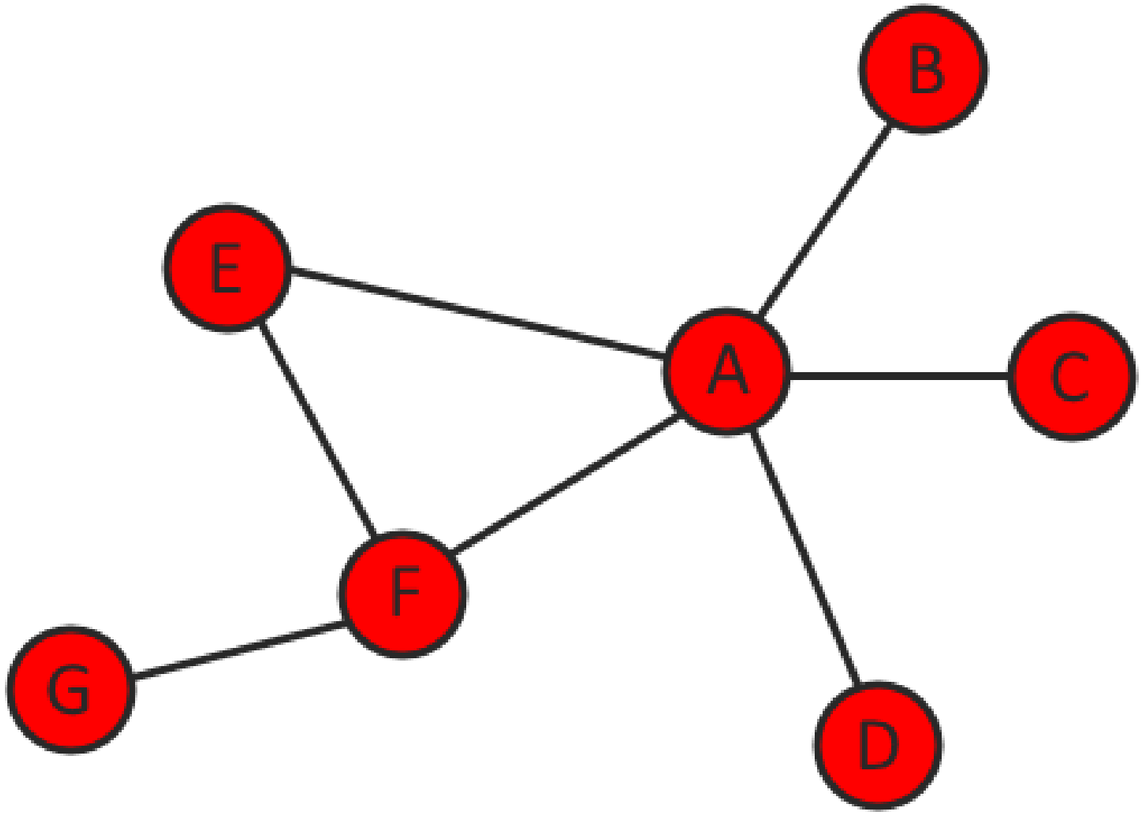
What are social networks?

NETWORK ANALYSIS IN R

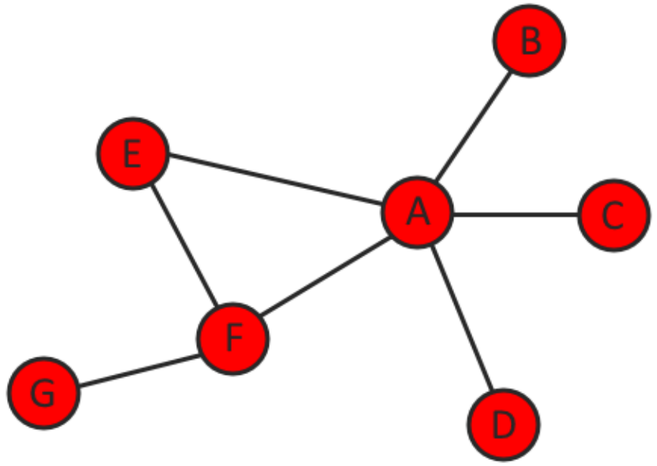
James Curley

Associate Professor, University of Texas at Austin

What are social networks?

