

**In the name of God**

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# **Network Flows**

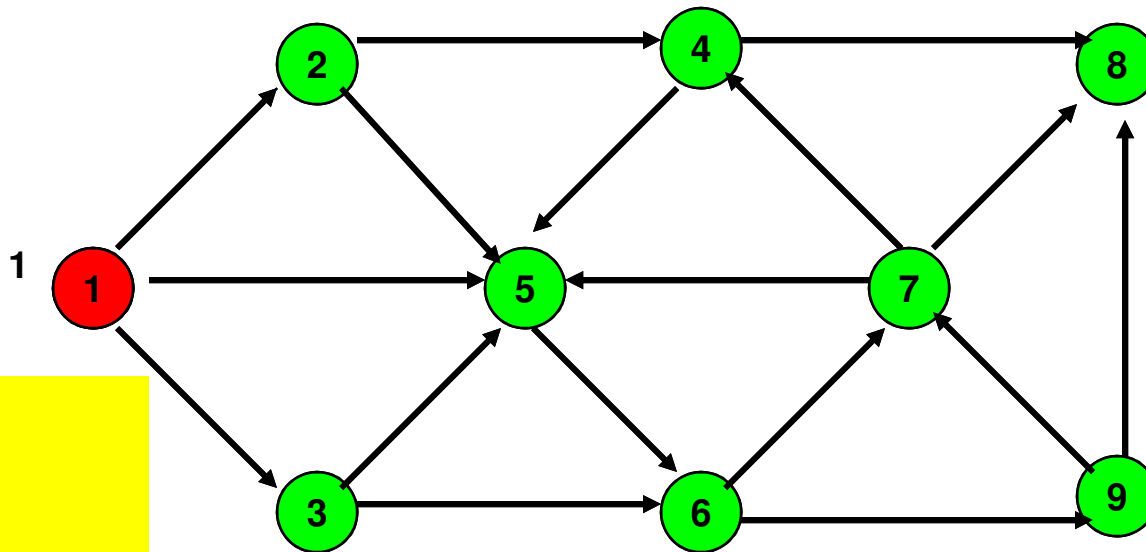
## **2. Search Algorithms**

### **2.3 Depth-First Search – An Example**

**Fall 2010**

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# Initialize



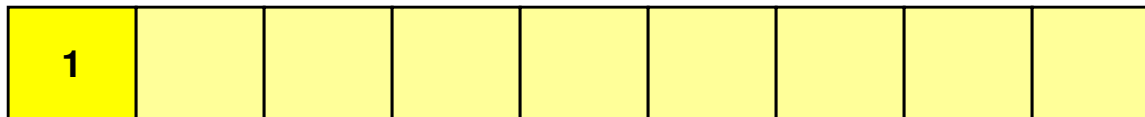
$\text{pred}(1) = 0$

$\text{next} := 1$

$\text{order}(\text{next}) = 1$

$\text{LIST} := \{1\}$

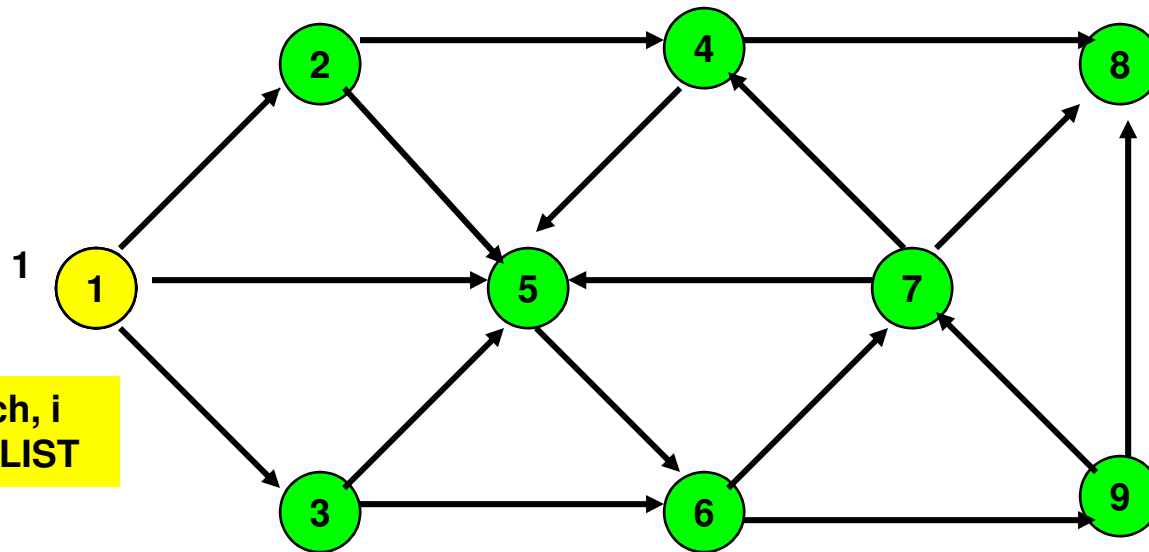
LIST



next

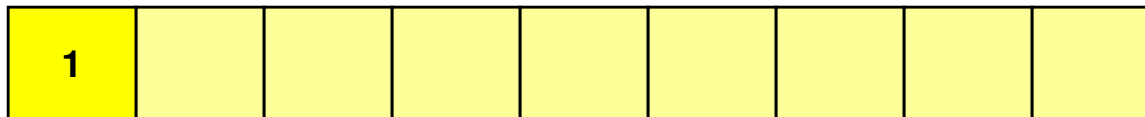


# Select a node i in LIST



In depth first search, i  
is the last node in LIST

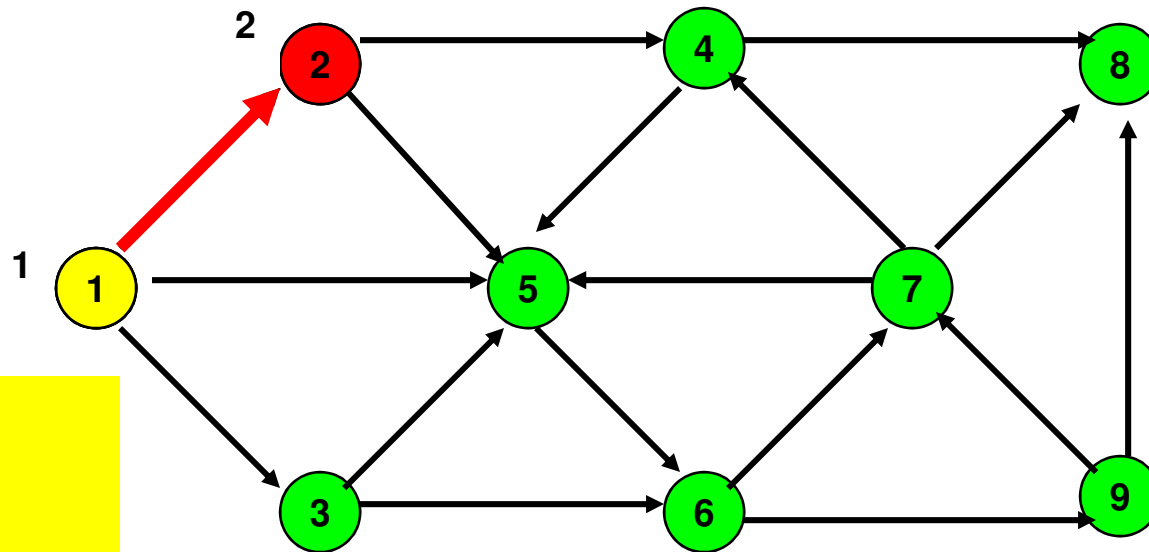
LIST



next



# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

