

Assignment 10

Max Wagner

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PS1

1.

Form the A matrix, introduce decay, and form the the B matrix.

```
A <- matrix(c(0, 1/2, 1/2, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1/4, 1/4, 0, 0, 1/4, 1/4, 0, 0, 0, 0, 1/2, 1/2, 0), nrow(A))  
decay <- .85  
n <- max(ncol(A), nrow(A))  
B <- decay * A + (.15 / n)
```

2. Starting with the uniform rank vector \mathbf{r} , and do some power iterations on \mathbf{B} . I'll write a mini function to take care of that.

```
r <- matrix(c(1/6, 1/6, 1/6, 1/6, 1/6, 1/6), nrow = 6)
p <- 100
```

```
powerIter <- function(A, B, power) {  
  if (power == 1)  
    return (A)  
  return(powerIter(A %*% B, B, power - 1))  
}
```

```
powered <- powerIter(B, B, p) %*% r; powered
```

```
##           [,1]
## [1,] 0.07735886
## [2,] 0.11023638
## [3,] 0.24639464
## [4,] 0.18635389
## [5,] 0.15655927
## [6,] 0.22309696
```

3. Eigen-decomp of B.

```
eigen(B)$values # shows a eigenvalue of 1
```

```
## [1] 1.0000000+0.000000i 0.5063824+0.000000i -0.4250000+0.000000i
## [4] -0.4250000-0.000000i -0.2531912+0.108131i -0.2531912-0.108131i
```

```
(powered / eigen(B)$vectors[,1]) * eigen(B)$vectors[,1] # scaling the vector
```

```
##           [,1]  
## [1,] 0.07735886+0i  
## [2,] 0.11023638+0i  
## [3,] 0.24639464+0i  
## [4,] 0.18635389+0i  
## [5,] 0.15655927+0i  
## [6,] 0.22309696+0i
```

4. Using the igraph package.

```
library(igraph)  
relations <- data.frame(from = c(1,1,2,3,3,3,3,4,4,5,5,6), to = c(2,3,3,1,2,5,6,5,6,4,6,4), weight = c(1,1,1,1,1,1,1,1,1,1,1,1))  
pageranking <- graph.data.frame(relations, directed = TRUE)
```

```
# and now scale it to check if it's right  
(powered / page.rank(pageranking)$vector) * page.rank(pageranking)$vector
```

```
##           [,1]  
## [1,] 0.07735886  
## [2,] 0.11023638  
## [3,] 0.24639464  
## [4,] 0.18635389  
## [5,] 0.15655927  
## [6,] 0.22309696
```

```
plot(pageranking) # plot it out to make sure it did match the example
```

