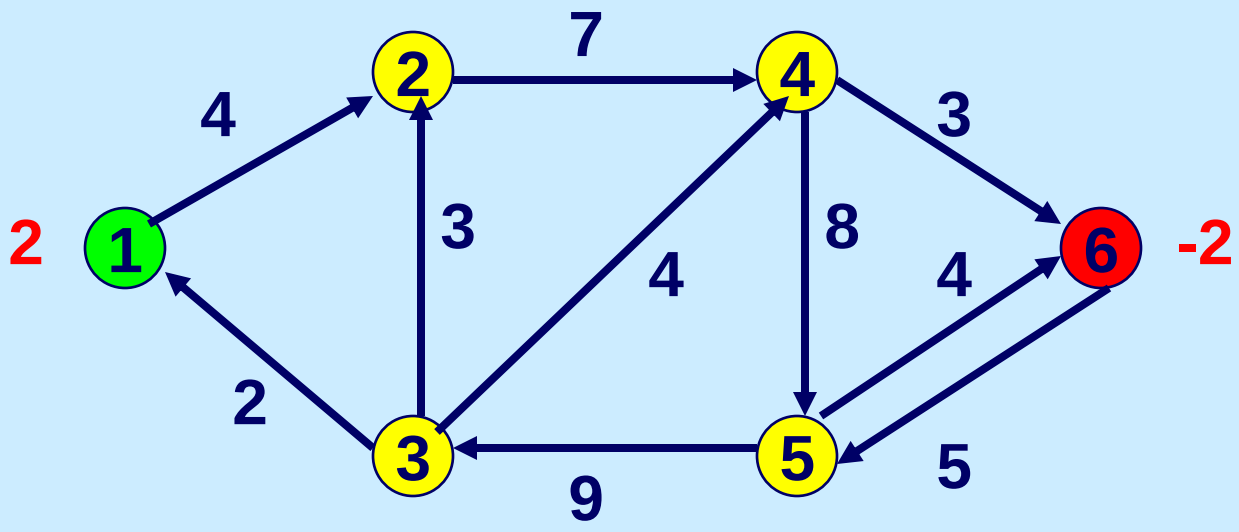
Network Optimization

Flow Decomposition

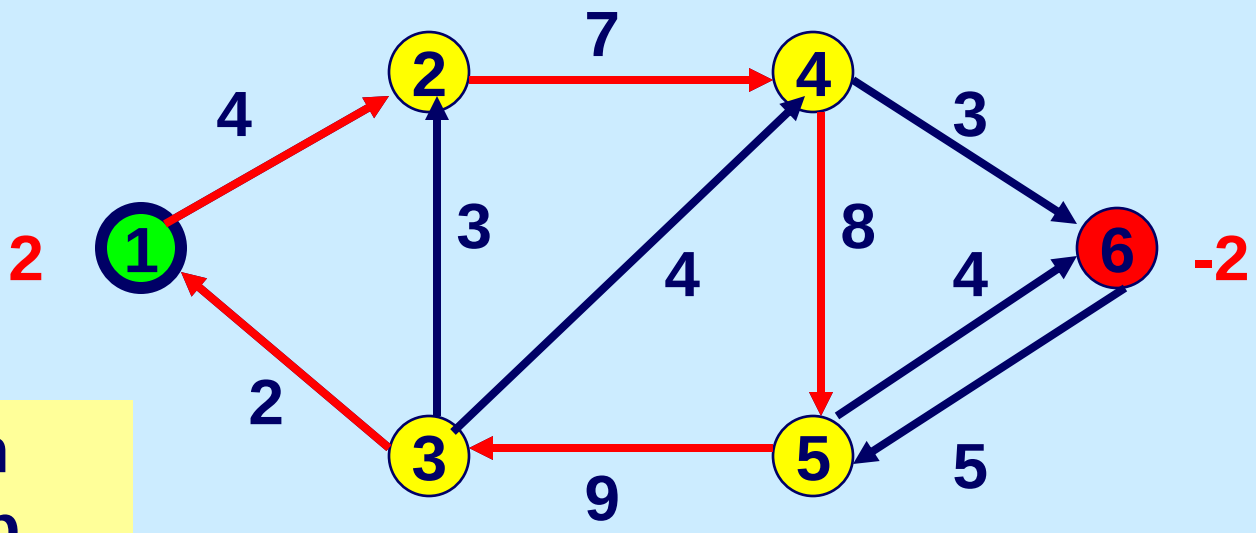
The initial flow



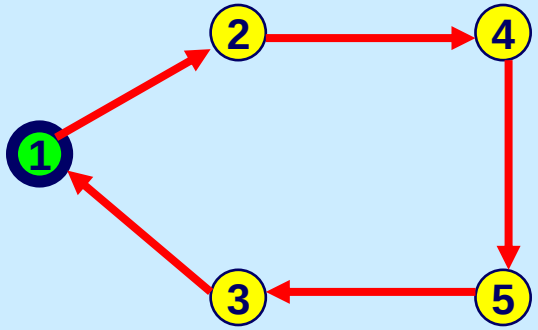
- A deficit node (more flow leaving than entering).
- An excess node (more flow entering than leaving)
- A balanced node (flow in = flow out)

