Q1.

(a)

Algorithm: addition(x,n)
Requires: two positive integers x,n
Returns: One integer = x*n

```
If n == 1
      Return x
Else     return x + addition(x,n-1)
Endif
```

(b)

Algorithm: power(x,n)
Requires: two positive integers x,n
Returns: One integer = x^n

```
If n == 1
      Return x
Else     return addition(x, power(x, n - 1))
Endif
```

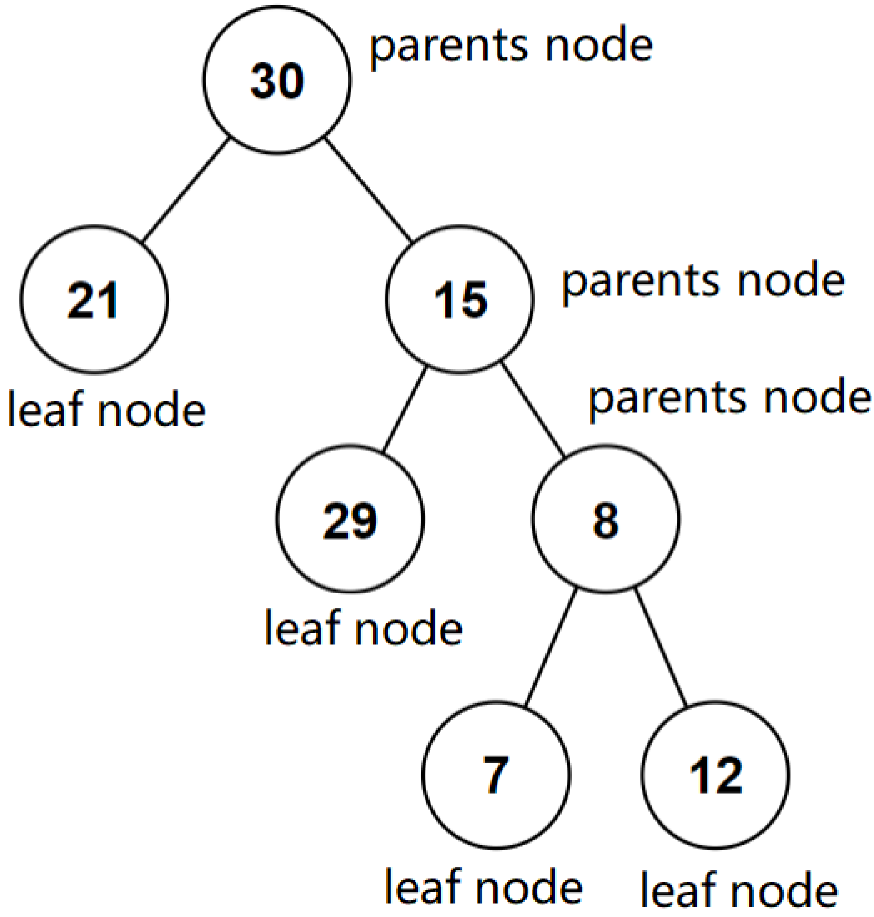
(c)

```
n=4, x=3
      return addition(3, power(3,3))
      =3 * power(3,3) = 3 * 27 = 81
            n=3, x=3
                  return addition(3, power(3,2))
                  =3 * power(3,2) = 3 * 9 = 27
                        n=2, x=3
                              return addition(3, power(3,1))
                              =3 * power(3,1) = 3 * 3 = 9
                                    n=1, x=3
                                          return 3
                              Return 3 * 3 = 9
                  Return 3 * 9 = 27
      Return 3 * 27 = 81
Return 81
```

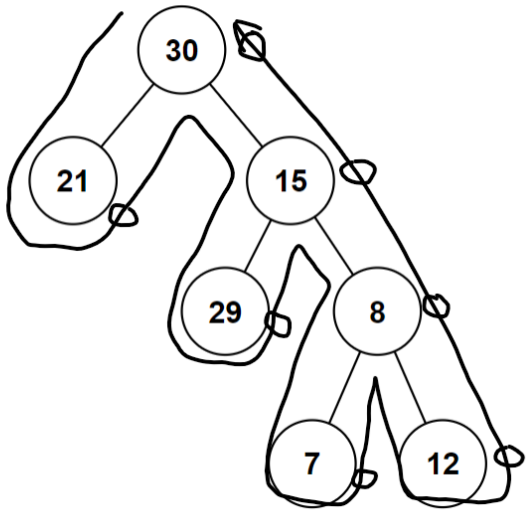
Q3.

