Week 13 - Social Network Mining

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10.2.1

Figure 10.9 is an example of a social-network graph. Use the Girvan-Newman approach to find the number of shortest paths from each of the following nodes that pass through each of the edges. (a) A (b) B.

10.2.2 (section 10.2.6)

Using symmetry, the calculations of Exercise 10.2.1 are all you need to compute the betweenness of each edge. Do the calculation.

Exercise 10.4.1

For the graph of Fig. 10.9, construct:

(a) The adjacency matrix.
(b) The degree matrix.
(c) The Laplacian matrix.

Answer

```
# Setup the degree matrix
D = matrix(c(2,0,0,0,0,0,0,0,0,
             0,3,0,0,0,0,0,0,0,
             0,0,3,0,0,0,0,0,0,
             0,0,0,3,0,0,0,0,0,
             0,0,0,0,3,0,0,0,0,
             0,0,0,0,0,2,0,0,0,
             0,0,0,0,0,0,3,0,0,
             0,0,0,0,0,0,0,3,0,
             0,0,0,0,0,0,0,0,2), ncol=9)

# Setup col and row names
colnames(D)<-c('A','B','C','D','E','F','G','H','I')
rownames(D)<-c('A','B','C','D','E','F','G','H','I')

# Write up the adjanceny matrix
          #  A B C D E F G H I
A = matrix(c(0,1,1,0,0,0,0,0,0, # A
             1,0,1,0,0,0,0,1,0, # B
             1,1,0,1,0,0,0,0,0, # C
             0,0,1,0,1,1,0,0,0, # D
             0,0,0,1,0,1,1,0,0, # E
             0,0,0,1,1,0,0,0,0, # F
             0,0,0,0,1,0,0,1,1, # G
             0,1,0,0,0,0,1,0,1, # H
             0,0,0,0,0,0,1,1,0), ncol=9)

# Setup col and row names
colnames(A)<-c('A','B','C','D','E','F','G','H','I')
rownames(A)<-c('A','B','C','D','E','F','G','H','I')

# Calculate Laplacian
L = D - A
```

```
# Print results
D
```

```
##   A B C D E F G H I
## A 2 0 0 0 0 0 0 0 0
## B 0 3 0 0 0 0 0 0 0
## C 0 0 3 0 0 0 0 0 0
## D 0 0 0 3 0 0 0 0 0
## E 0 0 0 0 3 0 0 0 0
## F 0 0 0 0 0 2 0 0 0
## G 0 0 0 0 0 0 3 0 0
## H 0 0 0 0 0 0 0 3 0
## I 0 0 0 0 0 0 0 0 2
```

```
A
```

```
##   A B C D E F G H I
## A 0 1 1 0 0 0 0 0 0
## B 1 0 1 0 0 0 0 1 0
## C 1 1 0 1 0 0 0 0 0
## D 0 0 1 0 1 1 0 0 0
## E 0 0 0 1 0 1 1 0 0
## F 0 0 0 1 1 0 0 0 0
## G 0 0 0 0 1 0 0 1 1
## H 0 1 0 0 0 0 1 0 1
## I 0 0 0 0 0 0 1 1 0
```

```
L
```

```
##    A  B  C  D  E  F  G  H  I
## A  2 -1 -1  0  0  0  0  0  0
## B -1  3 -1  0  0  0  0 -1  0
## C -1 -1  3 -1  0  0  0  0  0
## D  0  0 -1  3 -1 -1  0  0  0
## E  0  0  0 -1  3 -1 -1  0  0
## F  0  0  0 -1 -1  2  0  0  0
## G  0  0  0  0 -1  0  3 -1 -1
## H  0 -1  0  0  0  0 -1  3 -1
## I  0  0  0  0  0  0 -1 -1  2
```