Find a Path or Cycle W

Select a node with deficit if there is one.



Carry out a depth first search. Stop when a node with excess is reached or when there is a cycle.



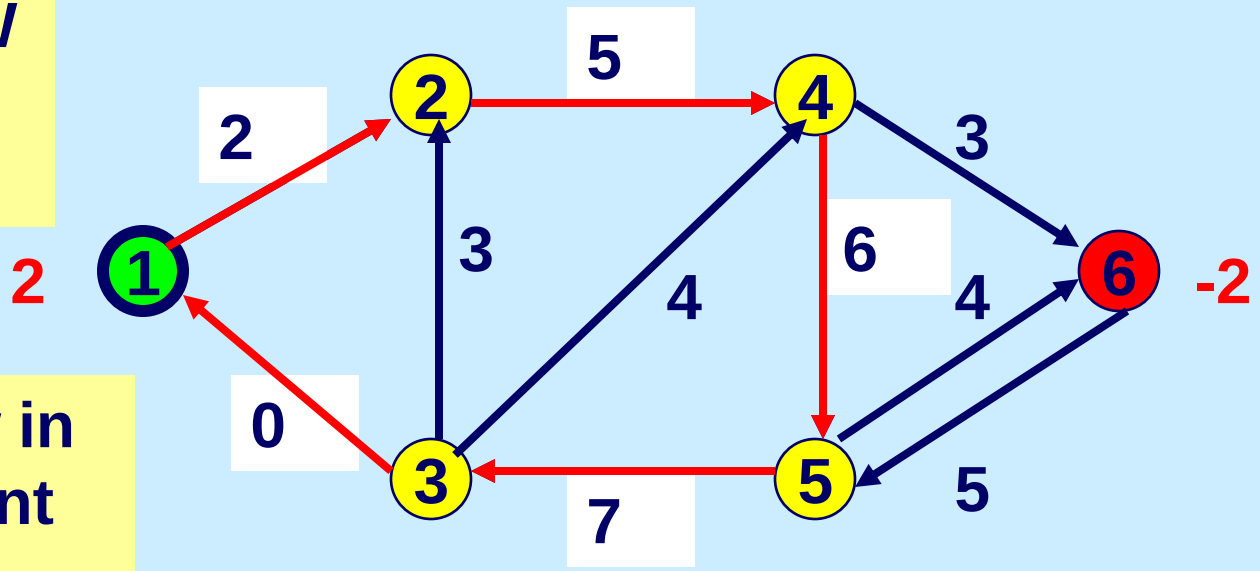
Determine the capacity of the walk W.

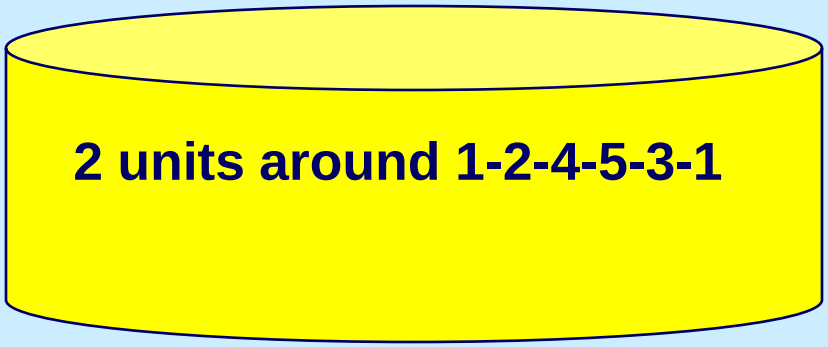
The capacity of 1-2-4-5-3-1 is 2.

