Chapter 5

5.1 Write a procedure for counting the number of nodes of a linked list.

Solution:

```
Algorithm Count(L)
%%  Input  : Linked list L
%% Output : count
Begin
    if ( L==null ) then
        return (0)
    else
        return( 1 + count(L.next))
    endif
End
```

5.2 Construct a stack with the following characters : CHECK

a) Write procedure for reversing using a stack

***Solution*:**

K
C
E
H
C

```
Begin
    L = pop()
    while ( L ≠ null)
        append list with L
        L = pop()
```

end while

End

b) Write a procedure for checking whether the word is a palindrome or not.

Solution:

Begin

Push string *s* on to a stack S

L = pop()

while (*L* ≠ null)

append list with *L*

L = pop()

end while

if (string on *p*(*s*,*L*) then

print (‘palindrome’)

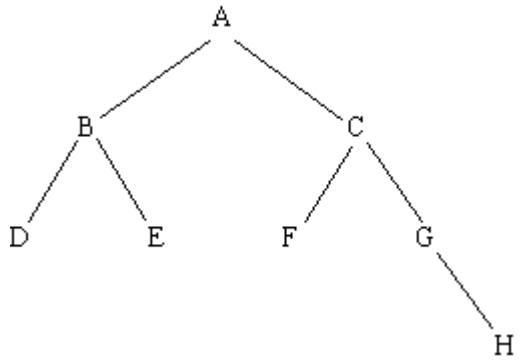
end if

End

5.3 Consider the following tree :

a) Mark the levels and depths of the nodes

level	No. of nodes
Level 0	1
Level 1	2
Level 2	4
Level 3	1
	8(size)



b) Parents : A(root)

Children of A is B & C

Children of B is D & E

Children of C is F & G

Children of G is H

B and C are Siblings

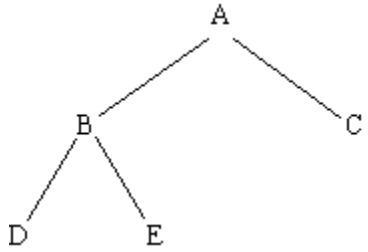
D,E,F,G are siblings

D,E,F,G,H are leaves. All other nodes are internal nodes

A is grand parent of D, E

C is grand parent of H

5.4 Represent the following tree using linear and linked representations.

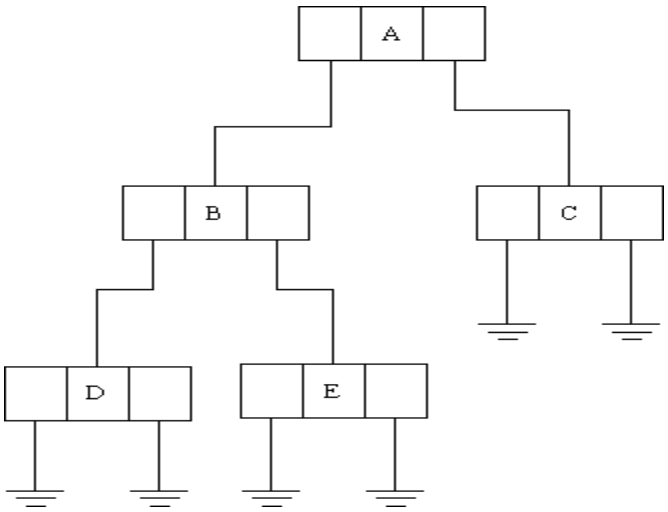


***Solution*:**

Indices	1	2	3	4	5
Node	A	B	C	D	E

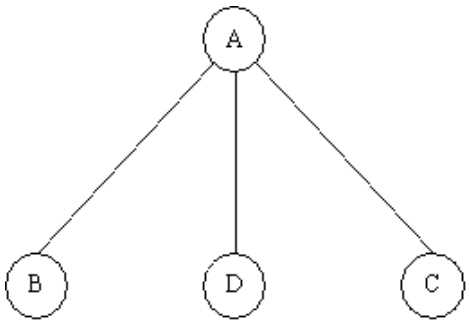
The above is the linear representations

The linked representations is given as



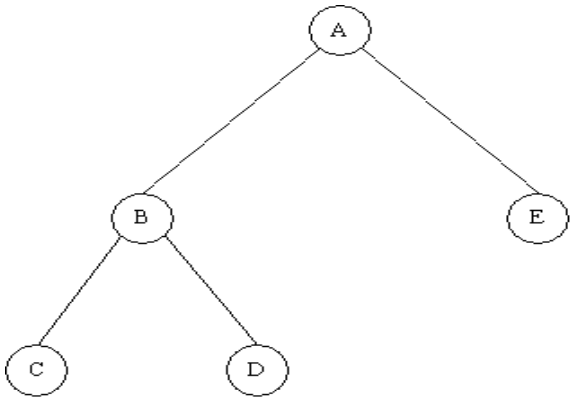
5.5 Identify what type of following tree is

a)



