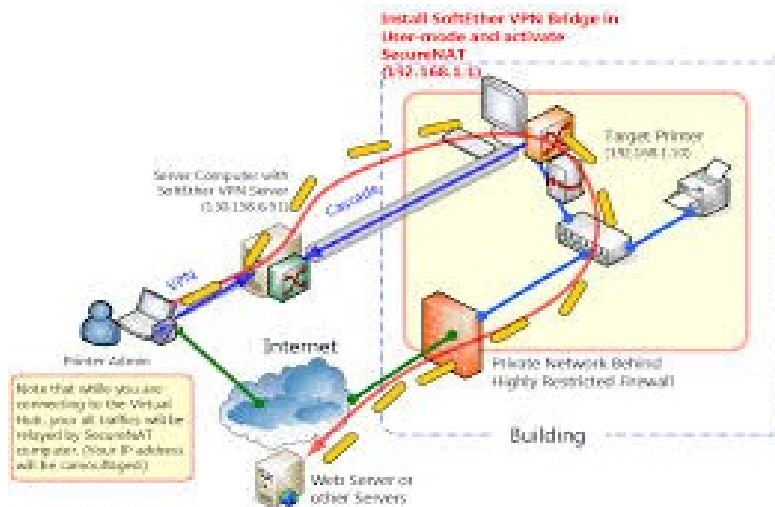


# Currents In An Electrical Circuit



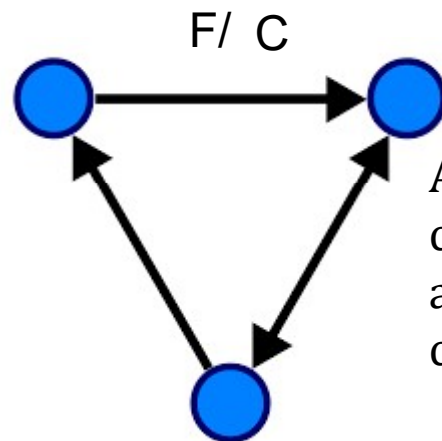


# Packet Traffic in Computer Networks





# Flow Network



A directed graph where each edge has a capacity and each edge receives a flow. The amount of flow on an edge cannot exceed the capacity of the edge

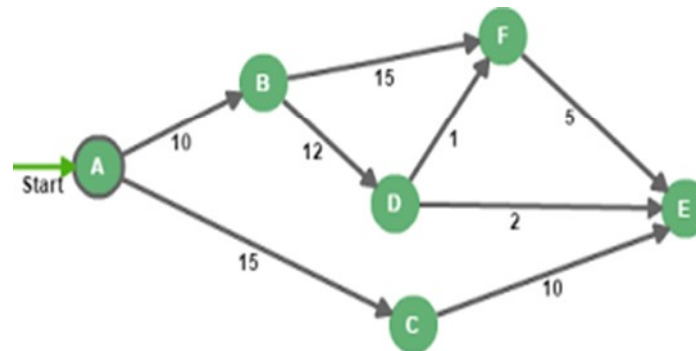




# Flow Network



- A flow must satisfy the restriction that the amount of flow into a node equals the amount of flow out of it, unless it is a source, which has only outgoing flow, or sink, which has only incoming flow



**Source** : Only one vertex  
no entering edge  
**Destination**: One vertex  
with no leaving vertex  
**Capacity**: Weight







# Max Flow Problem



- an optimization theory problem
- involves finding a feasible flow through a single-source, single-sink flow network that is maximum





# Ford Fulkerson Algorithm for Maximum flow problem



- Given a graph which represents a flow network where every edge has a capacity.
- Source  $s$  and Sink  $t$
- Find the maximum possible flow from  $s$  to  $t$  with following constraints
  - 1) Flow edge cannot exceed the given capacity of the edge
  - 2) Inflow is equal to out flow for every vertex except  $s$  and  $t$





# Algorithm



Step 1 : Start with a initial flow as 0

Step 2 : While there is an augmenting path from source to sink  
add two paths flow to flow

