1.
2.

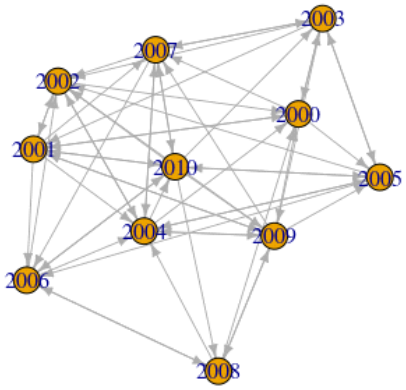
```{r}
library(igraph)
adj<-as.matrix(read.csv("Adjacency.csv"))
adj

edg<-as.matrix(read.csv("Edges.csv"))
edg
```

```
         X X2000 X2001 X2002 X2003 X2004 X2005 X2006 X2007 X2008 X2009 X2010
 [1,] 2000     0     1     0     1     0     1     0     1     0     0     0
 [2,] 2001     1     1     1     0     1     0     1     1     0     1     1
 [3,] 2002     1     1     0     0     1     0     0     0     0     0     0
 [4,] 2003     1     1     1     0     0     1     0     1     0     1     0
 [5,] 2004     1     0     1     0     0     1     0     1     0     1     1
 [6,] 2005     0     0     1     1     1     0     1     0     0     0     1
 [7,] 2006     0     0     1     0     1     0     0     0     1     0     1
 [8,] 2007     0     0     1     1     1     0     1     1     0     0     1
 [9,] 2008     1     0     0     0     1     0     1     0     0     1     0
[10,] 2009     1     1     1     0     1     1     0     1     1     1     0
[11,] 2010     0     1     1     1     0     1     1     1     1     1     1
        V1   V2
 [1,] 2000 2001
 [2,] 2001 2002
 [3,] 2002 2004
 [4,] 2003 2004
 [5,] 2004 2003
 [6,] 2004 2002
 [7,] 2006 2008
 [8,] 2006 2007
 [9,] 2008 2010
[10,] 2008 2000
[11,] 2010 2000
```

3.

```
dat=read.csv(file.choose(),header=TRUE,sep=',', row.names=1,check.names=FALSE)
m=as.matrix(dat)
net=graph.adjacency(m,mode="directed",weighted=TRUE,diag=FALSE)
plot.igraph(net,vertex.label=V(net)$name,layout=layout.fruchterman.reingold,
edge.arrow.size=0.5)
net
```



IGRAPH c8bf0fb DNW- 11 59 --
+ attr: name (v/c), weight (e/n)
+ edges from c8bf0fb (vertex names):
[1] 2000->2001 2000->2003 2000->2005 2000->2007 2001->2000 2001->2002
2001->2004 2001->2006 2001->2007 2001->2009 2001->2010
[12] 2002->2000 2002->2001 2002->2004 2003->2000 2003->2001 2003->2002
2003->2005 2003->2007 2003->2009 2004->2000 2004->2002
[23] 2004->2005 2004->2007 2004->2009 2004->2010 2005->2002 2005->2003
2005->2004 2005->2006 2005->2010 2006->2002 2006->2004
[34] 2006->2008 2006->2010 2007->2002 2007->2003 2007->2004 2007->2006
2007->2010 2008->2000 2008->2004 2008->2006 2008->2009
[45] 2009->2000 2009->2001 2009->2002 2009->2004 2009->2005 2009->2007
2009->2008 2010->2001 2010->2002 2010->2003 2010->2005
[56] 2010->2006 2010->2007 2010->2008 2010->2009