(a)

(i)

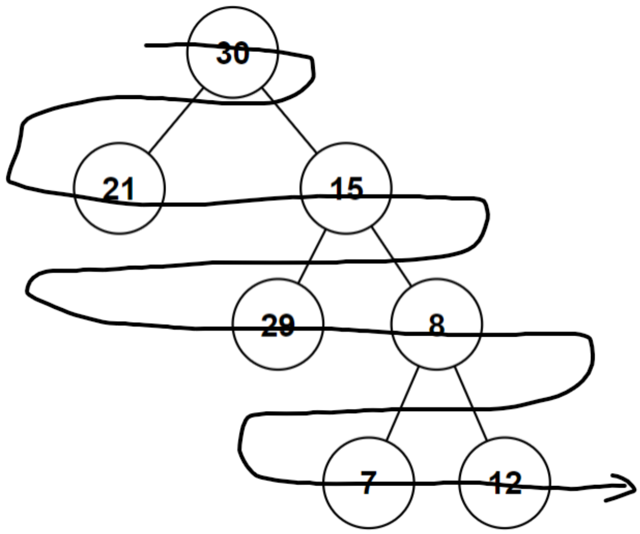


(ii)



21-29-7-12-8-15-30

(iii)



30-21-15-29-8-7-12

(b)

Algorithm: level(x,T)

Requires: a value x and a binary tree T

Returns: One integer = the level to which the value x belongs

1. If search(x,T) == False
2.   Return -1
3. Elseif x == root(T)
4.   Return 0
5. Else return max(level(x,left(T)+1, level(x,right(T))+1)
6. Endif

(c)

Put all the elements in a list using breadth first traversal scheme:

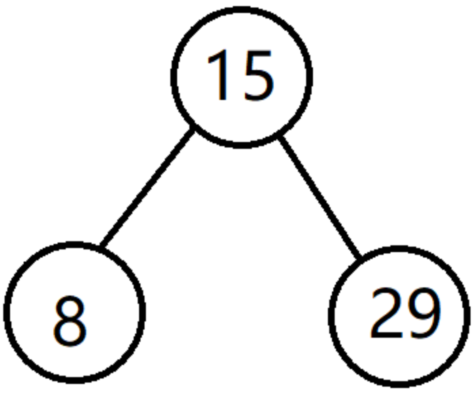
[30,21,15,29,8,7,12]

Sort the list:

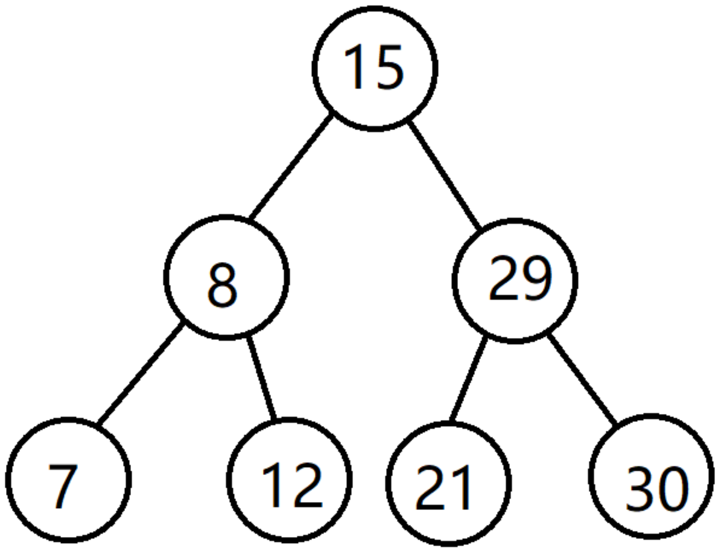
[7,8,12,15,21,29,30]

Find the middle element, and store it in root node.

For left/right sub-lists, find the middle elements and store them in the left/right child nodes on next level.



repeat this process until all elements are stored in the tree.



Q4.

(a)

(i)

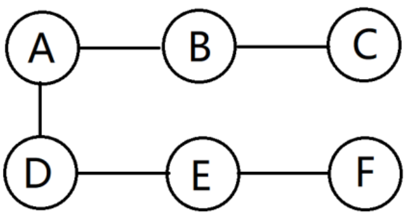
This graph is connected, and it has **two** odd vertexes, so it has Euler path.

(ii)