Step 3 : Return flow





# Terminologies

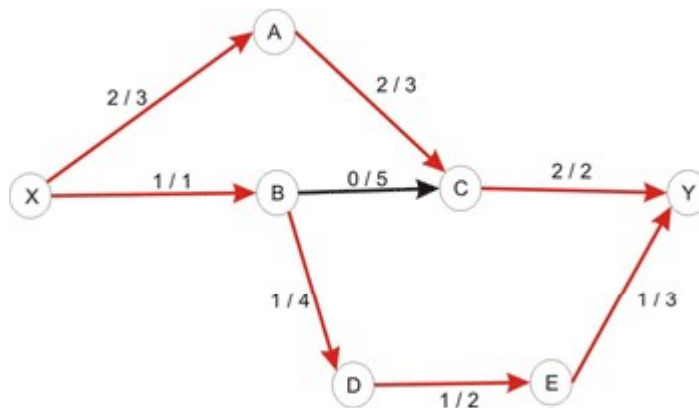


Figure 1a - Maximum Flow in a network

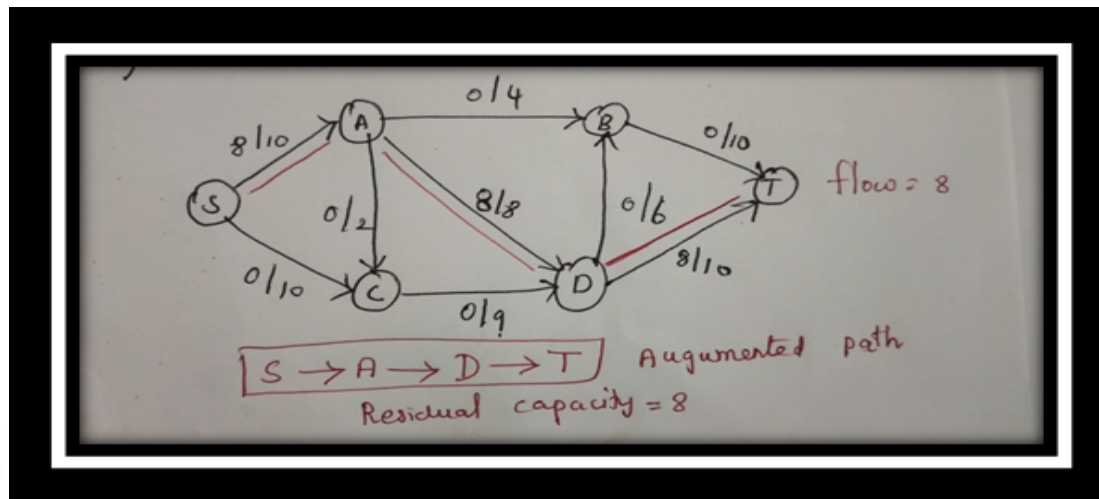
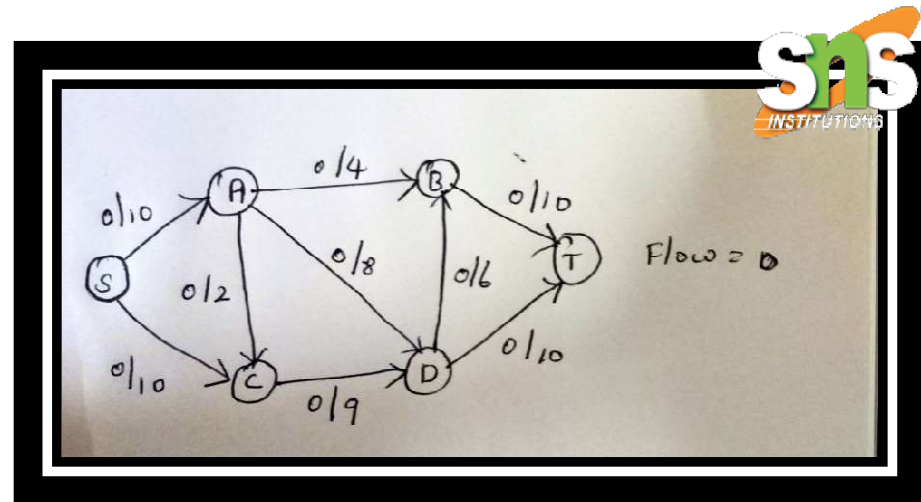
- **Residual Graph:** Adds Additional possible flow in graph
- **Residual Capacity:** Original capacity-Flow
- **Minimum Cut:** Maximum Possible flow
- **Augmented Path:**
  - 1) Non full forward edges
  - 2) Non empty backward edges