4.

```
> V(net)
+ 11/11 vertices, named, from ad2dcbc:
 [1] 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
> E(net)
+ 43/43 edges from ad2dcbc (vertex names):
 [1] 2000--2001 2000--2002 2000--2003 2000--2004 2000--2005 2000--2007 2000--
2008 2000--2009 2001--2002 2001--2003 2001--2004
[12] 2001--2006 2001--2007 2001--2009 2001--2010 2002--2003 2002--2004 2002--
2005 2002--2006 2002--2007 2002--2009 2002--2010
[23] 2003--2005 2003--2007 2003--2009 2003--2010 2004--2005 2004--2006 2004--
2007 2004--2008 2004--2009 2004--2010 2005--2006
[34] 2005--2009 2005--2010 2006--2007 2006--2008 2006--2010 2007--2009 2007--
2010 2008--2009 2008--2010 2009--2010
>
```

5. Find the count of vertices and edges of the created graph

```
> vcount(net)
[1] 11
> ecount(net)
[1] 43
```

6.Display the adjacency vertices of each vertex(individual) in the created graph

```
x<-adjacent_vertices(net, V(net), mode = c("out", "in", "all", "total"))
x
```


```
+ 9/11 vertices, named, from 9cea254:
[1] 2000 2001 2002 2005 2006 2007 2008 2009 2010

$`2005`
+ 7/11 vertices, named, from 9cea254:
[1] 2000 2002 2003 2004 2006 2009 2010

$`2006`
+ 7/11 vertices, named, from 9cea254:
[1] 2001 2002 2004 2005 2007 2008 2010

$`2007`
+ 8/11 vertices, named, from 9cea254:
[1] 2000 2001 2002 2003 2004 2006 2009 2010

$`2008`
+ 5/11 vertices, named, from 9cea254:
[1] 2000 2004 2006 2009 2010

$`2009`
+ 9/11 vertices, named, from 9cea254:
[1] 2000 2001 2002 2003 2004 2005 2007 2008 2010

$`2010`
+ 9/11 vertices, named, from 9cea254:
[1] 2001 2002 2003 2004 2005 2006 2007 2008 2009
```

7.

```
degree(net, v = V(net), mode = c("all", "out", "in", "total"),
  loops = TRUE, normalized = FALSE)
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
  8    8    9    7    9    7    7    8    5    9    9
```

8.

```
net=set_vertex_attr(net, "Profit", index = V(net), c("+", "-", "+", "-", "+", "-","+", "-", "+", "-","+"))
plot.igraph(net, vertex.label.color="red", vertex.label.dist=0, vertex.label.family="Helvetica", vertex.frame.color="yellow",
vertex.size=35)
net
```


```
IGRAPH 984bdbf UNW- 11 43 --
+ attr: name (v/c), color (v/c), Profit (v/c), weight (e/n)
+ edges from 984bdbf (vertex names):
 [1] 2000--2001 2000--2002 2000--2003 2000--2004 2000--2005 2000--2007 2000--2008 2000-
-2009 2001--2002 2001--2003 2001--2004
[12] 2001--2006 2001--2007 2001--2009 2001--2010 2002--2003 2002--2004 2002--2005 2002-
-2006 2002--2007 2002--2009 2002--2010
[23] 2003--2005 2003--2007 2003--2009 2003--2010 2004--2005 2004--2006 2004--2007 2004-
-2008 2004--2009 2004--2010 2005--2006
[34] 2005--2009 2005--2010 2006--2007 2006--2008 2006--2010 2007--2009 2007--2010 2008-
-2009 2008--2010 2009--2010
```

9.

```
net=set_vertex_attr(net, "Type", index = V(net),
c("leap","nonleap","nonleap","nonleap","leap","nonleap","nonleap","nonleap","leap","nonleap","nonleap"))
plot.igraph(net, vertex.label.color="red", vertex.label.dist=0, vertex.label.family="Helvetica", vertex.frame.color="yellow",
vertex.size=35)
net
```


```
IGRAPH 2e7d2c4 UNW- 11 43 --
+ attr: name (v/c), color (v/c), Type (v/c), weight (e/n)
+ edges from 2e7d2c4 (vertex names):
 [1] 2000--2001 2000--2002 2000--2003 2000--2004 2000--2005 2000--2007 2000--2008 2000-
-2009 2001--2002 2001--2003 2001--2004
[12] 2001--2006 2001--2007 2001--2009 2001--2010 2002--2003 2002--2004 2002--2005 2002-
-2006 2002--2007 2002--2009 2002--2010
[23] 2003--2005 2003--2007 2003--2009 2003--2010 2004--2005 2004--2006 2004--2007 2004-
-2008 2004--2009 2004--2010 2005--2006
[34] 2005--2009 2005--2010 2006--2007 2006--2008 2006--2010 2007--2009 2007--2010 2008-
-2009 2008--2010 2009--2010
```

10.