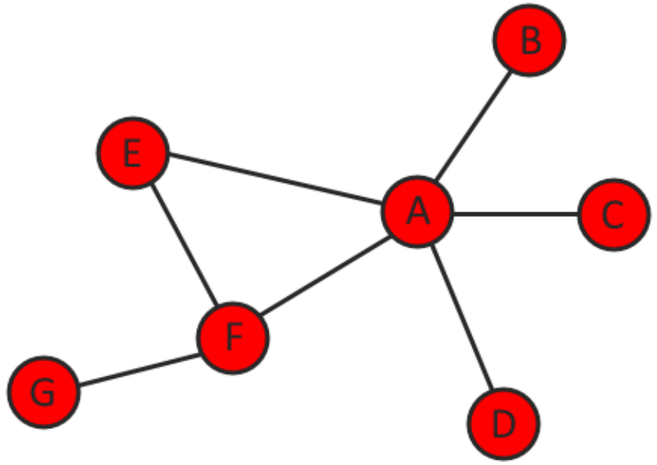


Network data: adjacency matrix



	A	B	C	D	E	F	G
A	0	1	1	1	1	1	0
B	1	0	0	0	0	0	0
C	1	0	0	0	0	0	0
D	1	0	0	0	0	0	0
E	1	0	0	0	0	1	0
F	1	0	0	0	1	0	1
G	0	0	0	0	0	1	0

Network data: edgelist



A	B
A	C
A	D
A	E
A	F
E	F
F	G

The igraph R package

A	B
A	C
A	D
A	E
A	F
E	F
F	G

```
library(igraph)

g <- graph.edgelist(as.matrix(df),
                    directed = FALSE)

g
```

```
IGRAPH UN-- 7 7 --
+ attr: name (v/c)
+ edges (vertex names):
[1] A--B A--C A--D A--E A--F E--F F--G
```

```
V(g)
```

```
+ 7/7 vertices, named:
[1] A B C D E F G
```

```
E(g)
```

```
+ 7/7 edges (vertex names):
[1] A--B A--C A--D A--E A--F E--F F--G
```

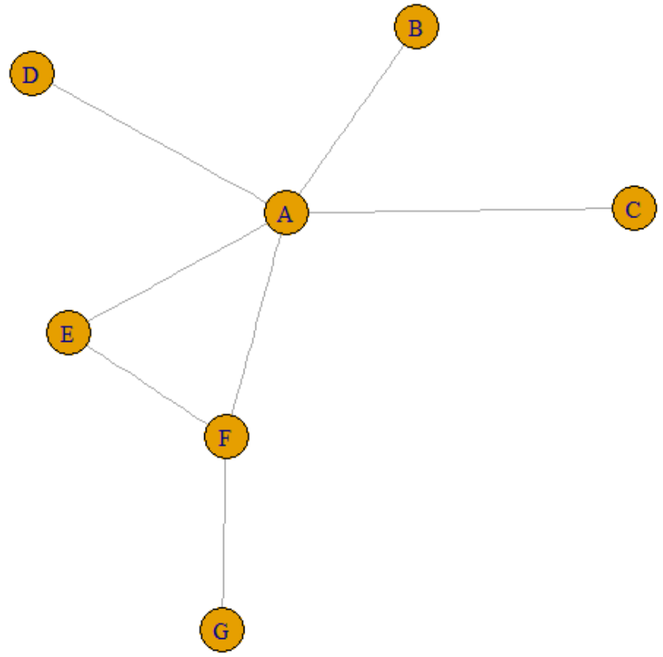
```
gorder(g)
```

```
[1] 7
```

```
gsize(g)
```

```
[1] 7
```

```
plot(g)
```



Let's practice!