# Example

Step : 0



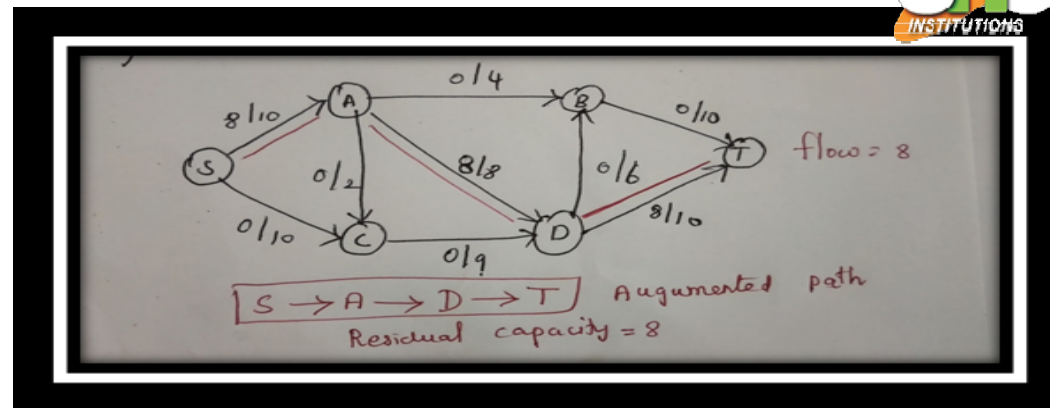
Step : 1



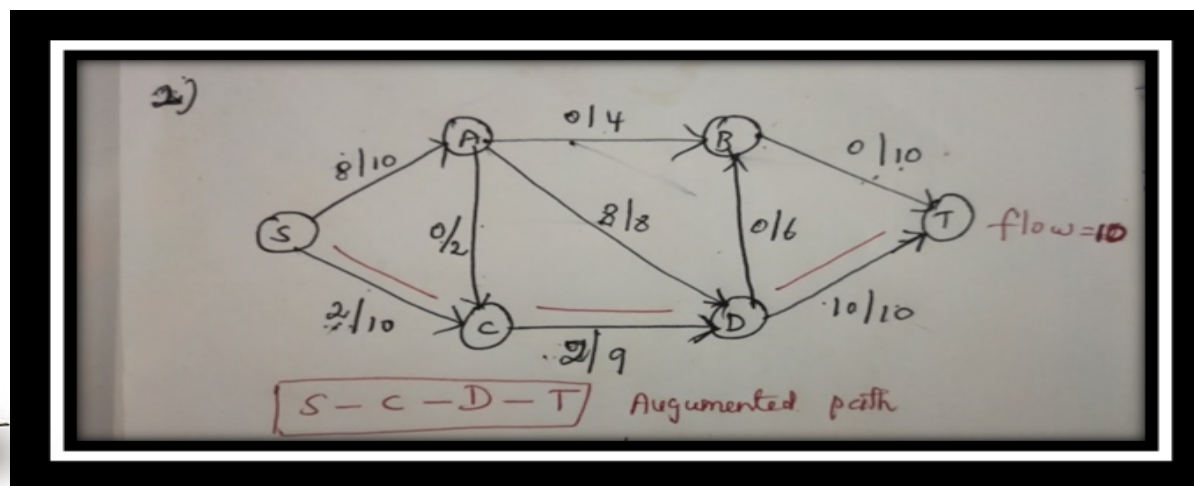
# Example



Step : 1



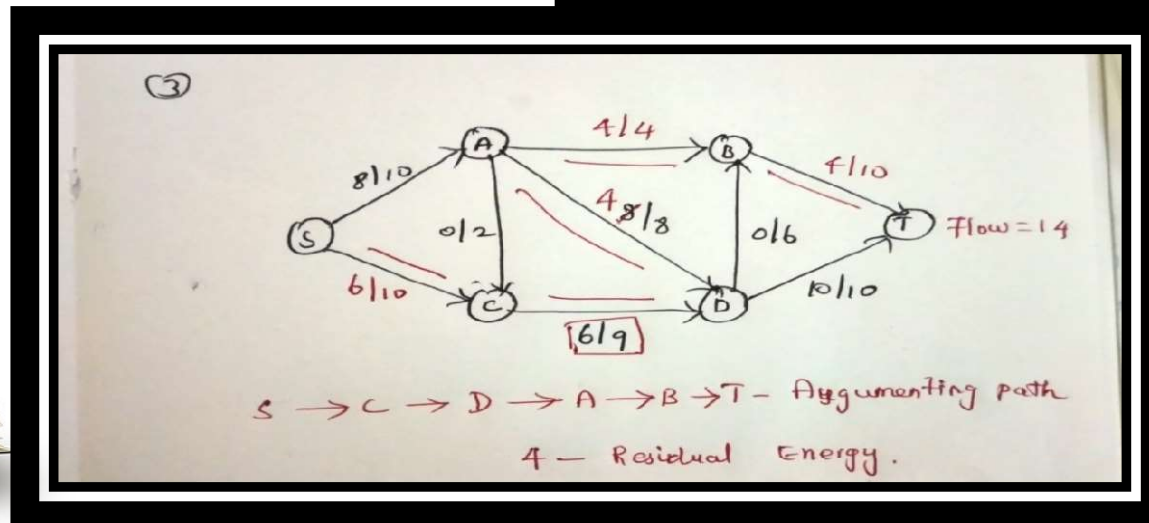