Updates

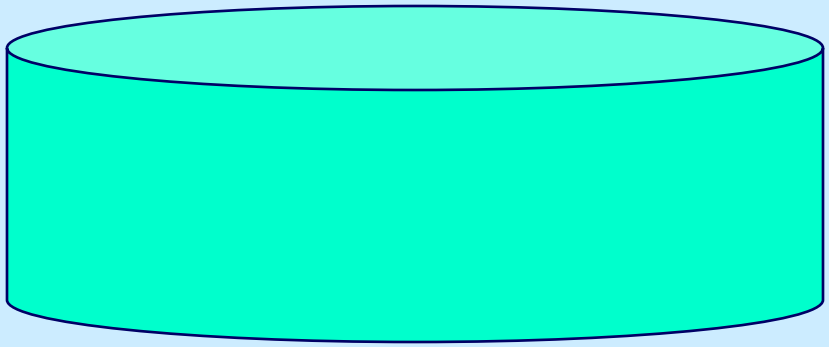
Add the flow in W to the decomposition.

Subtract the flow in W from the current flow.





cycle flows



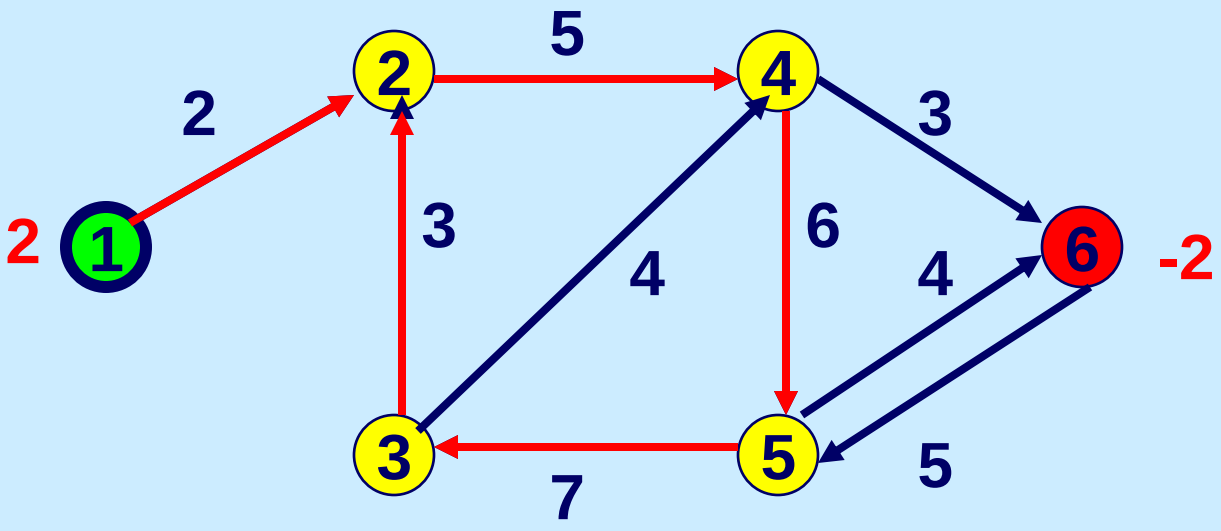
path flows

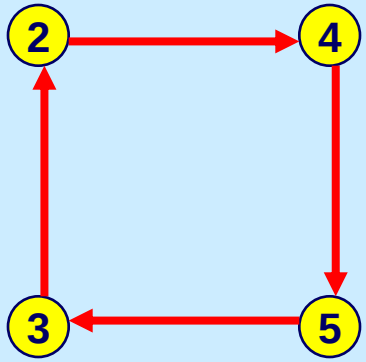
Find a path or cycle W

Select a node with deficit if there is one.

Carry out a dfs.

Determine the capacity of W.