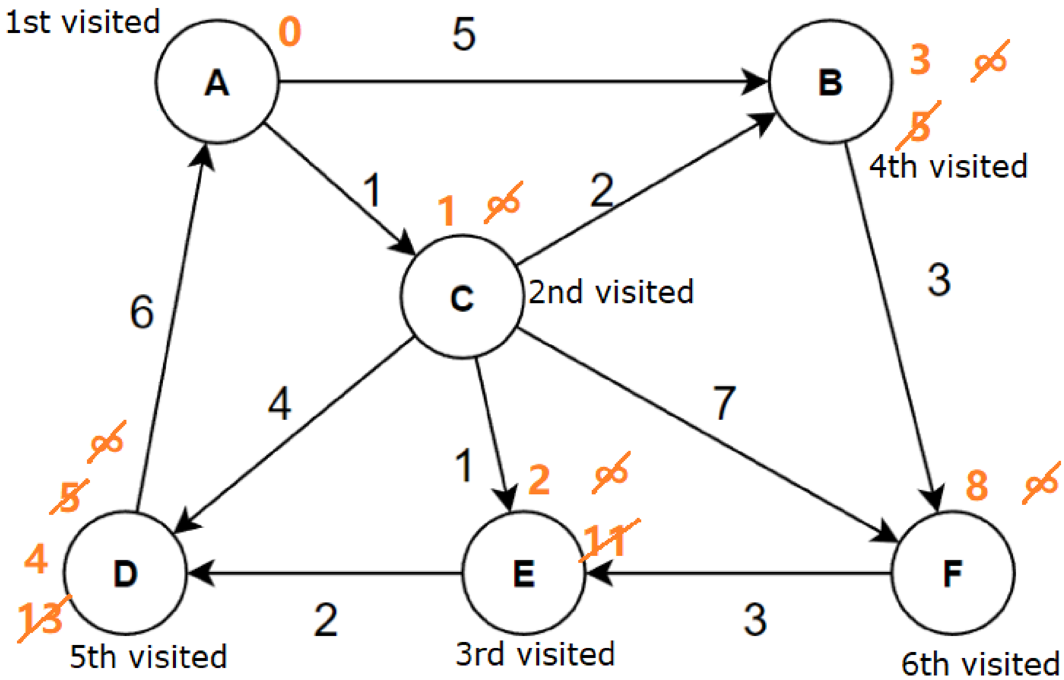
It is NOT a bipartite graph.

It can't be put into two sets, since there are multiple triangular cycles in the graph.

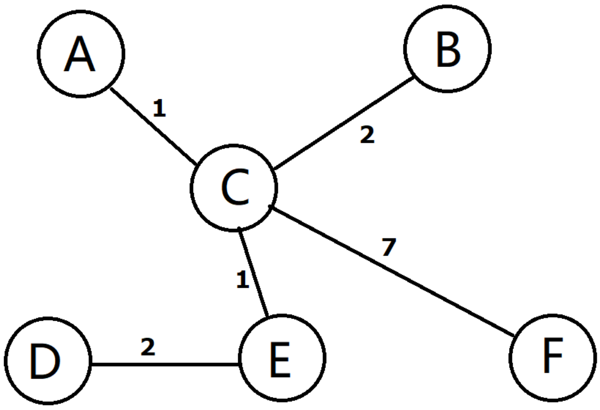
(iii)



(b)



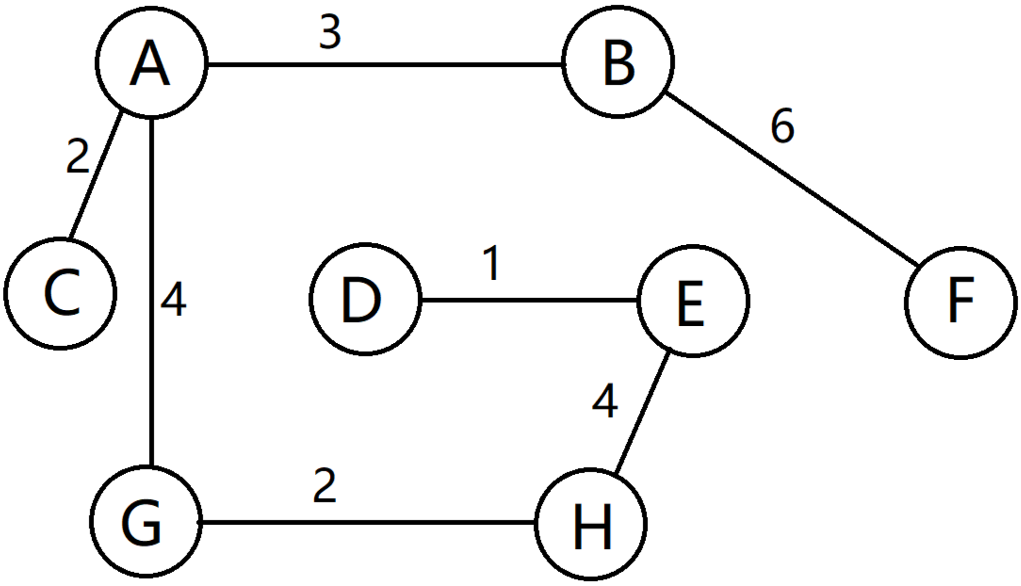
Vertices	Shortest path	Mininum cost
A to B	A-C-B	3
A to C	A-C	1
A to D	A-C-E-D	4
A to E	A-C-E	2
A to F	A-C-F	8



(c)

Start with A.

Visited	Unvisited	Edge selected
A	B,C,D,E,F,G,H	AC-2
A,C	B,D,E,F,G,H	AB-3
A,C,B	D,E,F,G,H	AG-4
A,C,B,G	D,E,F,H	GH-2
A,C,B,G,H	D,E,F	EH-4
A,C,B,G,H,E	D,F	DE-1
A,C,B,G,H,E,D	F	BF-6
A,C,B,G,H,E,D,F		Done.



Mininum cost

1+2+2+3+4+4+6=22