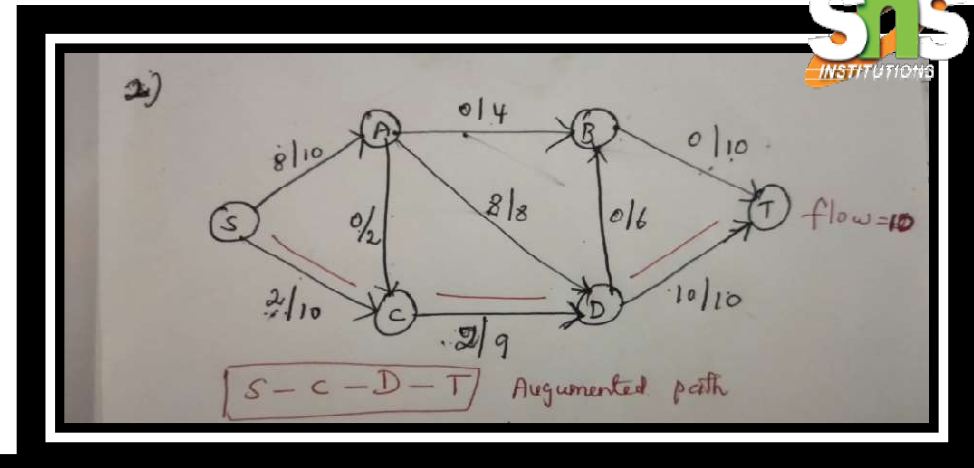
Step : 2





# Example

Step : 2

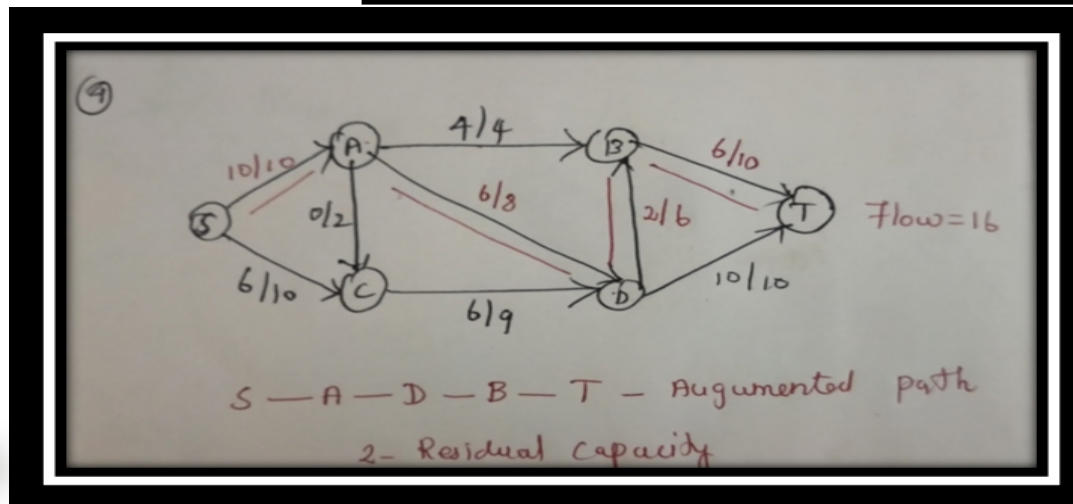
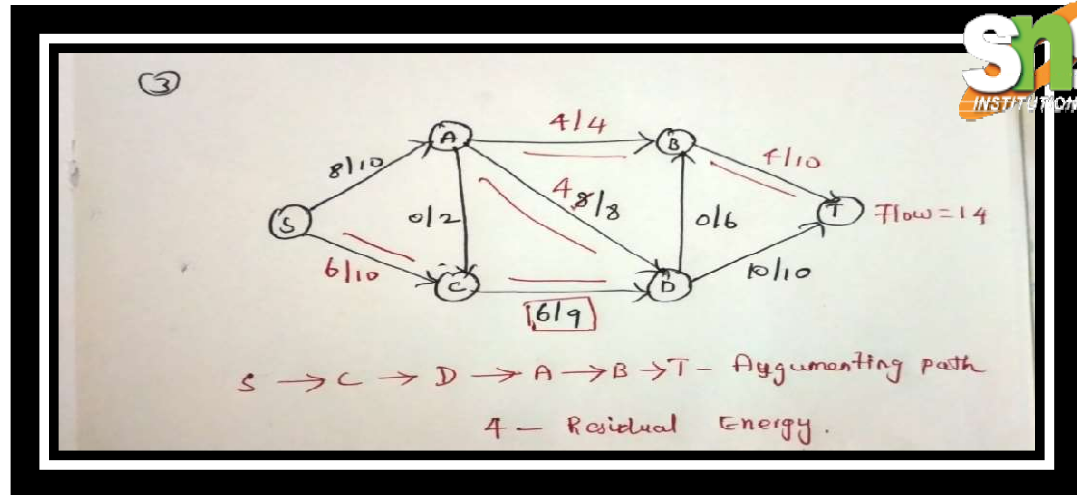