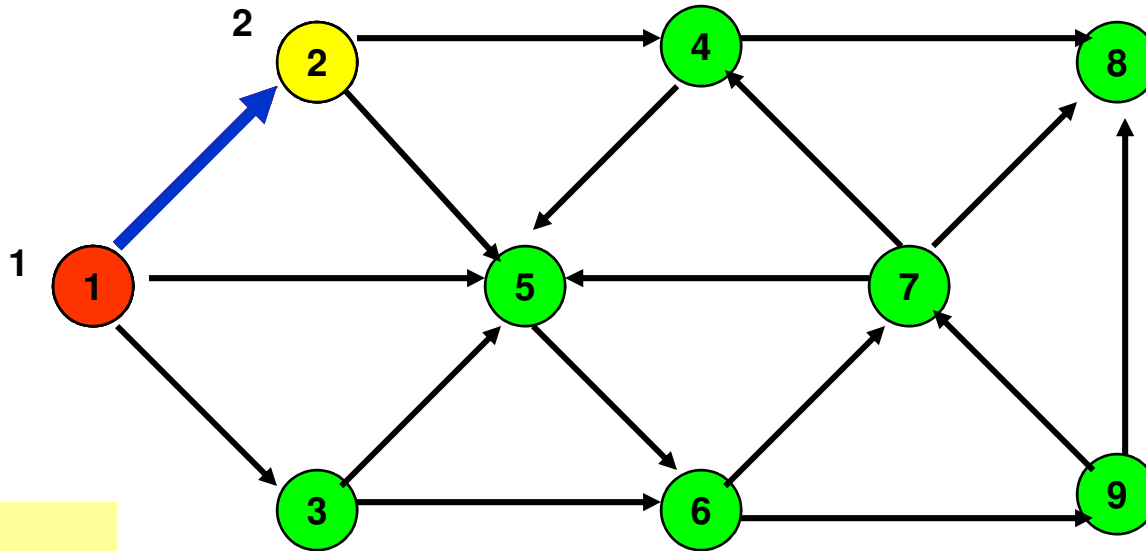
LIST

1	2							
---	---	--	--	--	--	--	--	--

next

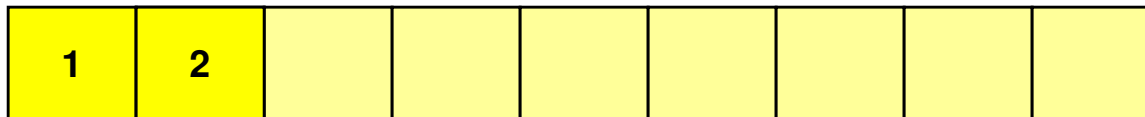
2

# Select the last node on LIST



Node 2 gets  
selected

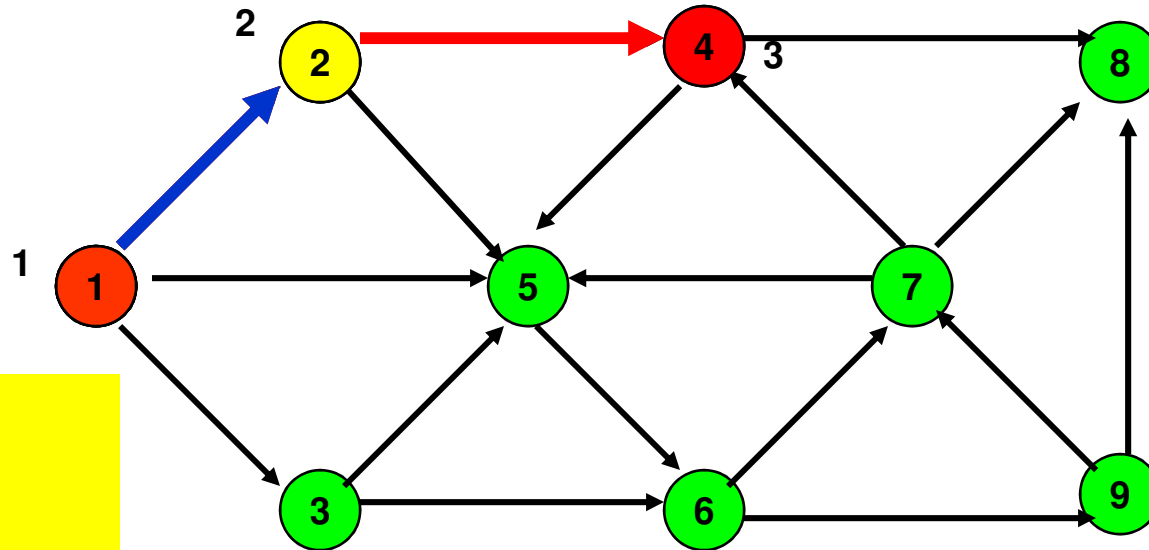
LIST



next

2

# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

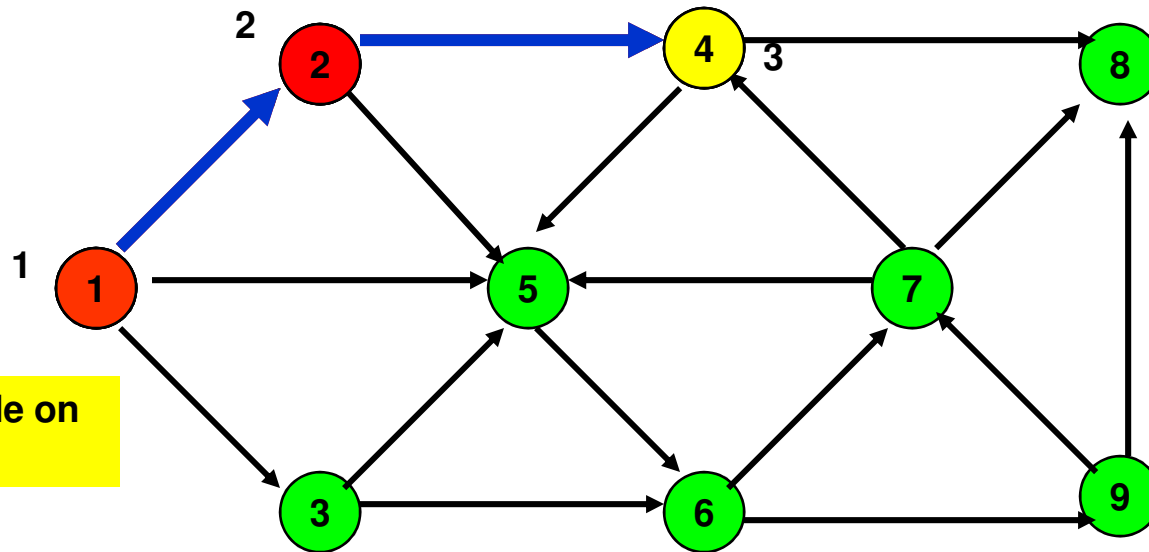
LIST

1	2	4						
---	---	---	--	--	--	--	--	--

next

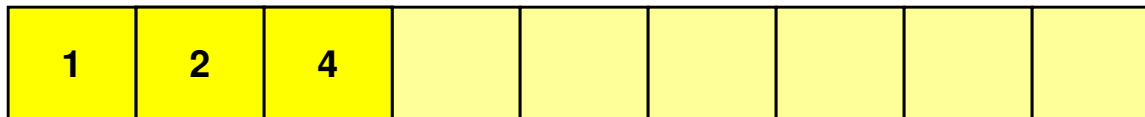
3

# Select



Select the last node on LIST

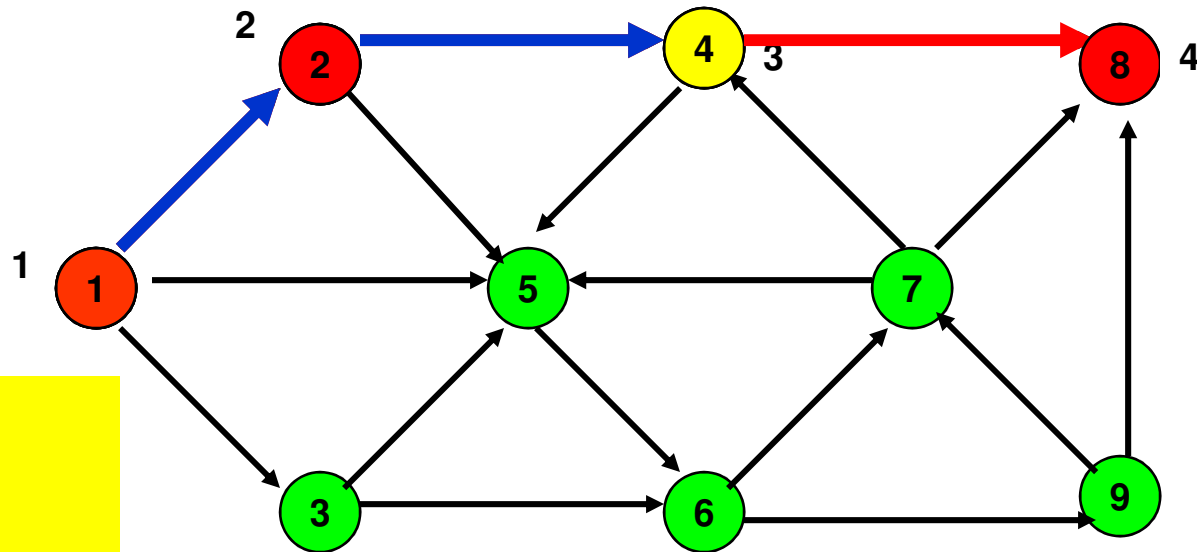
LIST



next

3

# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

LIST

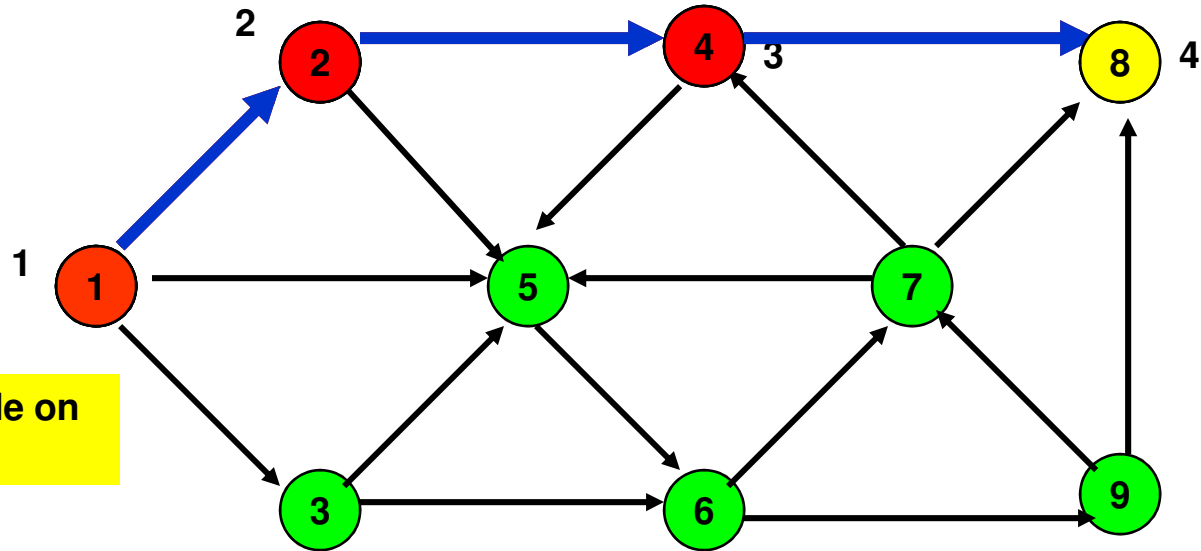
1	2	4	8					
---	---	---	---	--	--	--	--	--