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Network Attributes

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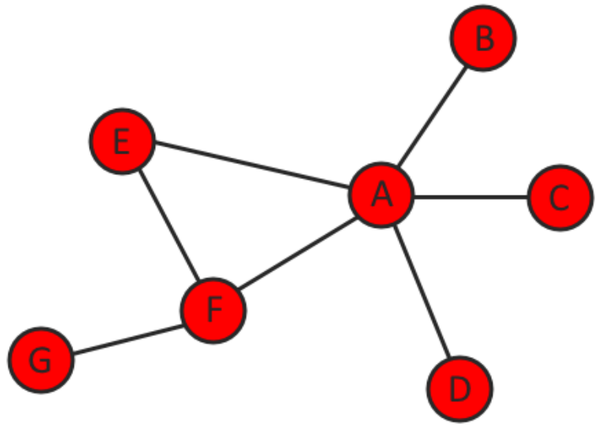
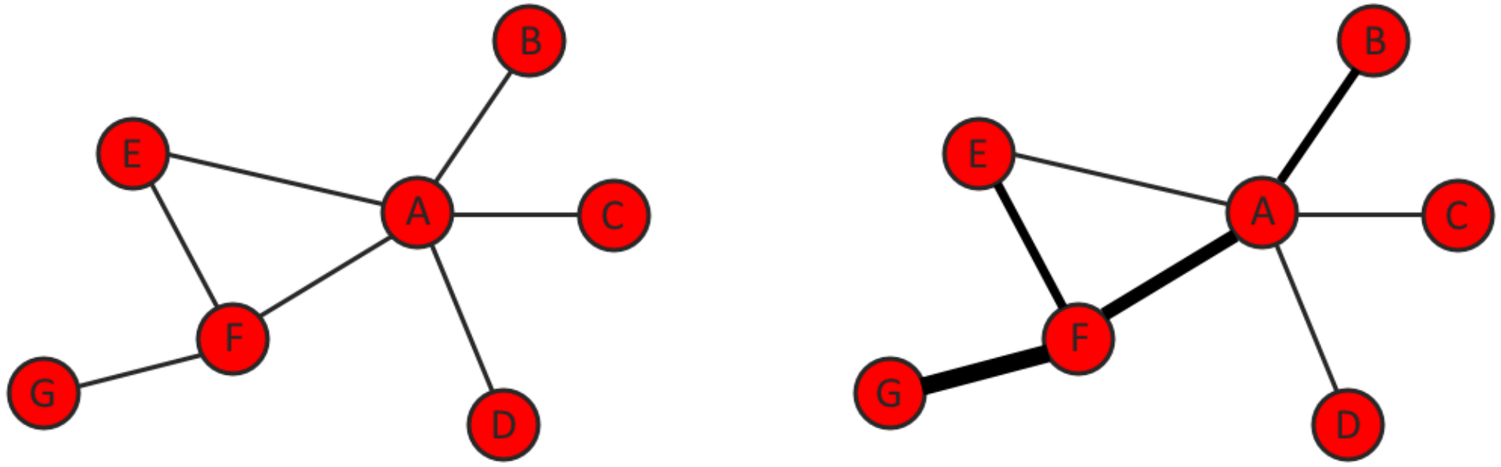
Vertex attributes




```
g
```

```
IGRAPH UN-- 7 7 --
+ attr: name (v/c)
+ edges (vertex names):
[1] A--B A--C A--D A--E A--F E--F F--G
```

Edge attributes



Adding Vertex Attributes

```
g <- set_vertex_attr(
  g,
  "age",
  value = c(
    20,25,21,23,24,23,22
    )
  )

vertex_attr(g)
```

```
$name
[1] "A" "B" "C" "D" "E" "F" "G"

$age
[1] 20 25 21 23 24 23 22
```

Adding Edge Attributes

```
g <- set_edge_attr(
  g,
  "frequency",
  value = c(
    2,1,1,1,3,2,4
    )
  )

edge_attr(g)
```

```
$frequency
[1] 2 1 1 1 3 2 4
```