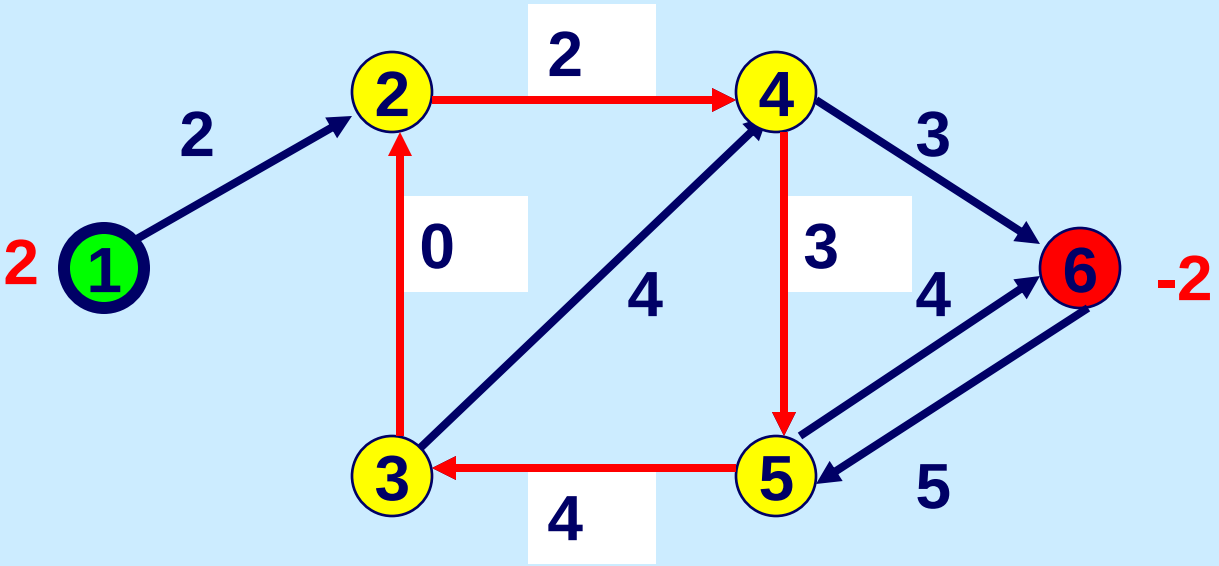


The capacity of 2-4-5-3-2 is 3.