next

4



# Select



Select the last node on LIST

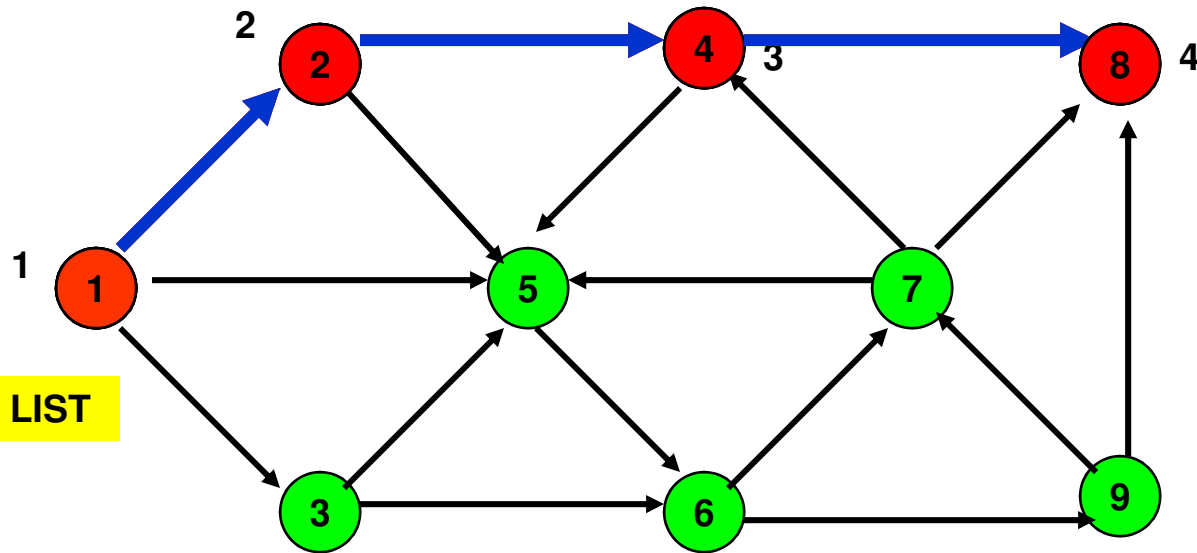
LIST

1	2	4	8					
---	---	---	---	--	--	--	--	--

next

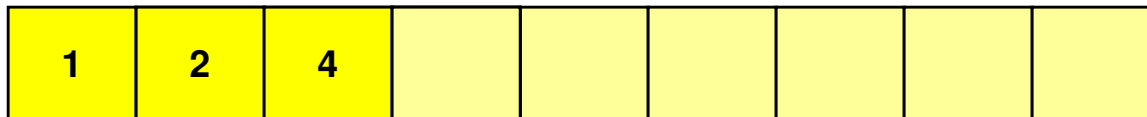
4

If node  $i$  is not incident to an admissible arc...