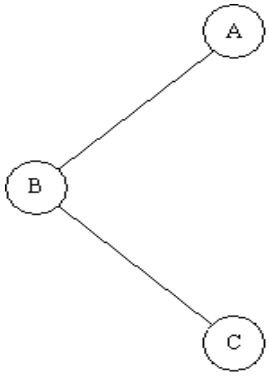
Solution: General tree

b)



Solution: Binary tree

c)



Solution: Binary tree

5.6 Identify whether the following tree is a perfect tree or not

a) *Solution* : Perfect Tree

b) *Solution* : Not a perfect Binary Tree

5.7 Represent the trees of 5.6 using linear representation after numbering the node as per your chain

a)

Indices	1	2	3	4	5	6	7
	A	B	C	D	E	F	G

It can be observed that there is no gaps. So this is a perfect tree

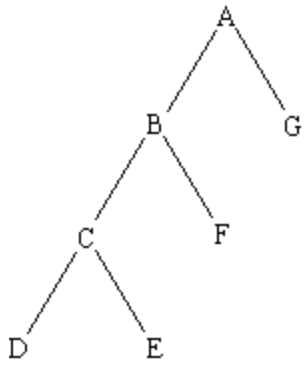
b)

Indices	1	2	3	4	5	6	7
	A	B	C	D	E		F

It can be observed that there is a gap. Therefore, the tree is not a perfect binary tree.

5.8 Show the pre order, in order and post order of the following tree.

a)

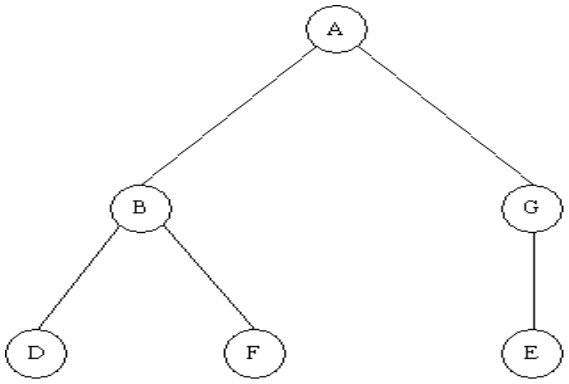


Pre order : A B C D E F G

In order : D C E B F A G

Post order : D E C F B G A

b)