Updates

Add the cycle flow to the decomposition

update the current flow



2 units around 1-2-4-5-3-1
3 units around 2-4-5-3-2

cycle flows

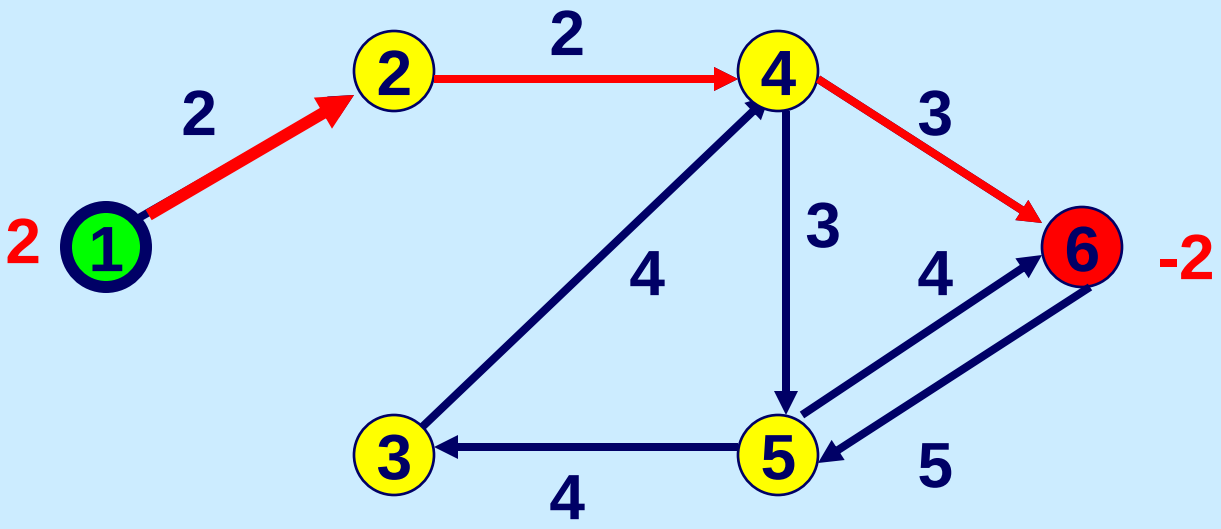
path flows

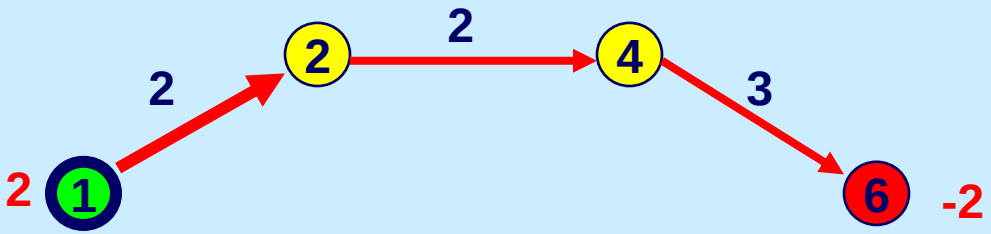
Find a path or cycle using dfs

Select a node with deficit if there is one.

Carry out a dfs.

Determine the capacity of W.