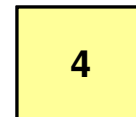


Delete node  $i$  from LIST

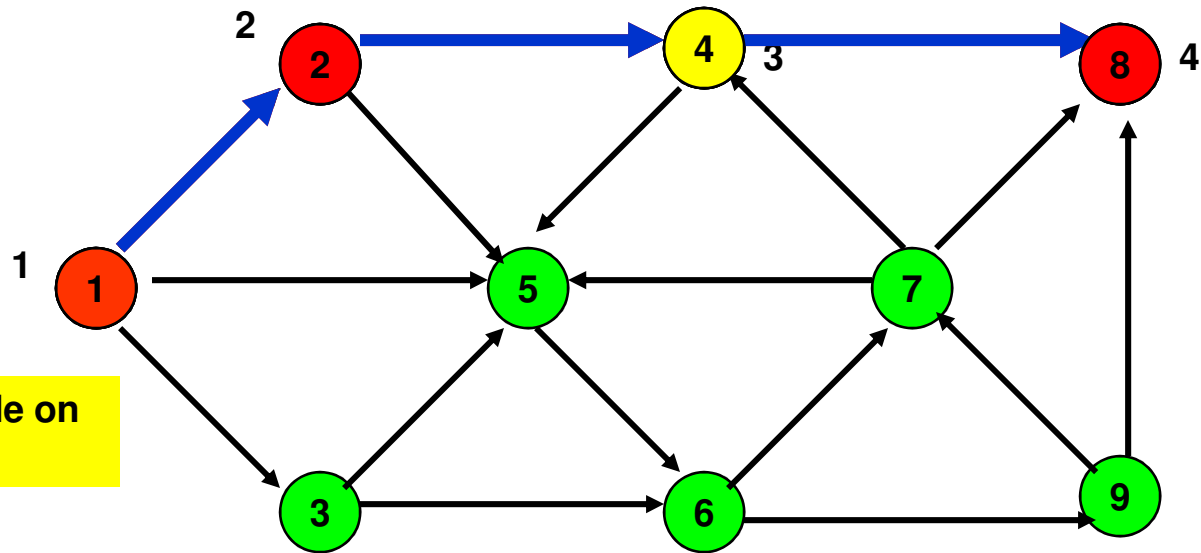
LIST



next

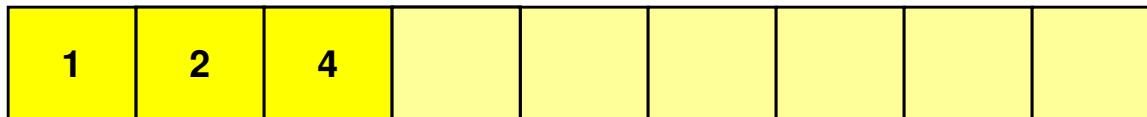


# Select

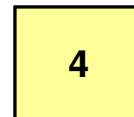


Select the last node on LIST

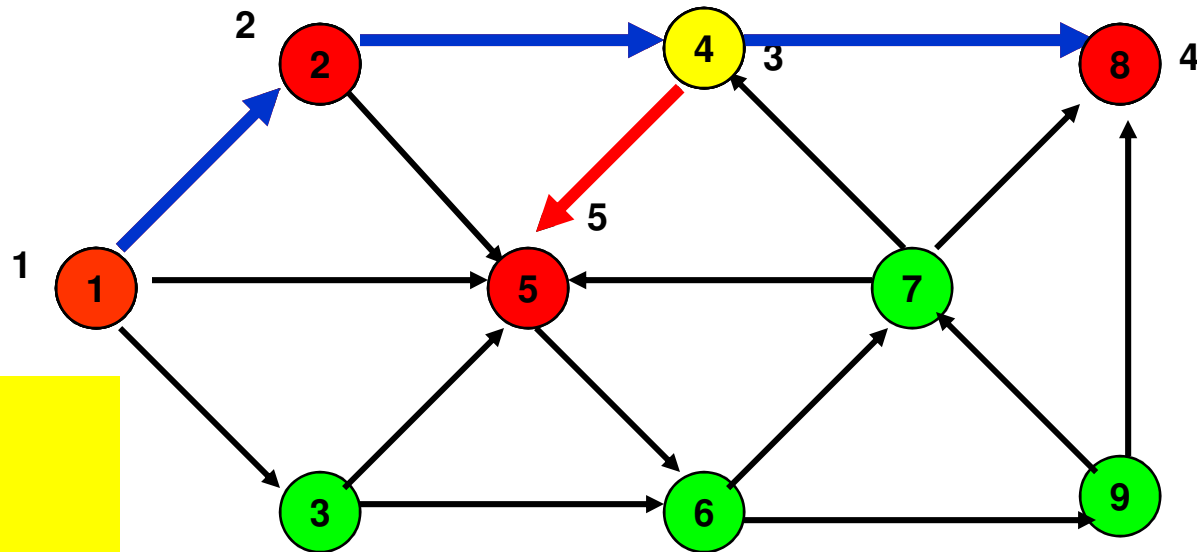
LIST



next



# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

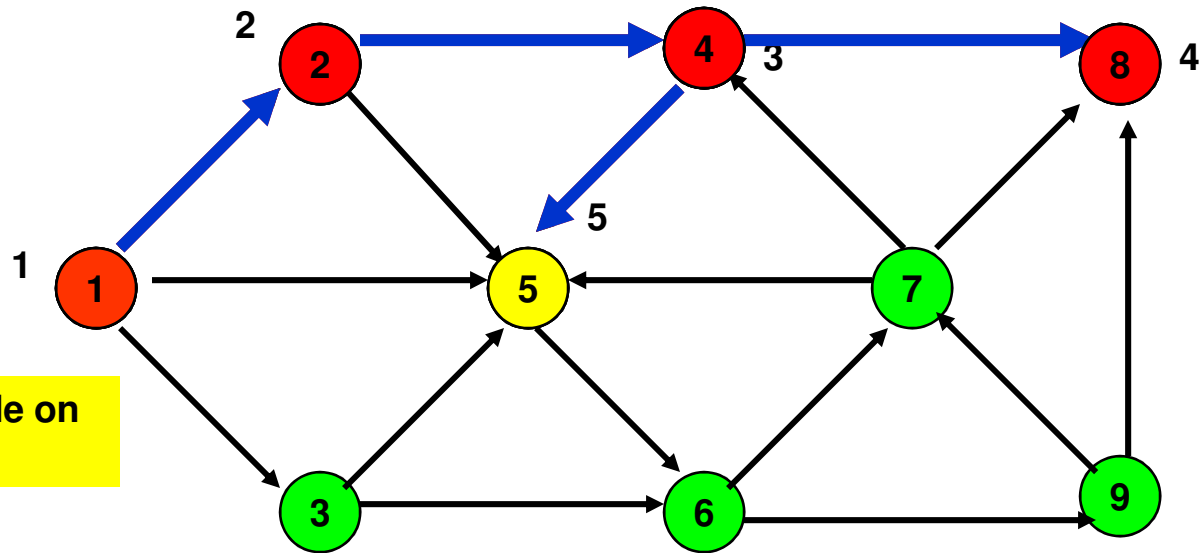
LIST

1	2	4	5					
---	---	---	---	--	--	--	--	--

next

5

# Select



Select the last node on LIST

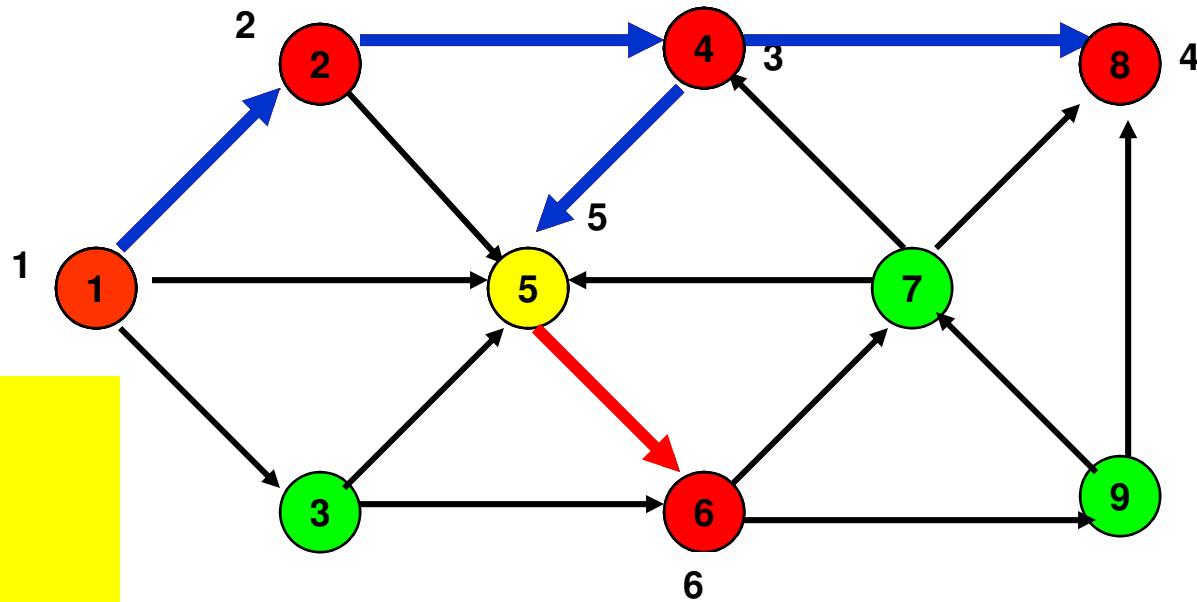
LIST

1	2	4	5					
---	---	---	---	--	--	--	--	--

next

5

# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

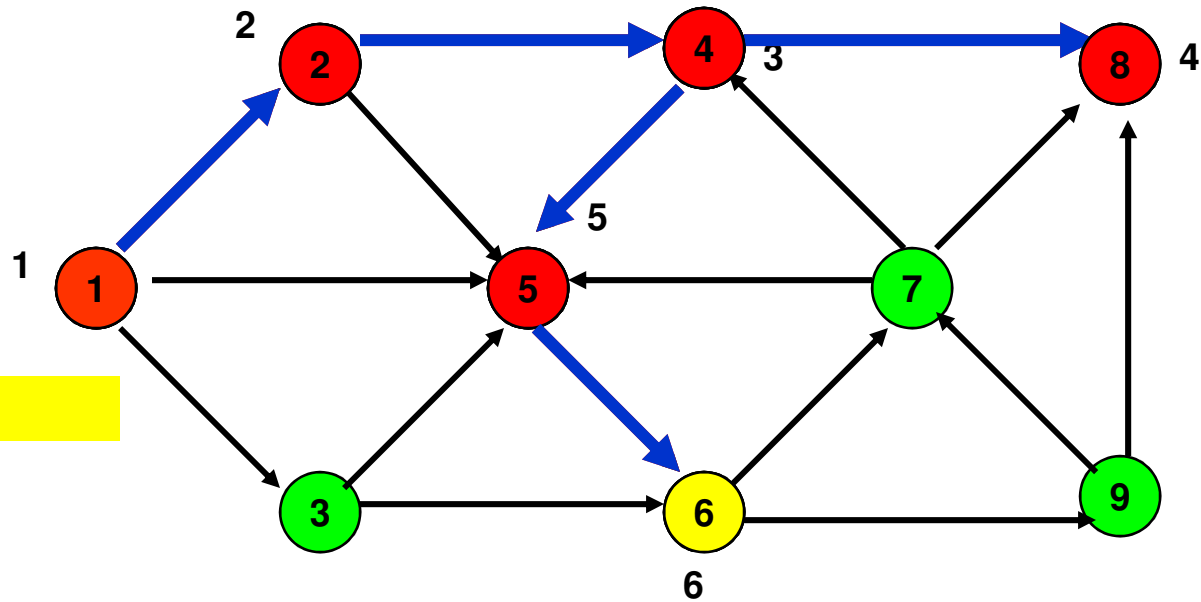
LIST

1	2	4	5	6				
---	---	---	---	---	--	--	--	--

next

6

# Select the last node on LIST



Select node 6