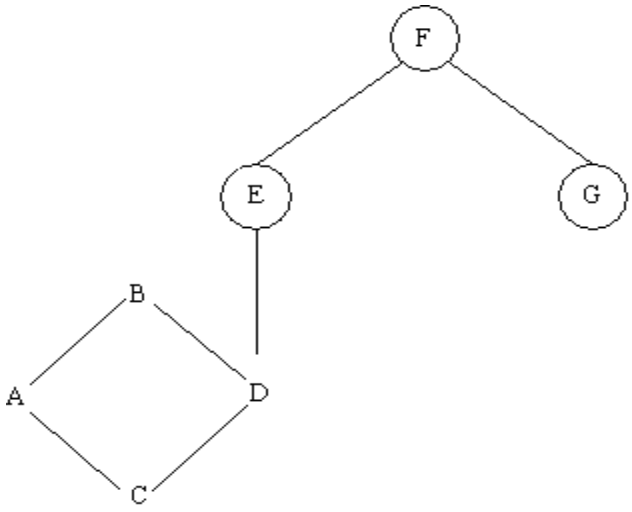
Pre order : A B D F G E

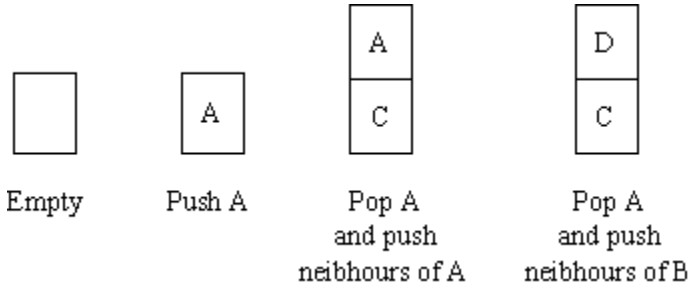
In order : D B F A G E

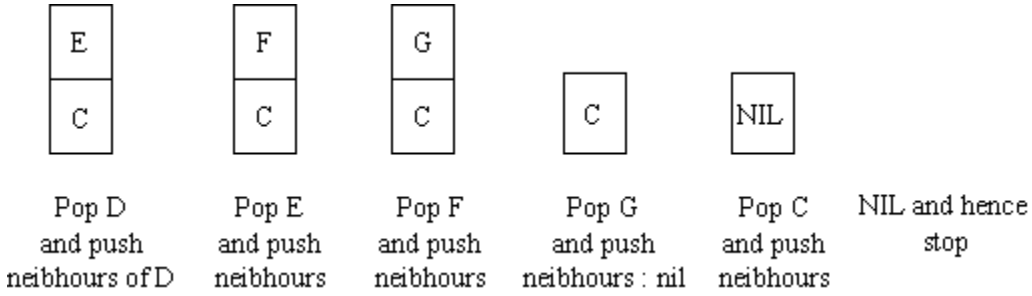
Post order : D F B E G A

5.9 Show the DFS and BFS of the following graphs

a)







∴ DFS : A B D E F G C

For BFS, one has to use queue. Therefore, the BFS is

A B C D E F and G

b)

DFS : D, C, B, A, F, G and E

BFS : D, C, B, A, E, F and G

5.10 How many binary trees can be constructed for eight vertices? Can you generalize this for *N*' nodes?

***Solution*:**

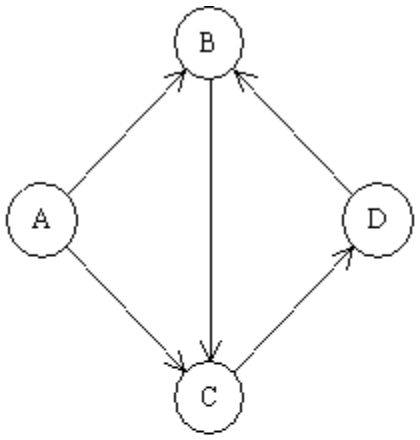
$$c_8 = \frac{1}{9}\binom{18}{8}$$ nodes are possible.

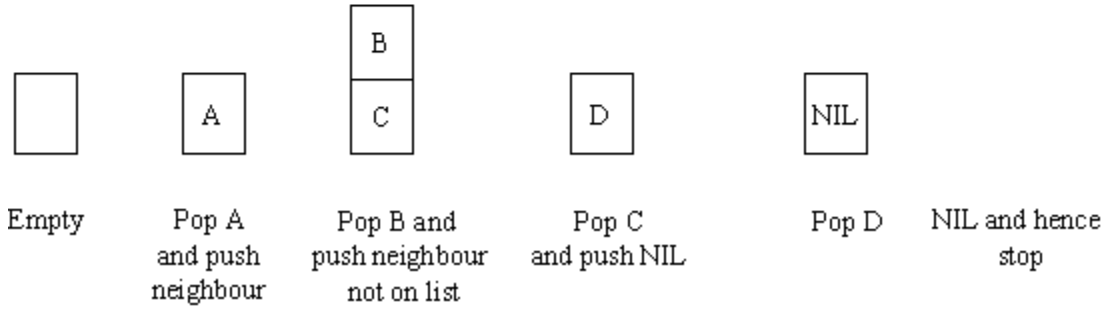
In general, the Catalan for '*n*' is given as

$$c_n = \frac{1}{n+1}\binom{2n}{n}$$

5.11 Consider the following directed graphs. Show that DFS and BFS traversals.

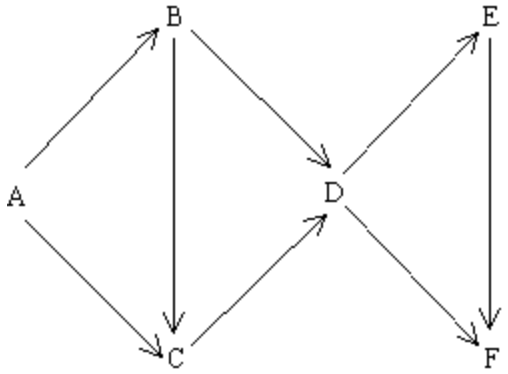
a)