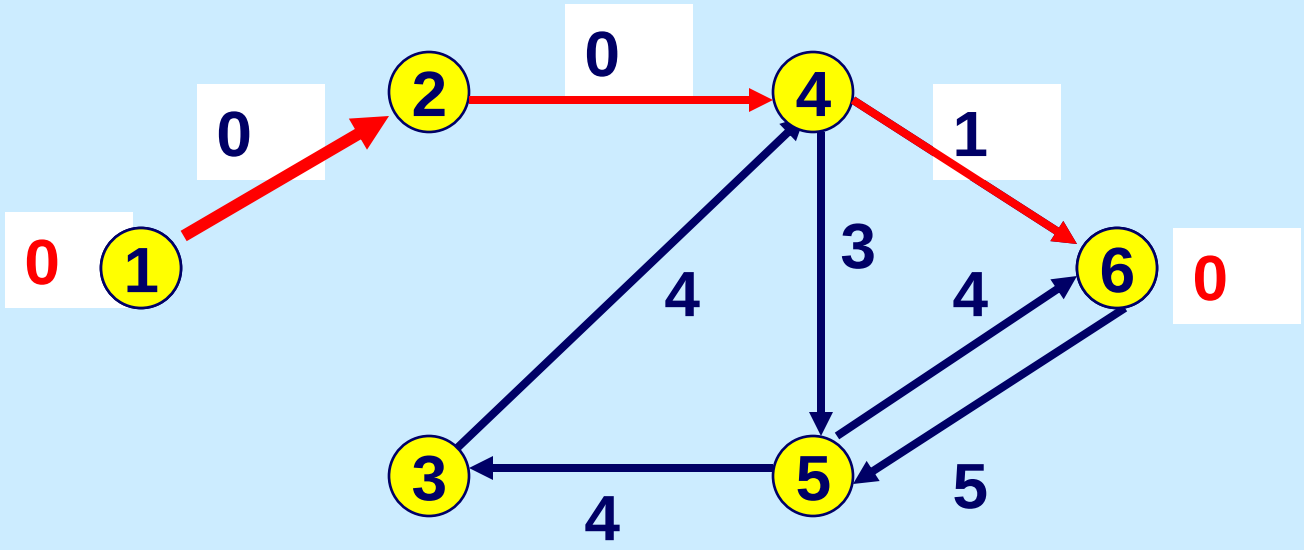


capacity of a path =
min {arc capacity, excess, deficit} = 2

Updates

Add the path flow to the decomposition

update the current flow



2 units around 1-2-4-5-3-1
3 units around 2-4-5-3-2

cycle flows

2 units in 1-2-4-6

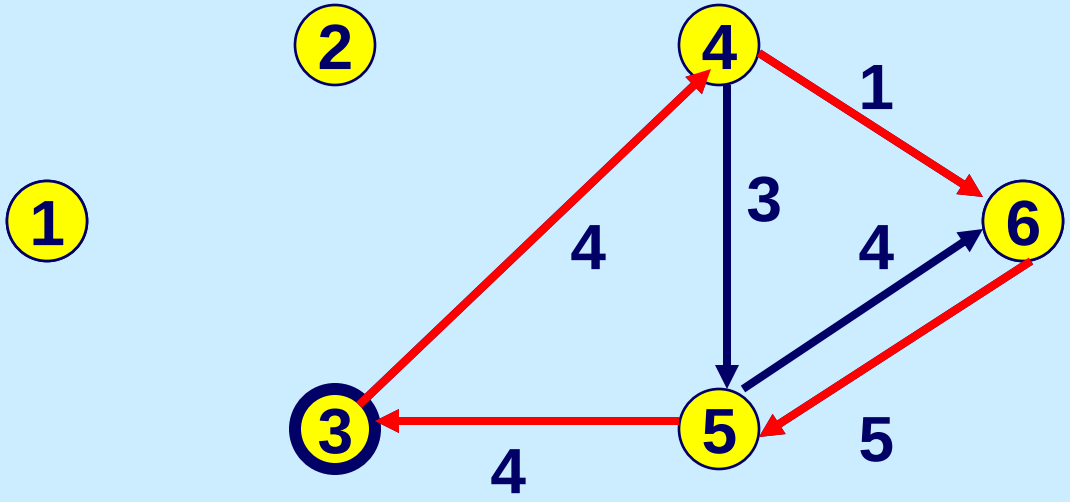
path flows

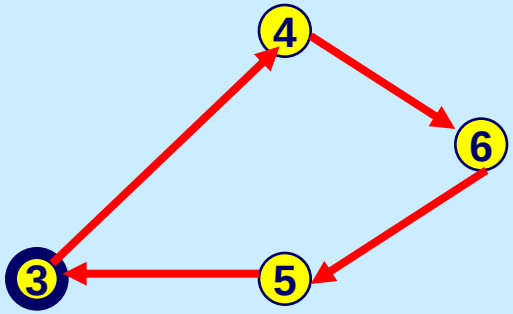
Find a path or cycle using dfs

Select a node with deficit if there is one. Otherwise, select any node with flow leaving.

Carry out a dfs.

Determine the capacity of W.