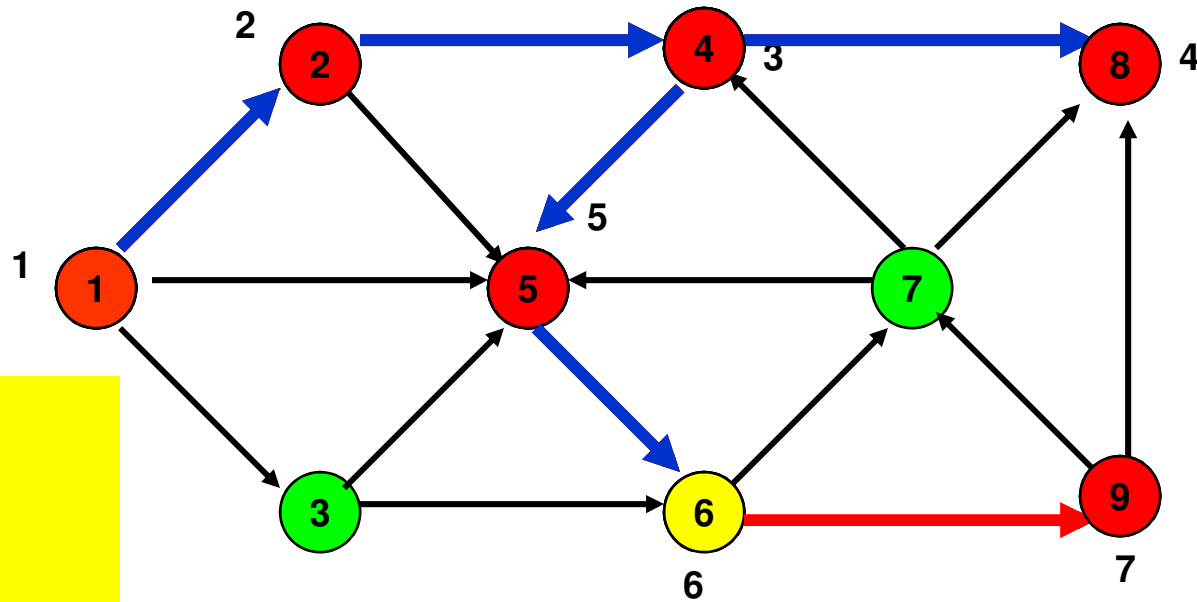
LIST

1	2	4	5	6				
---	---	---	---	---	--	--	--	--

next

6

# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

LIST

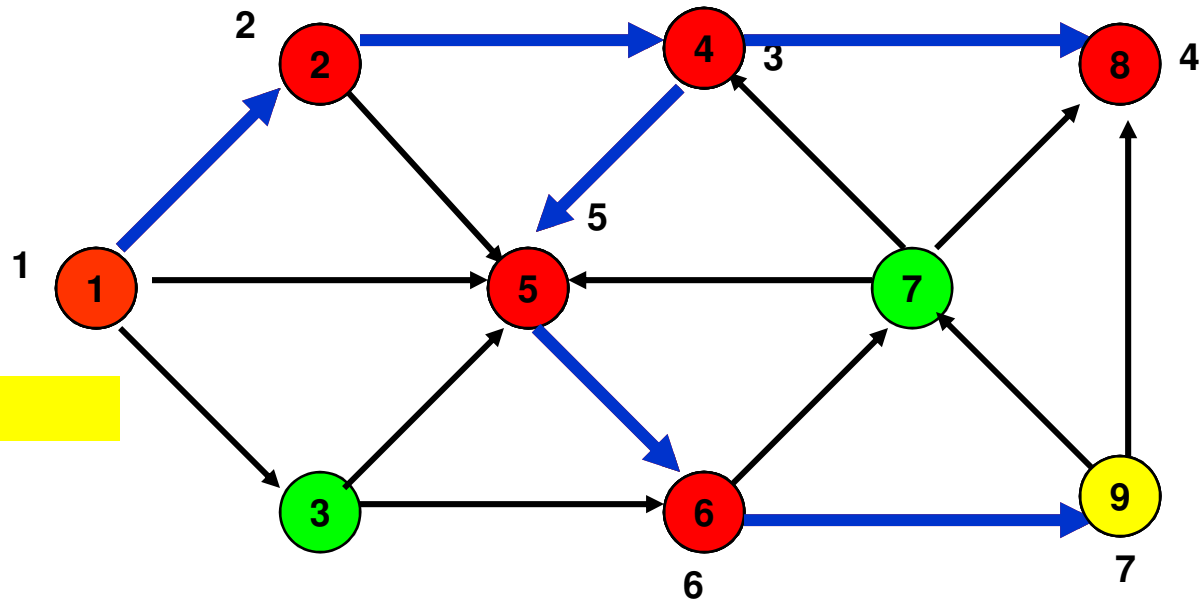
1	2	4	5	6	9			
---	---	---	---	---	---	--	--	--

next

7



# Select the last node on LIST



Select node 9

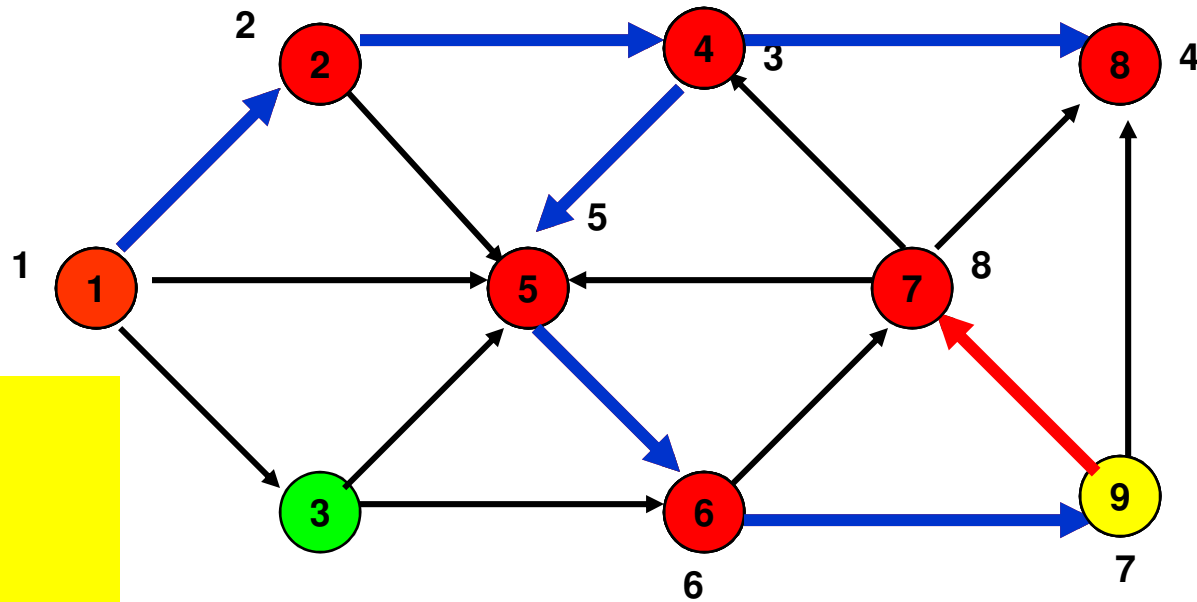
LIST

1	2	4	5	6	9			
---	---	---	---	---	---	--	--	--

next

7

# If node i is incident to an admissible arc...



Next :=  
Next + 1  
order(j) := next  
add j to LIST

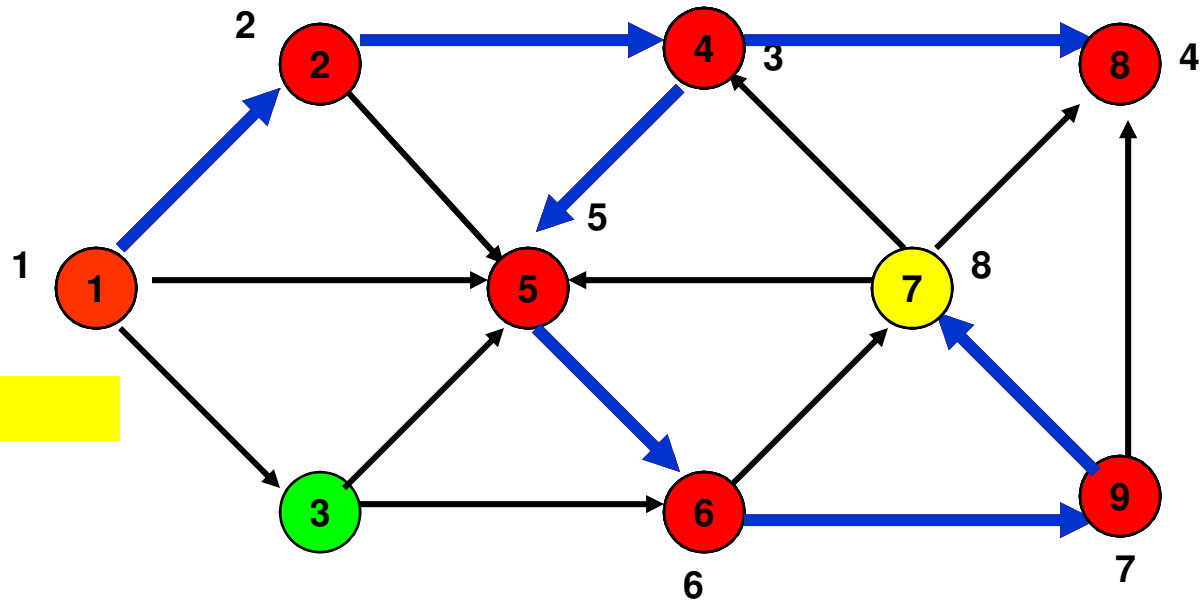
LIST

1	2	4	5	6	9	7		
---	---	---	---	---	---	---	--	--

next

8

# Select the last node on LIST



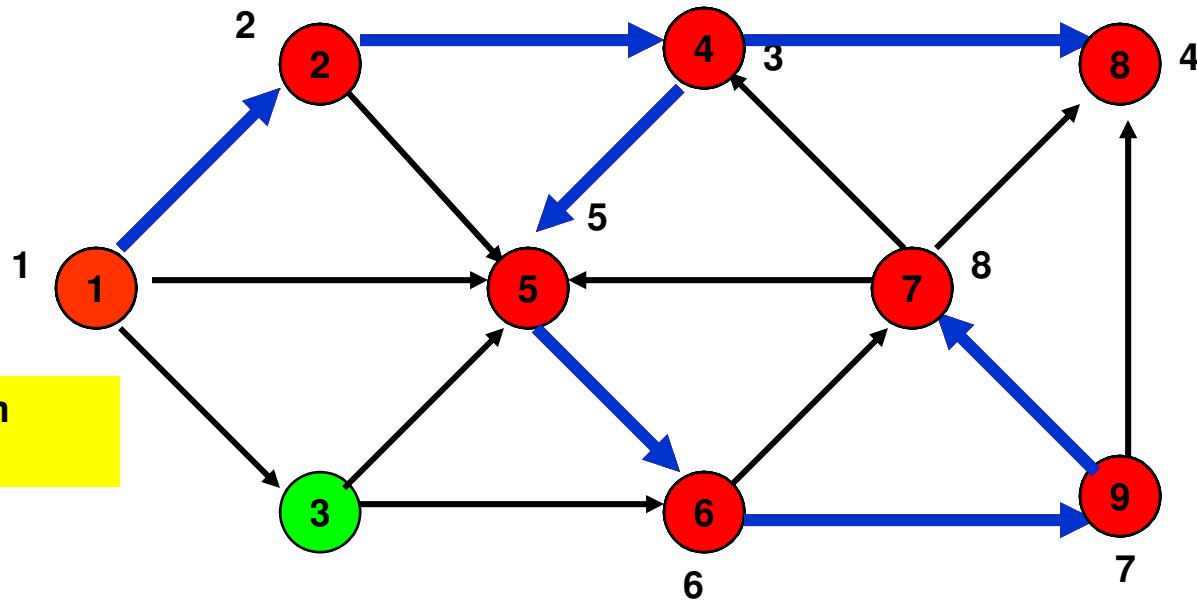
LIST

1	2	4	5	6	9	7		
---	---	---	---	---	---	---	--	--

next

8

If node  $i$  is not incident to an admissible arc...