Step : 3



# Example

Step : 3



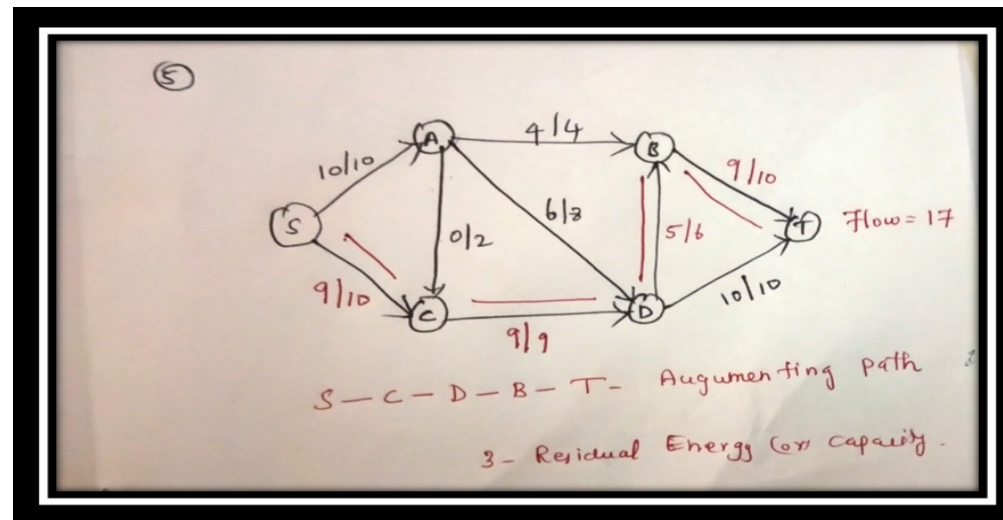
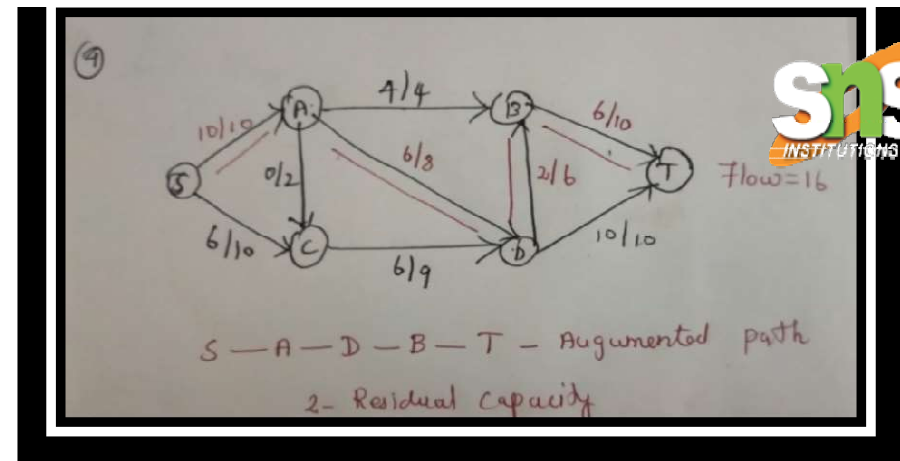
Step : 4