BFS : A B C D

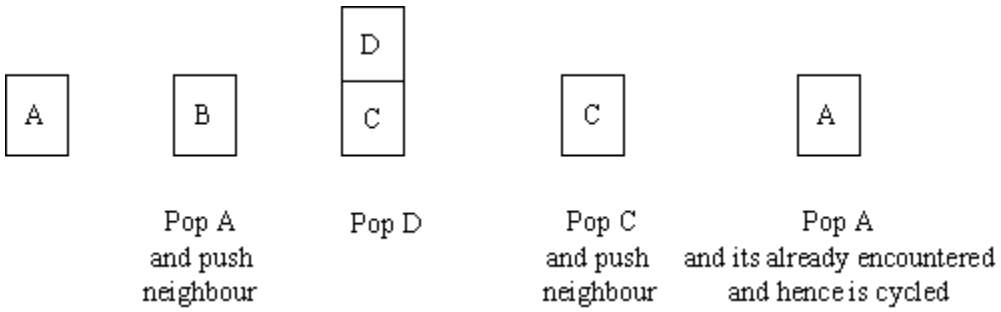
b)



DFS : A, B, D, E, F, C

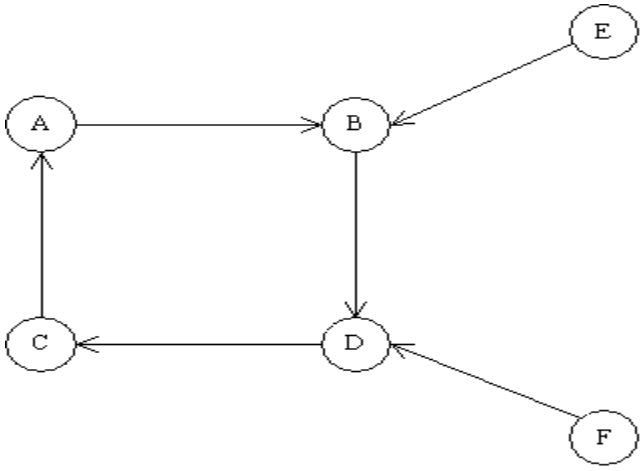
BFS : A, B, C, D, E, F

5.12 Show the presence of cycle in the following graph using DFS



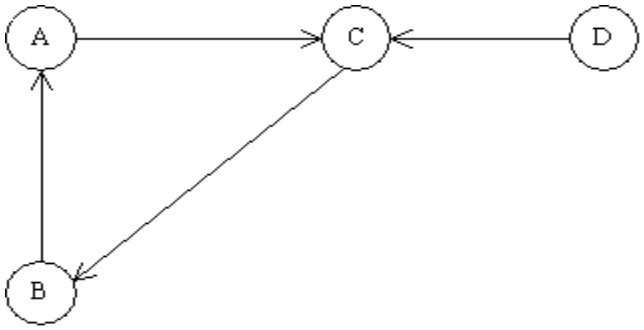
5.13 Show the connected components of the following graph using DFS.

a)



It can be observed that E and F are unreachable. Hence the connected components are A, B, D and C.

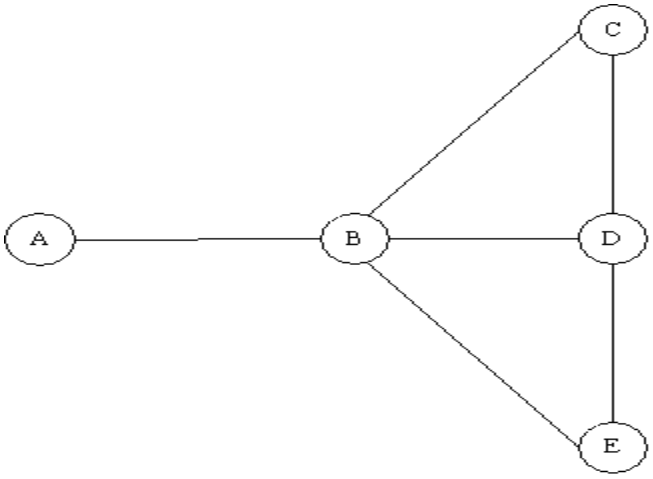
b)



It can be observed that the node ‘D’ is not reachable. Hence, the connected components are A, C and B.