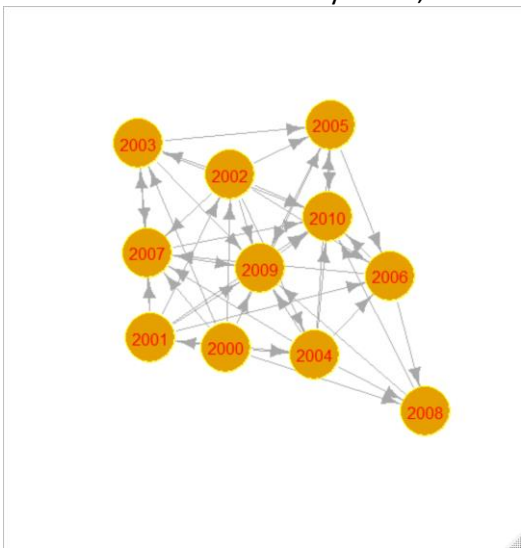
```
e=set_edge_attr(net, "Weight", index=V(net), c(1,1,1,1,1,1,1,1,5,1))
plot.igraph(net, vertex.label.color="red", vertex.label.dist=0, vertex.label.family="Helvetica",
        vertex.frame.color="yellow", vertex.size=35)
e
```

```
IGRAPH e0bcb71 UNW- 11 43 --
+ attr: name (v/c), Type (v/c), weight (e/n), Weight (e/n)
+ edges from e0bcb71 (vertex names):
 [1] 2000--2001 2000--2002 2000--2003 2000--2004 2000--2005 2000--2007
 [7] 2000--2008 2000--2009 2001--2002 2001--2003 2001--2004 2001--2006
[13] 2001--2007 2001--2009 2001--2010 2002--2003 2002--2004 2002--2005
[19] 2002--2006 2002--2007 2002--2009 2002--2010 2003--2005 2003--2007
[25] 2003--2009 2003--2010 2004--2005 2004--2006 2004--2007 2004--2008
[31] 2004--2009 2004--2010 2005--2006 2005--2009 2005--2010 2006--2007
```

```
[37] 2006--2008 2006--2010 2007--2009 2007--2010 2008--2009 2008--2010
[43] 2009--2010
```

11.

```
newnet=as.directed(net, "arbitrary")
plot.igraph(newnet, vertex.label.color="red", vertex.label.dist=0, vertex.label.family="Helvetica",
        vertex.frame.color="yellow", vertex.size=35)
```



12.

```
get.adjacency(newnet)
11 x 11 sparse Matrix of class "dgCMatrix"
   [[ suppressing 11 column names '2000', '2001', '2002' ... ]]

2000 . 1 1 1 1 1 . 1 1 1 .
2001 . . 1 1 1 . 1 1 . 1 1
2002 . . . 1 1 1 1 1 . 1 1
2003 . . . . . 1 . 1 . 1 1
2004 . . . . . 1 1 1 1 1 1
2005 . . . . . . 1 . . 1 1
2006 . . . . . . . 1 1 . 1
2007 . . . . . . . . . . 1 1
2008 . . . . . . . . . . 1 1
2009 . . . . . . . . . . . 1
2010 . . . . . . . . . . . .
```

13.

```
d=data.frame(
 In=dgr(newnet, "indegree", undirected = FALSE),
 Out=dgr(newnet, "outdegree", undirected = FALSE))
```