Delete node 7 from LIST

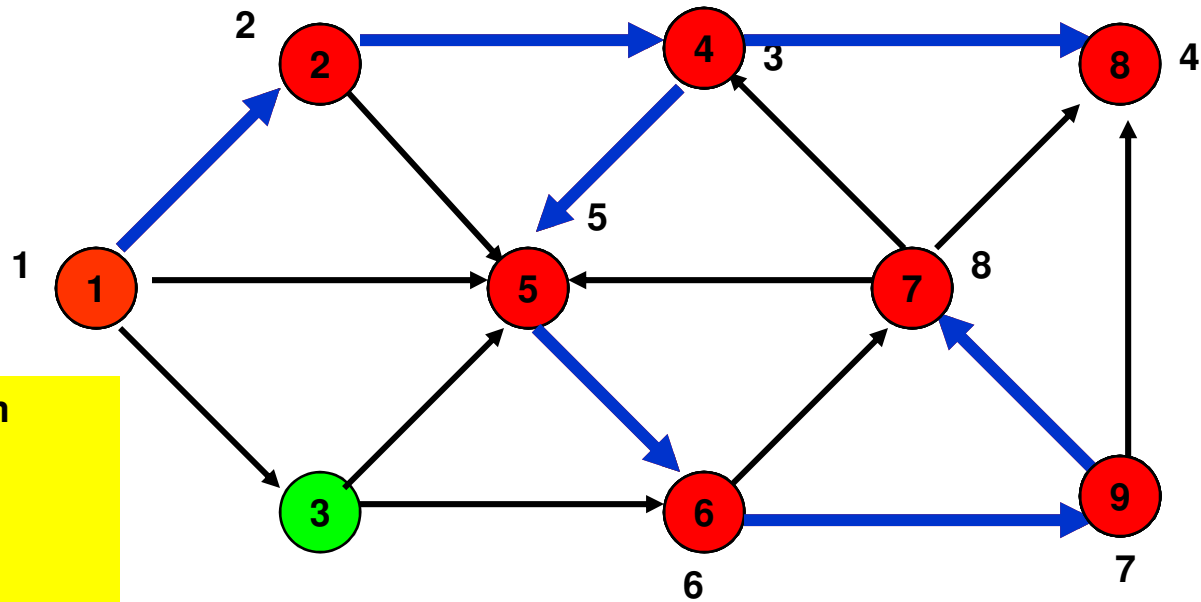
LIST

1	2	4	5	6	9			
---	---	---	---	---	---	--	--	--

next

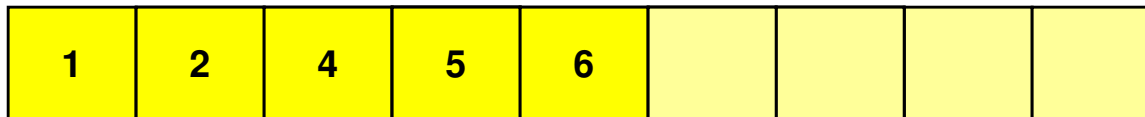
8

## Select node 9



Delete node 9 from LIST

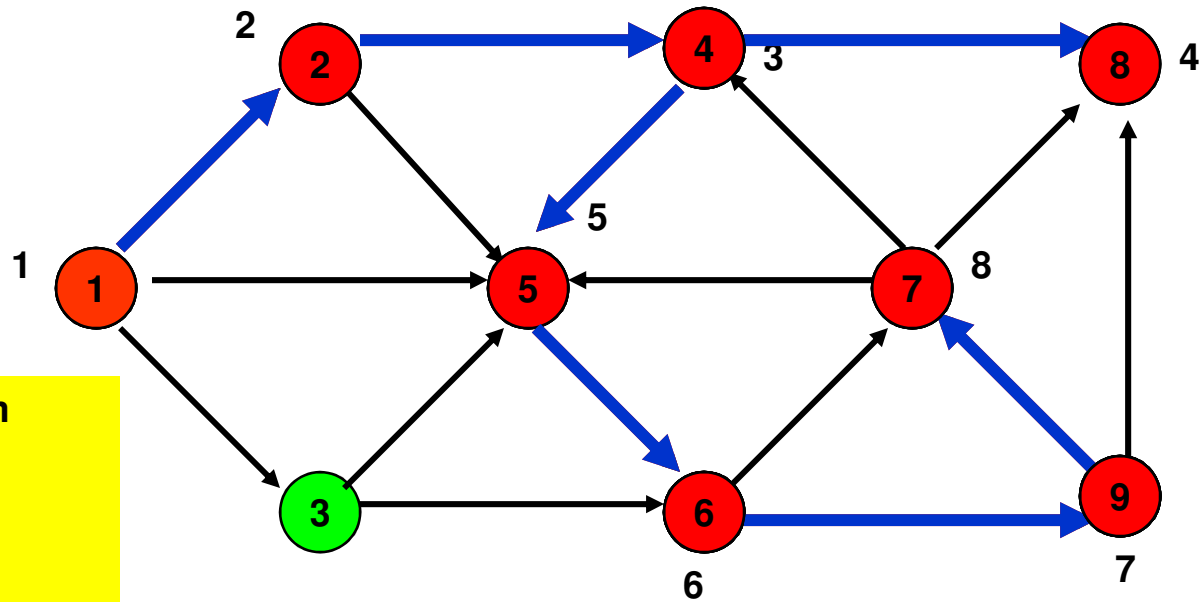
LIST



next

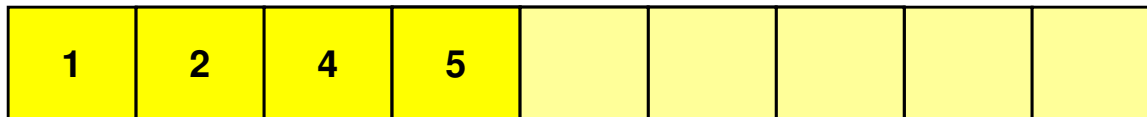
8

## Select node 6



Delete node 6 from  
LIST

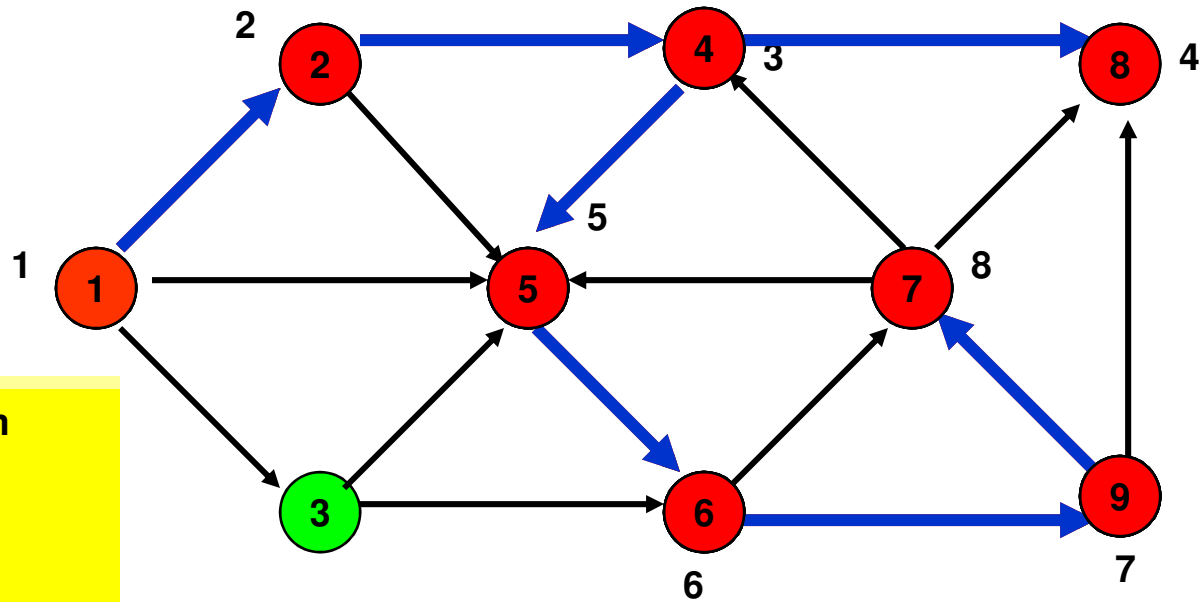
LIST



next

8

## Select node 5



Delete node 5 from  
LIST

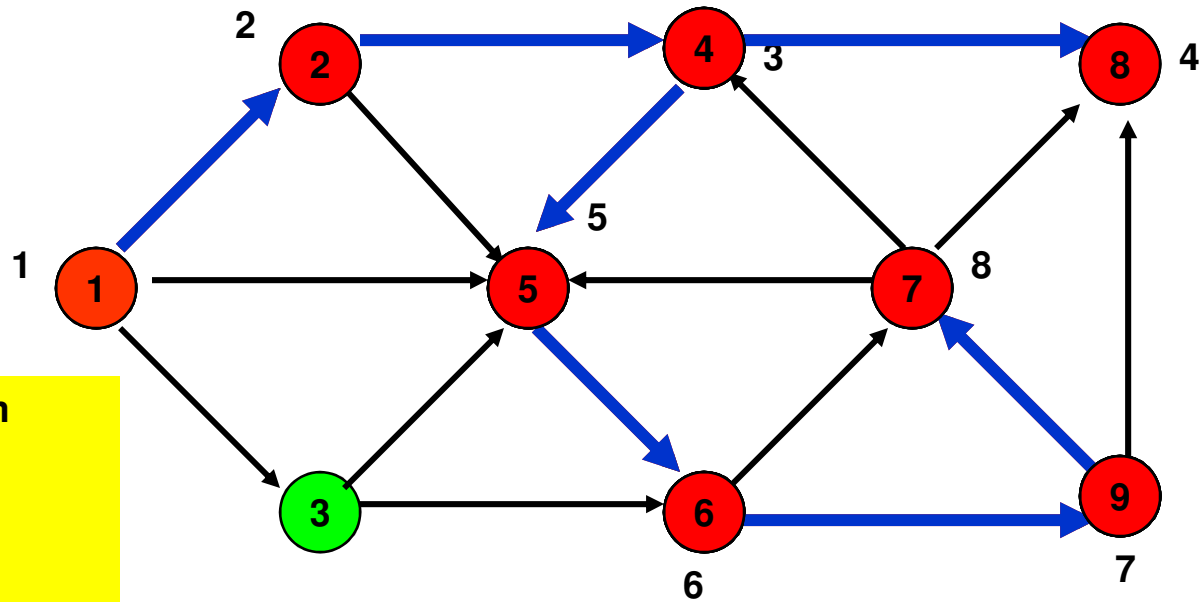
LIST

1	2	4						