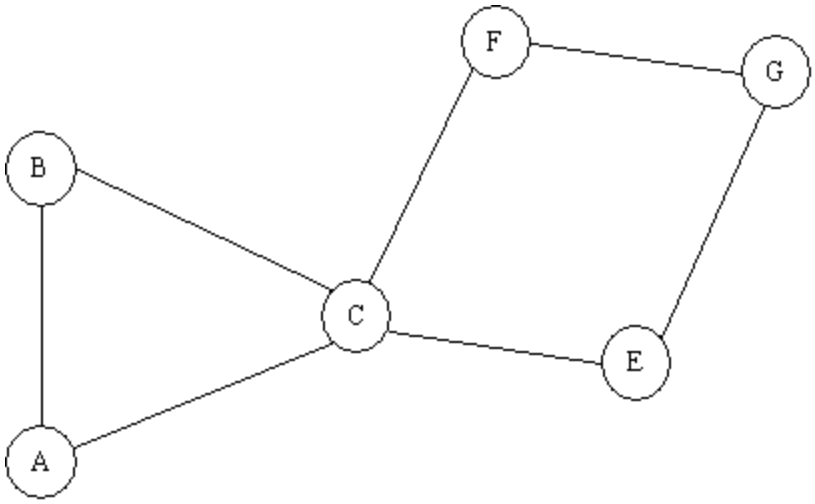
5.14 Find the articulation point in the following graph?

a)



The articulation point is B.

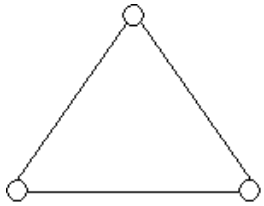
b)



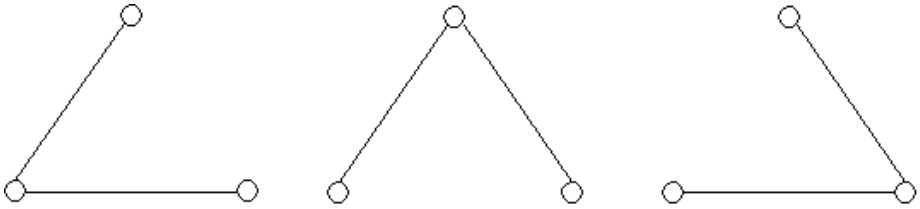
The articulation point is C.

5.15 Construct the spanning graph of the following graphs:

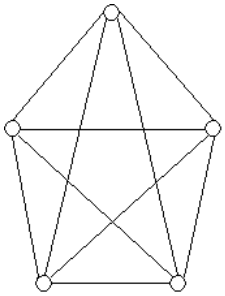
a) K 3



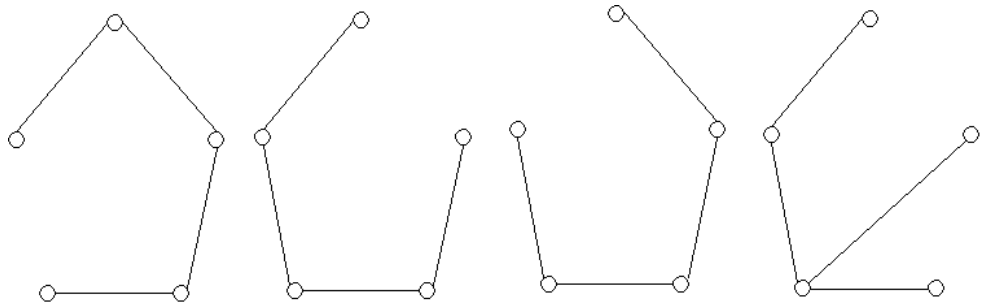
The possible spanning trees are



b) K 5



The possible spanning trees are



5.16 How many spanning trees are possible for a complete graph of 8 vertices?

***Solution*:**

$$T_n = n^{n-2}$$

$$= 8^6$$

$$= 8 \times 8 \times 8 \times 8 \times 8 \times 8$$

= 2,62,144 spanning trees are possible