Adding attributes II

vertices.df

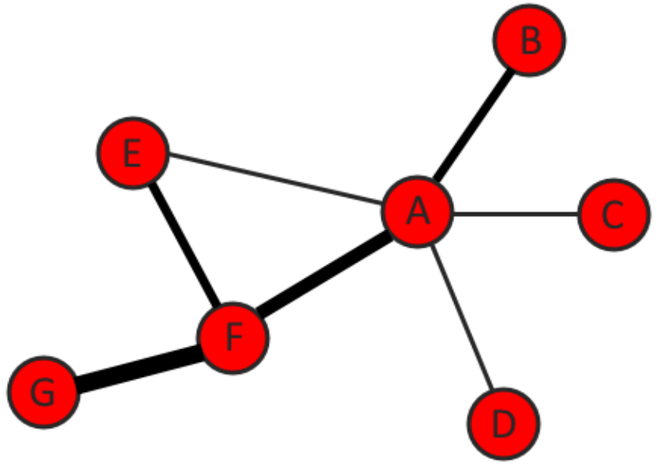
name	age
A	20
B	25
C	21
D	23
E	24
F	23
G	22

edges.df

from	to	frequency
A	B	2
A	C	1
A	D	1
A	E	1
A	F	3
E	F	2
F	G	4

```
graph_from_data_frame(d = edges.df, vertices = vertices.df,
                      directed = FALSE)
```

Subsetting networks




```
E(g)[[inc('E')]]
```

```
+ 2/7 edges (vertex names):
  tail head tid hid frequency
4    E    A   5   1         1
6    F    E   6   5         2
```

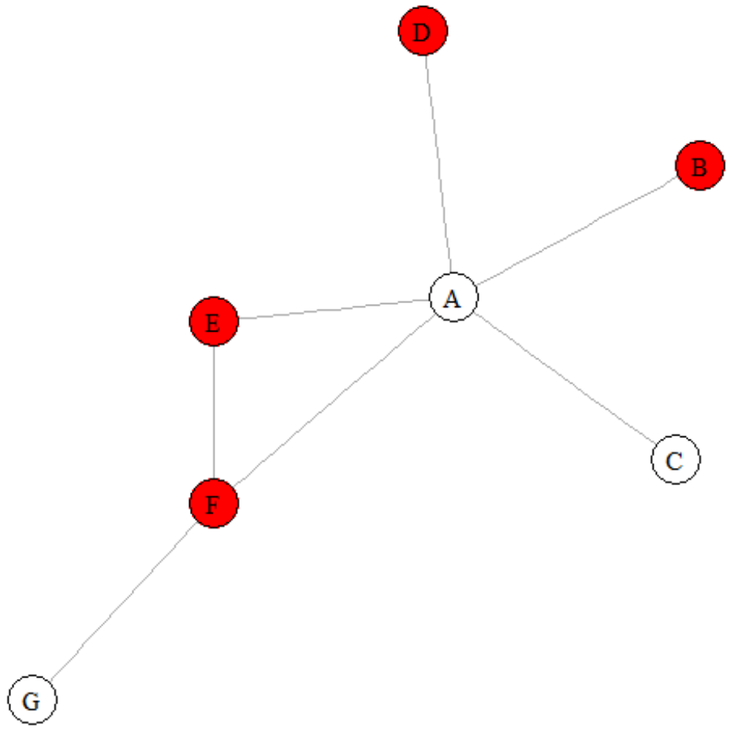
```
E(g)[[frequency>=3]]
```

```
+ 2/7 edges (vertex names):
  tail head tid hid frequency
5    F    A   6   1         3
7    G    F   7   6         4
```

Network visualization

```
V(g)$color <- ifelse(
  V(g)$age > 22, "red", "white"
)

plot(
  g,
  vertex.label.color = "black"
)
```



Let's practice!