---	---	---	--	--	--	--	--	--

next

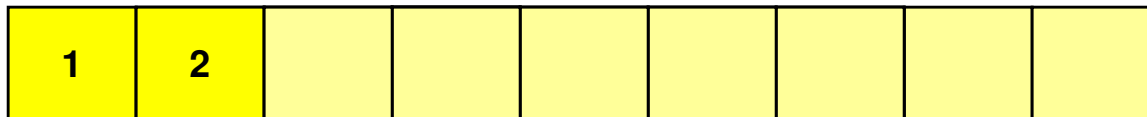
8

## Select node 4



Delete node 4 from  
LIST

LIST

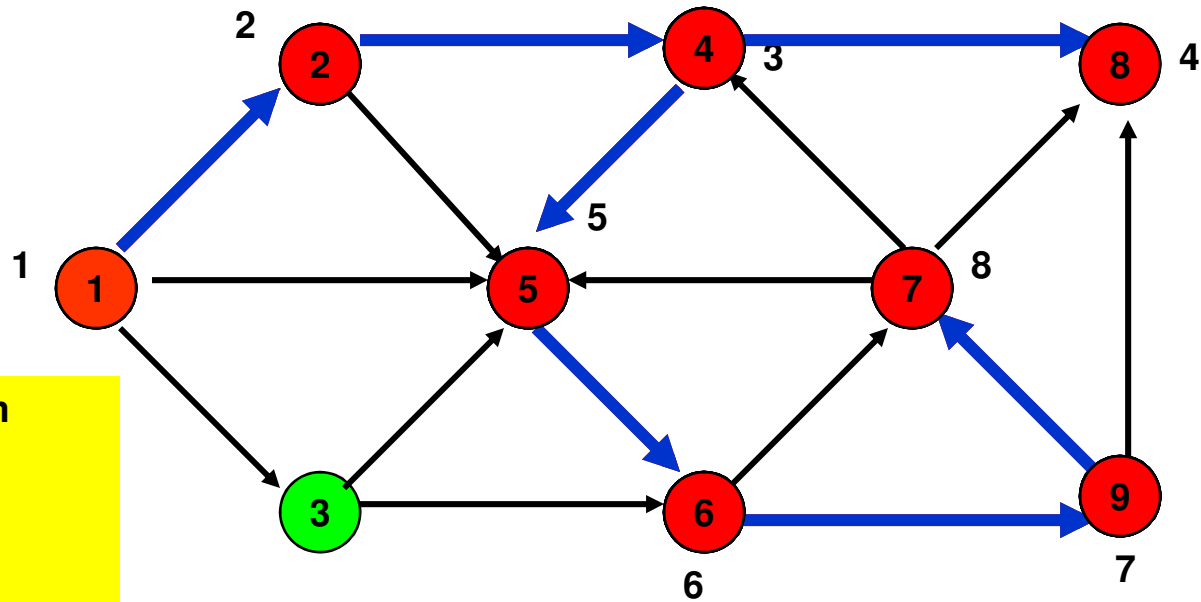


next

8

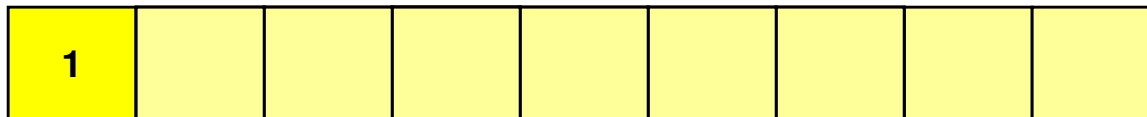


## Select node 2



Delete node 2 from  
LIST

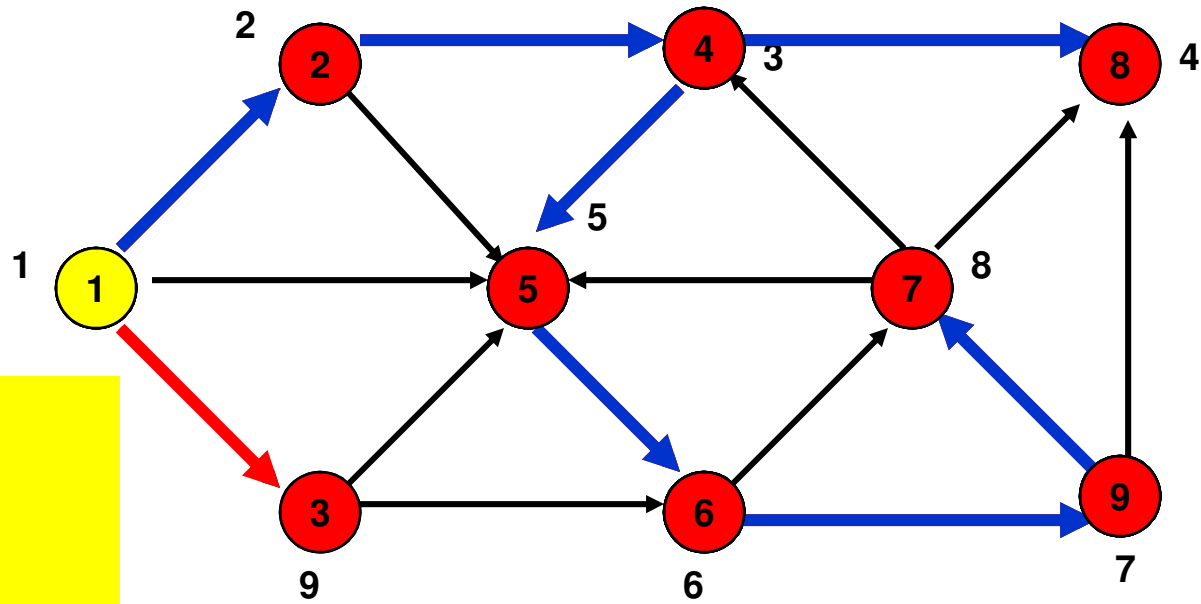
LIST



next

8

## Select node 1



Next :=  
Next + 1  
order(j) := next  
add j to LIST

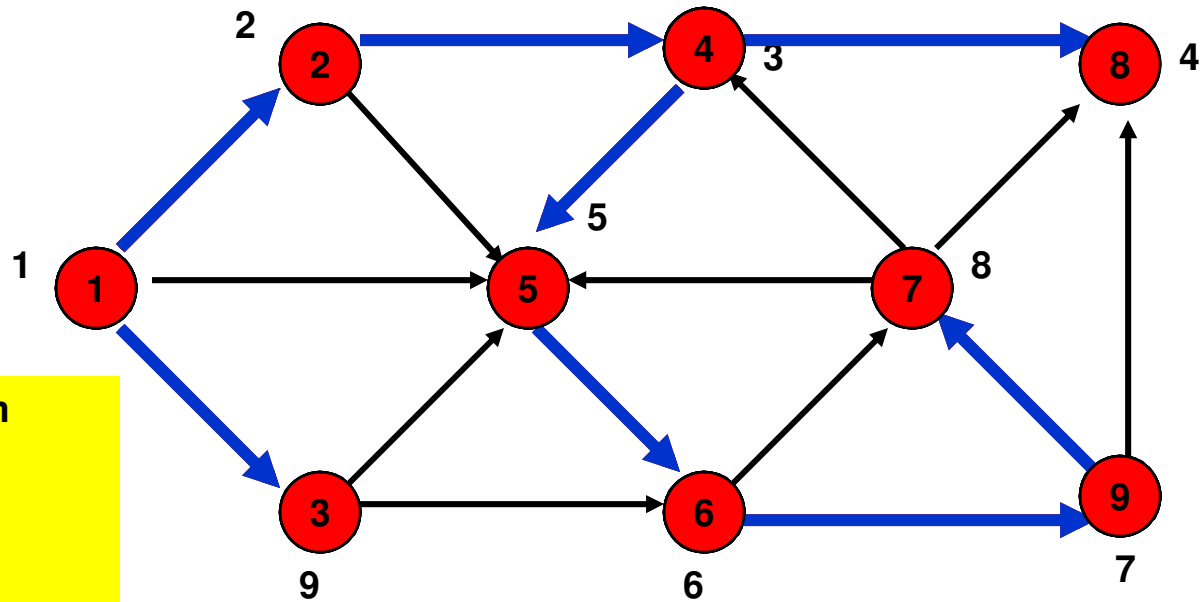
LIST

1	3							
---	---	--	--	--	--	--	--	--

next