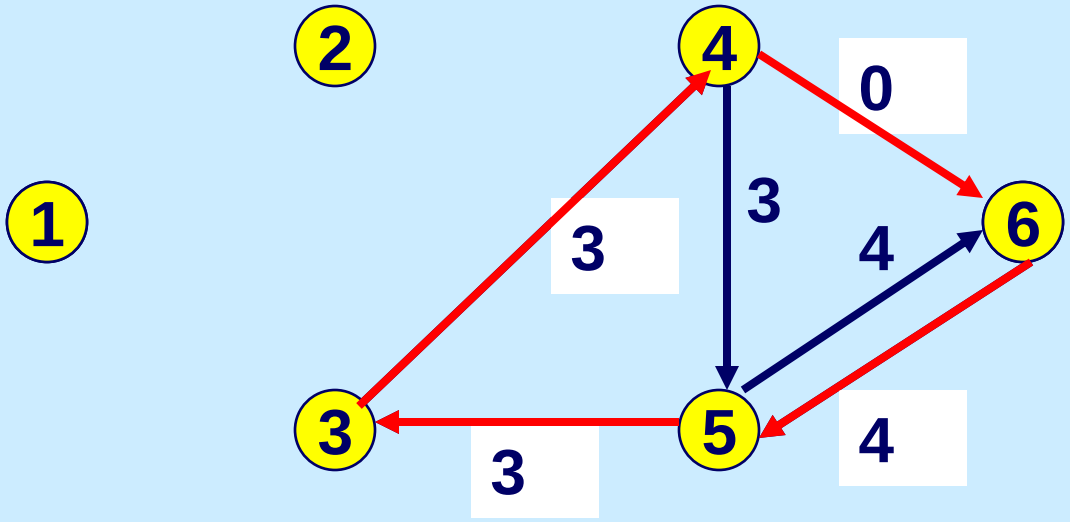


The capacity is 1

Updates

Add the cycle flow to the decomposition

update the current flow



2 units around 1-2-4-5-3-1
3 units around 2-4-5-3-2
1 unit around 3-4-6-5-3

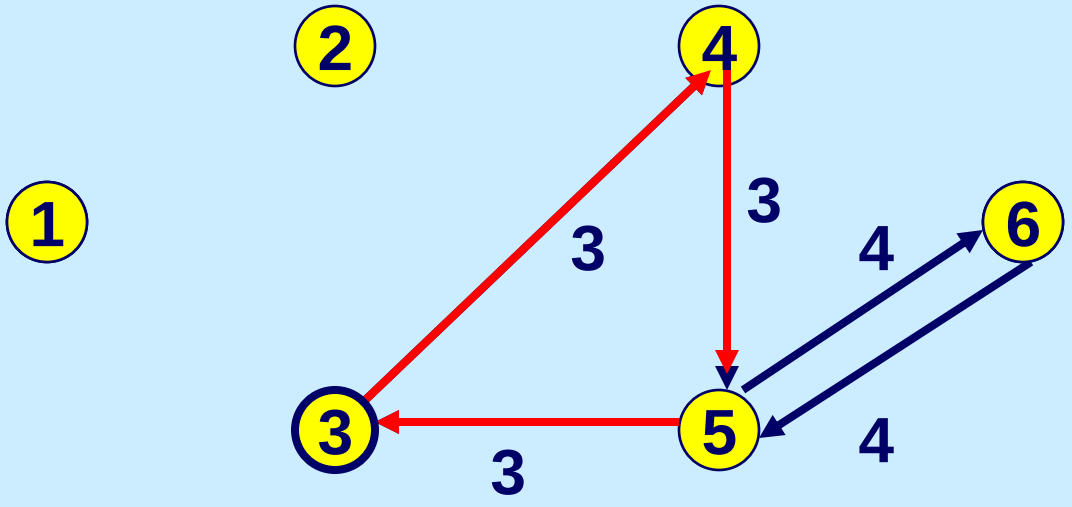
cycle flows

2 units in 1-2-4-6

path flows

Find a path or cycle using dfs

Select a node with deficit if there is one. Otherwise, select any node with flow leaving.



Carry out a dfs.

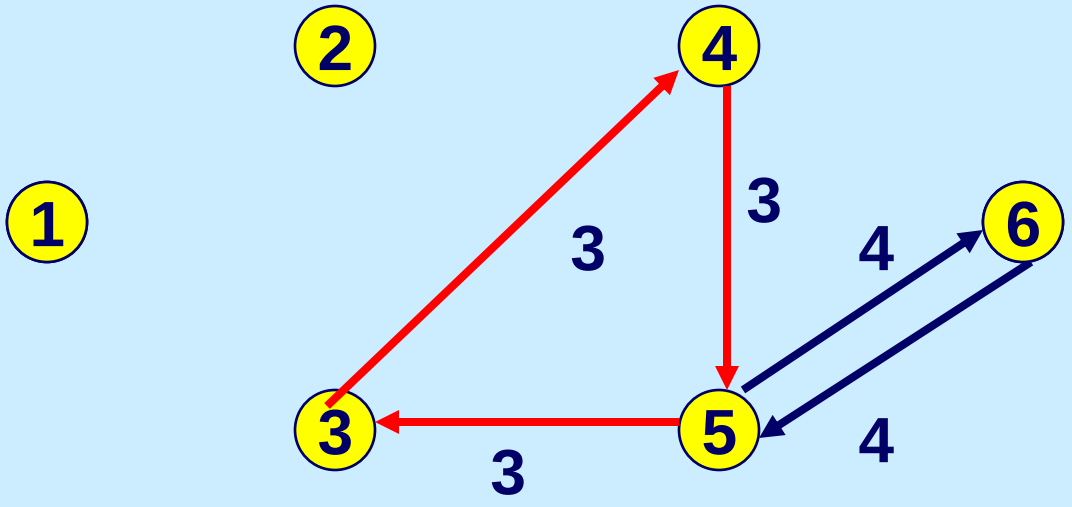
Determine the capacity of W.