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Network visualization

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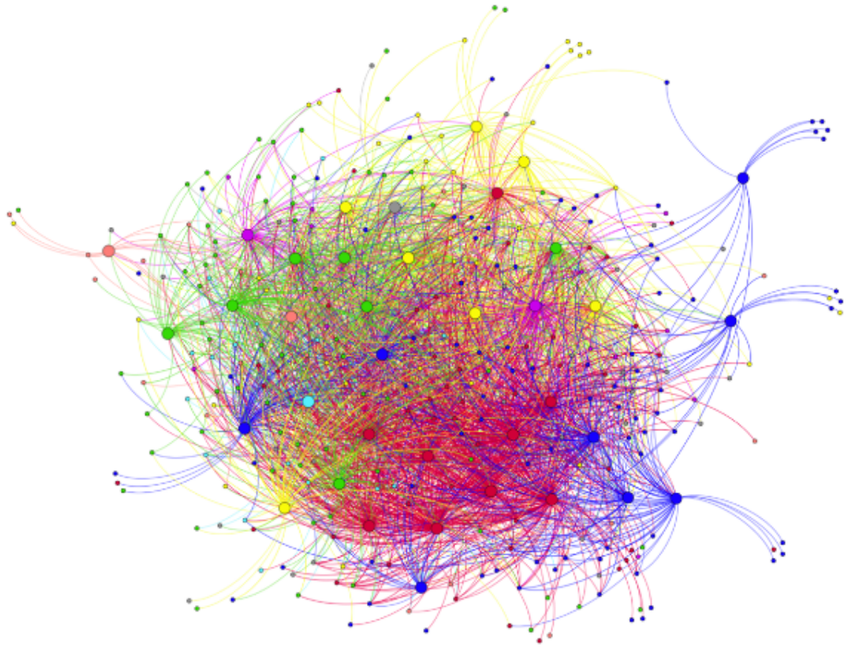
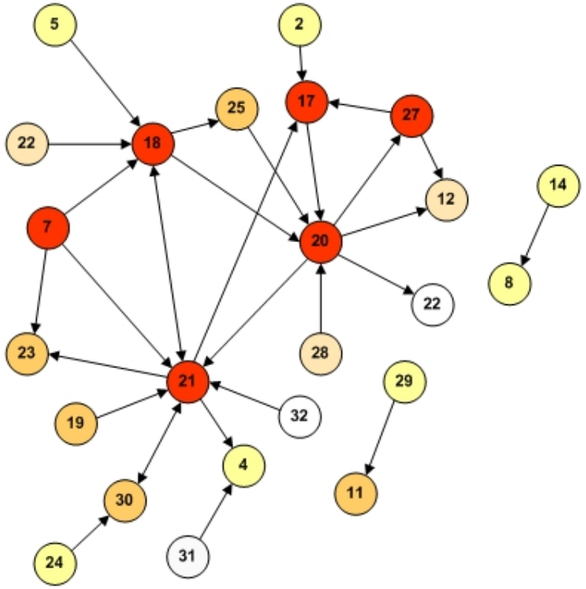
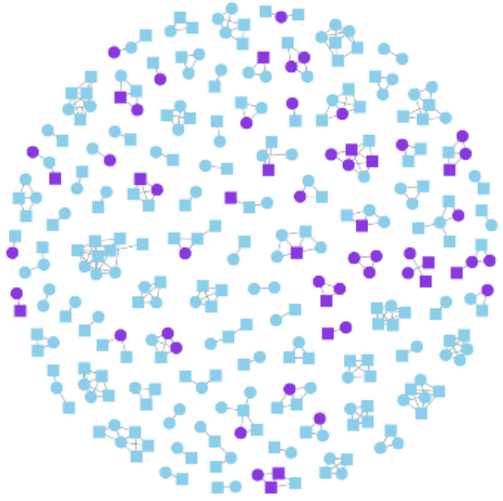


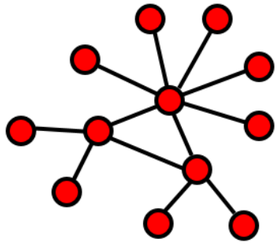

5
2
25
17
27
22
18
12
14
7
20
8
22
23
28
21
29
19
32
4
30
11
24
31


High Barnet
Cockfosters
Walthamstow Central
Edgware
Loughton
Stanmore
Hainault
Ealing Broadway
Stratford
Heathrow Terminal 5
Brixton