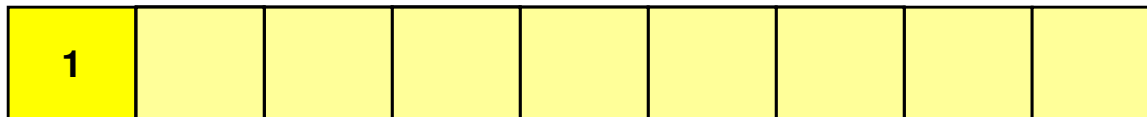
9

## Select node 3



Delete node 3 from  
LIST

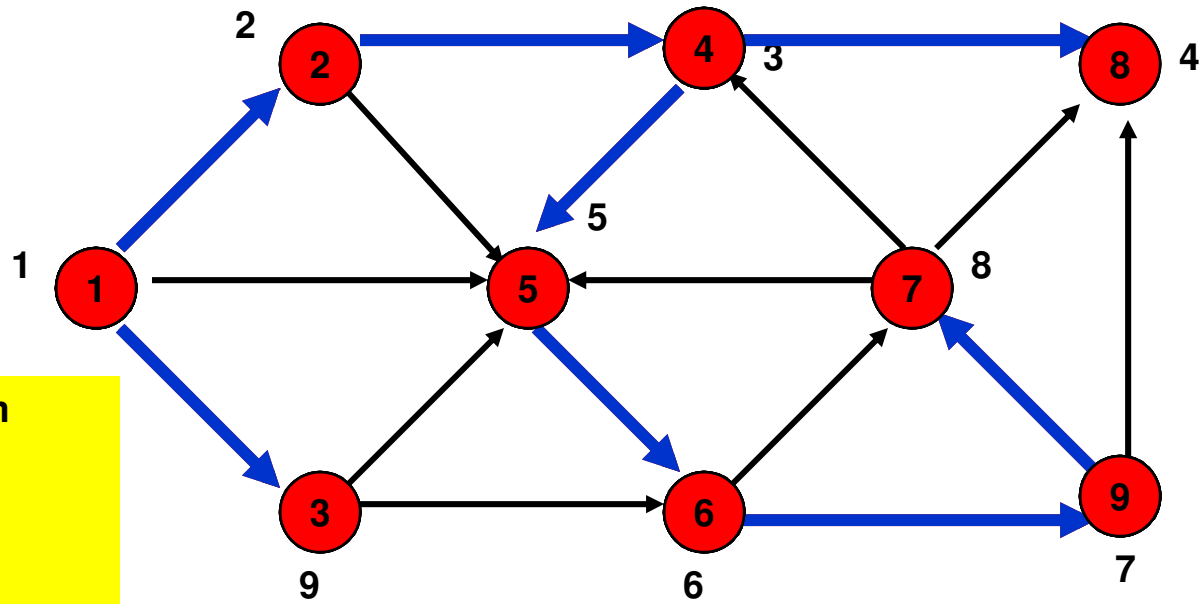
LIST



next

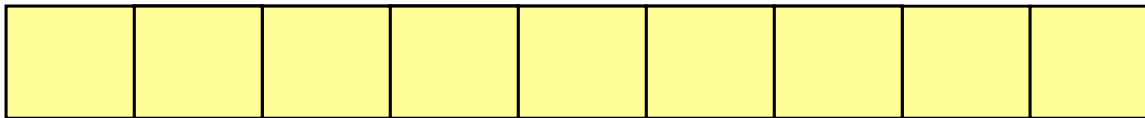
9

# Select node 1



Delete node 1 from  
LIST

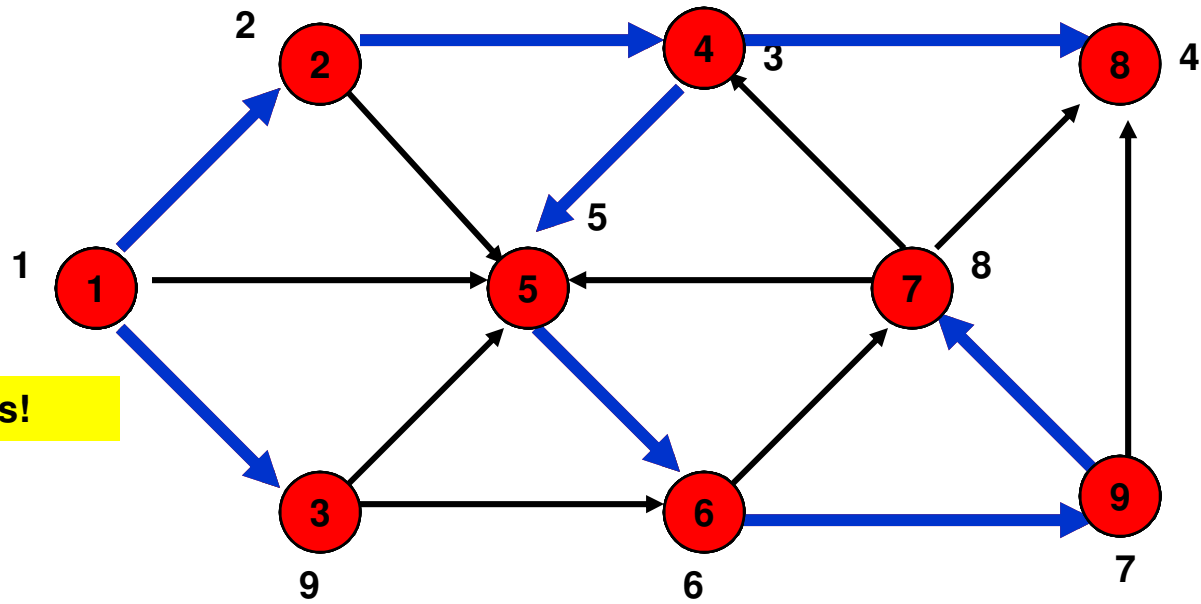
LIST



next

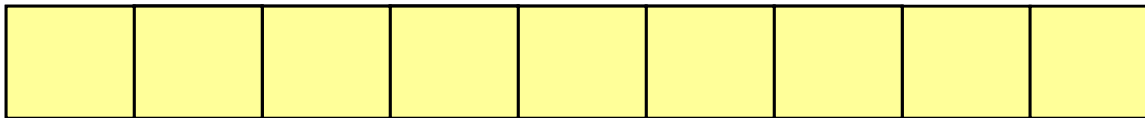
9

# LIST is empty



The algorithm ends!

LIST

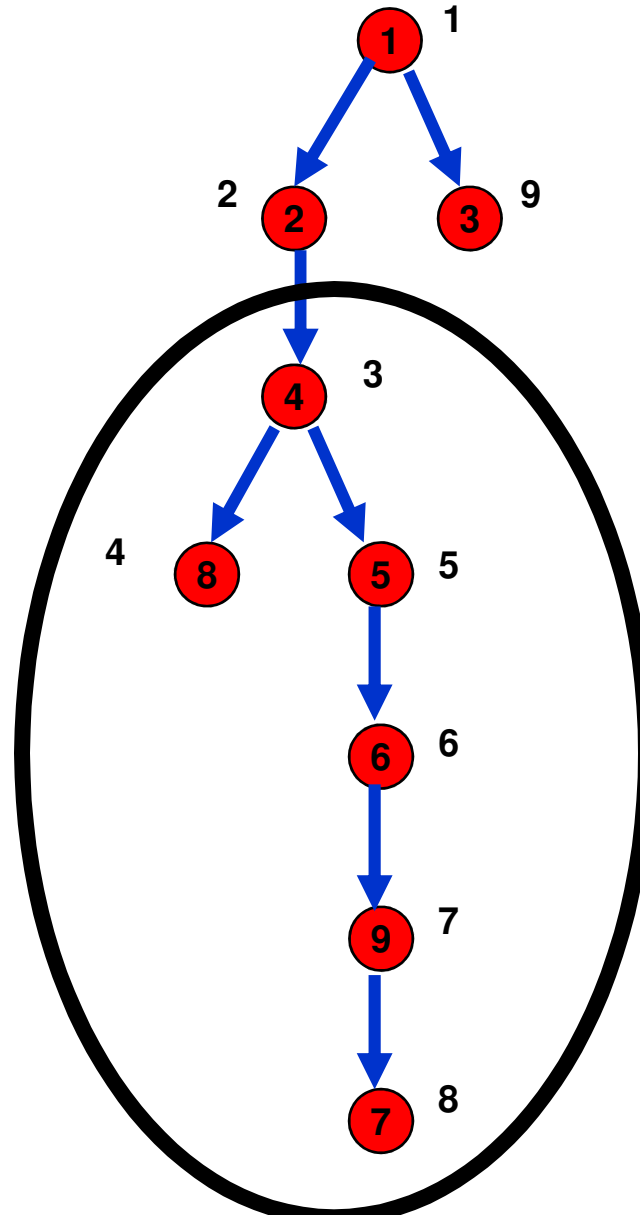


next

9

# The depth first search tree

Note that each induced subtree has consecutively labeled nodes





The End