# Example

Step : 4

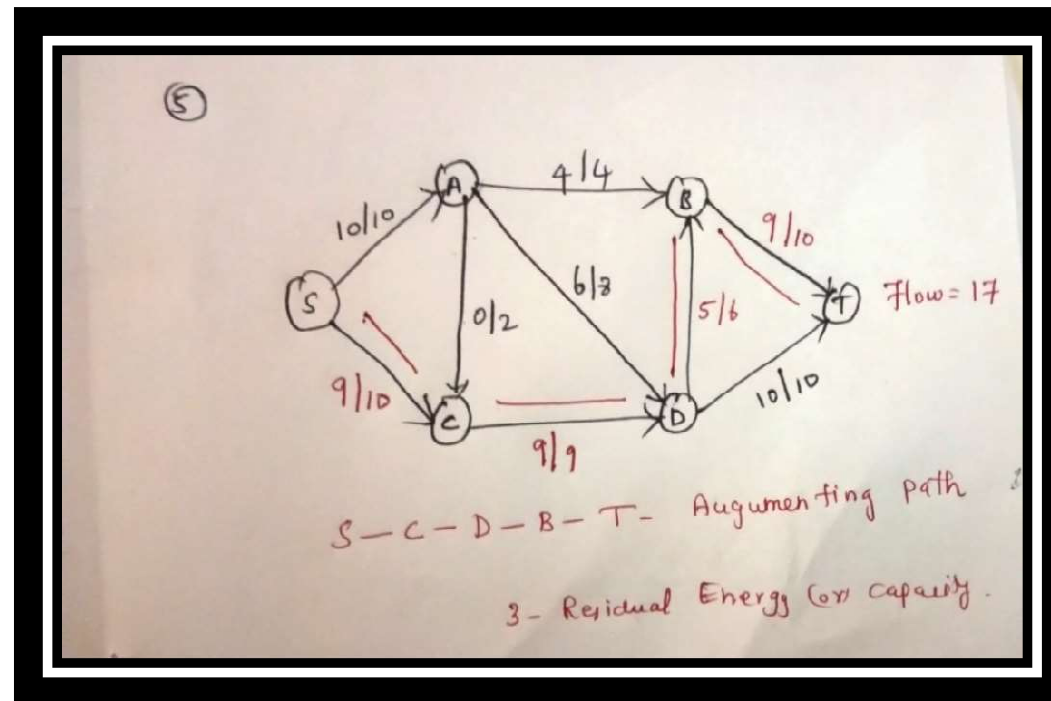


Step : 5



# Example

Step : 5 flow=19





# Use in Computer Networks



- Technology Impact
- Modern Lifestyle
- Advancing Civilization
- Flourishing Networks

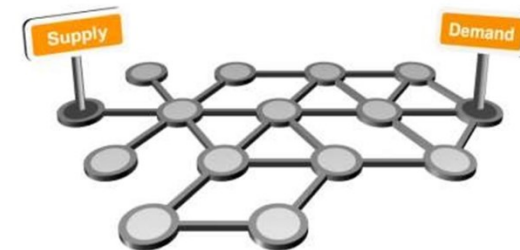




# Network Optimization



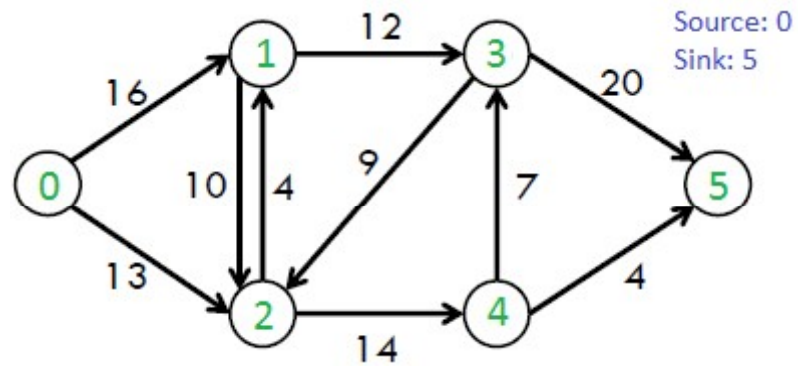
- Cost Vs Profit
- Supply Vs Demand
- Network Optimization

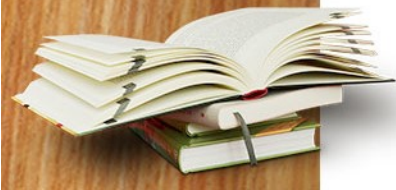




## Assessment

Find max flow using ford Fulkerson algorithm for a given graph







Thank  
you