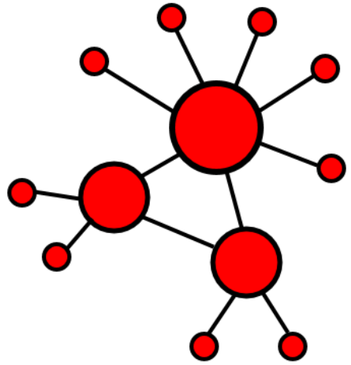


Styling vertices and edges

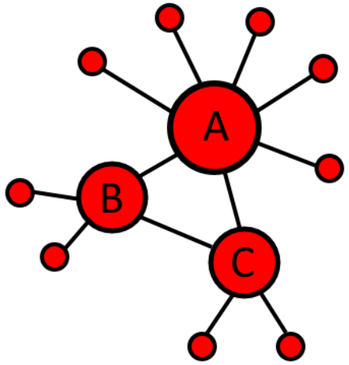
default



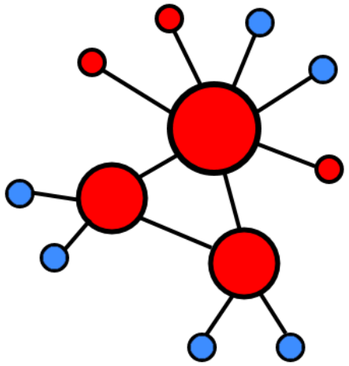
size



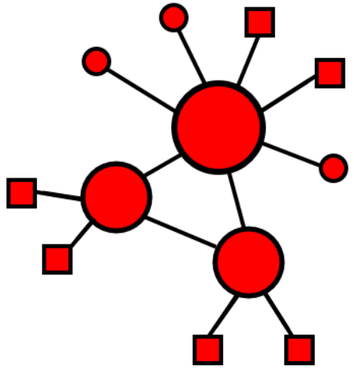
labels



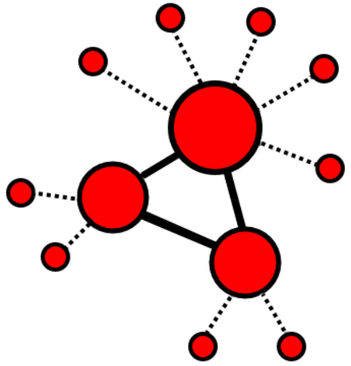
color



shape



edges

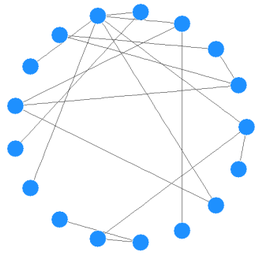


Choosing the appropriate layout

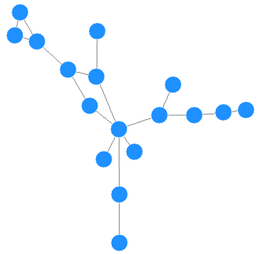
- Minimize edge crossing
- Do not allow vertices to overlap
- Make edge lengths as uniform as possible
- Increase symmetry of the network as much as possible
- Position more influential nodes towards the center

igraph layouts

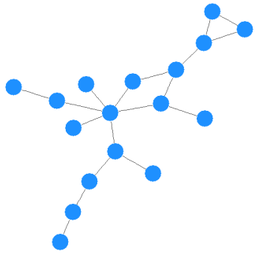
circle



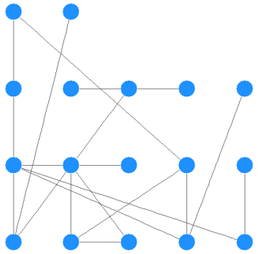
fruchterman-reingold



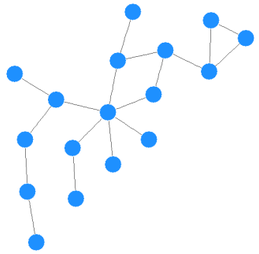
kamada-kawai



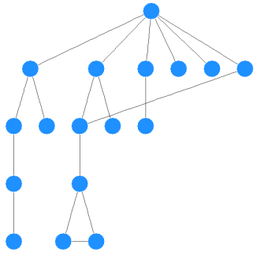
grid



lgl



tree



```
plot(g, layout = layout.fruchterman.reingold(g))
```

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