The capacity of 3-4-5-3 is 3

Updates

Add the cycle flow to the decomposition

update the current flow



2 units around 1-2-4-5-3-1
3 units around 2-4-5-3-2
1 unit around 3-4-6-5-3
3 units around 3-4-5-3

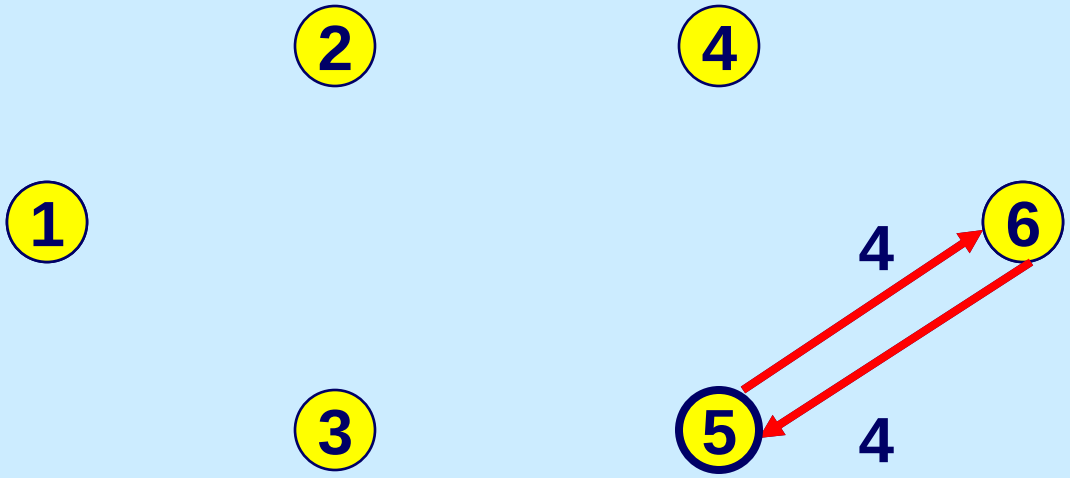
cycle flows

2 units in 1-2-4-6

path flows

Find a path or cycle using dfs

Select a node with deficit if there is one. Otherwise, select any node with flow leaving.



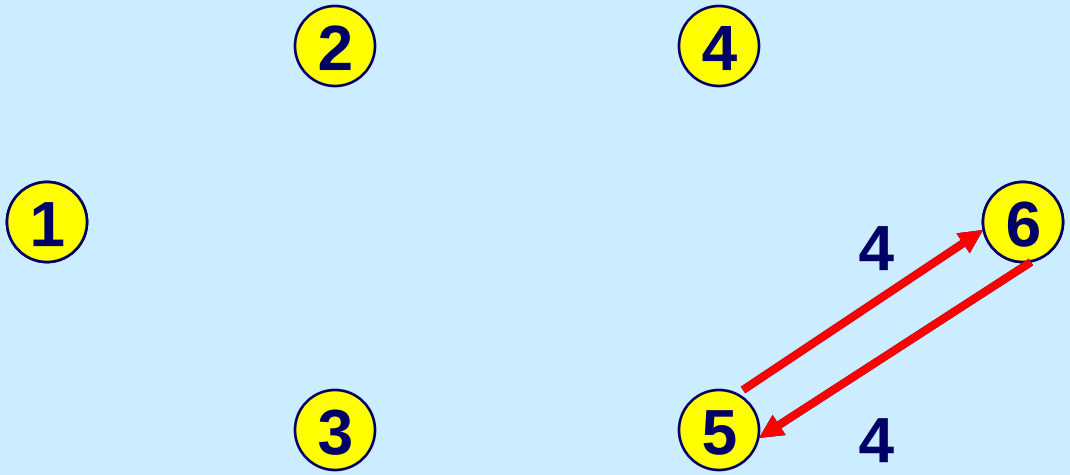
Carry out a dfs.

Determine the capacity of W.

Updates and the final flow decomposition

Add the cycle flow to the decomposition

update the current flow



2 units around 1-2-4-5-3-1
3 units around 2-4-5-3-2
1 unit around 3-4-6-5-3
3 units around 3-4-5-3
4 units around 5-6-5

cycle flows

2 units in 1-2-4-6

path flows

15.082J / 6.855J / ESD.78J Network Optimization

Fall 2010