Barabasi Document

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Barabasi Graph 1

Investigation of Barabasi Network

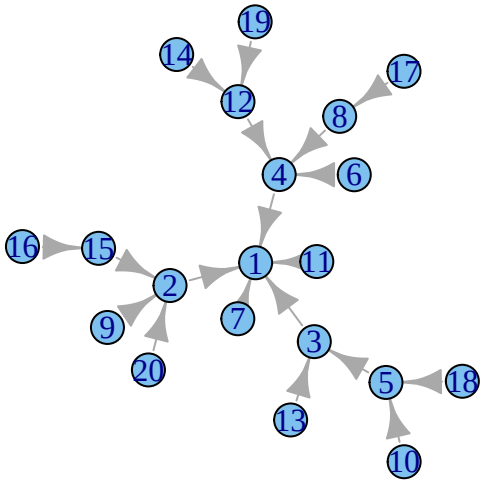
```
library(igraph)
library(ggplot2)
library(data.table)
```

Barabasi Graph

A Barabasi graph is generated as follows:

- generate a new node, N
- select an existing node, E, with a probability of selection proportional to the number of edges already connected to it
- create an edge to connect N to E
- repeat for a number of times

```
g <- barabasi.game(20)
plot(g)
```



The graph thus created has the following properties:

- all nodes are connected to at least one other
- earlier nodes tend to have a higher degree (number of neighburs) than later nodes
- the more connected a node, the more likely it is to attract new nodes to connect to it

```
degree.distribution(g)
```

```
## [1] 0.00 0.60 0.10 0.15 0.10 0.05
```

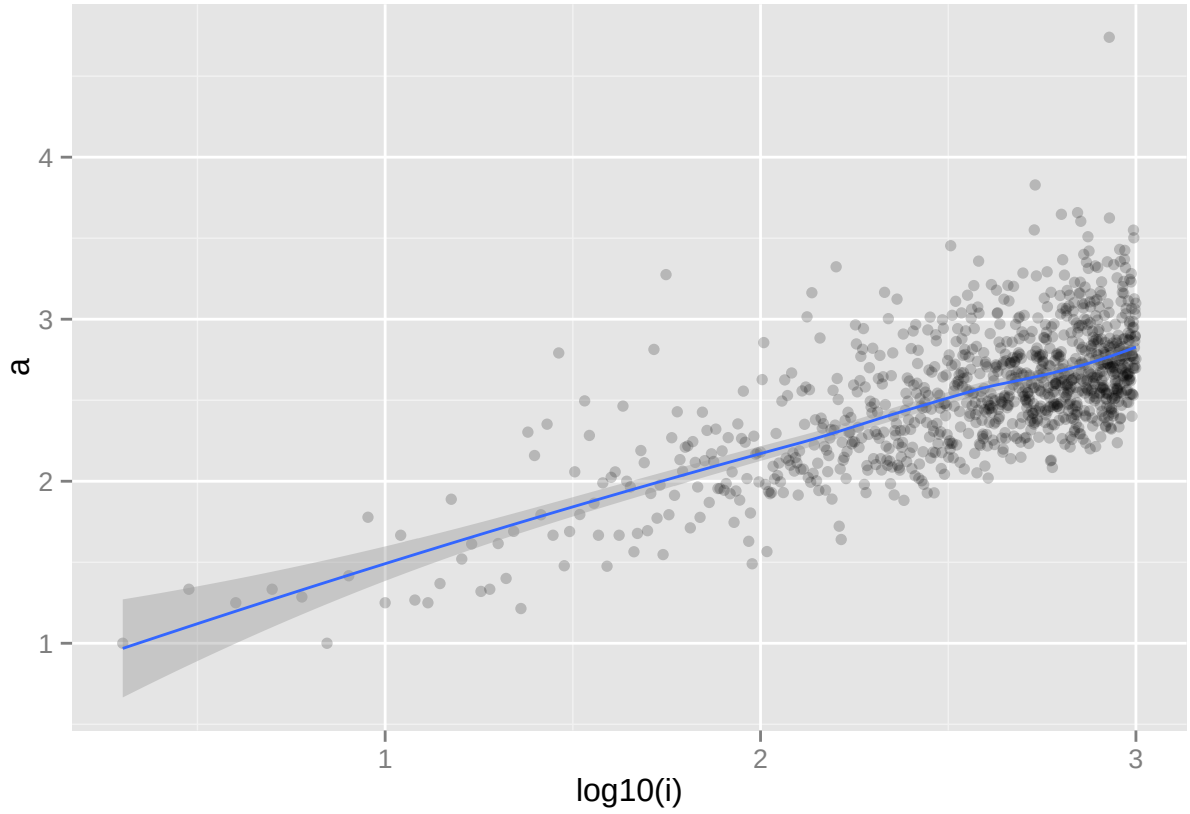
```
average.path.length(g)
```

```
## [1] 1.667
```

```
df <- data.frame(i=c(), a=c())
for (i in 2:1000) {
    g <- barabasi.game(i)
    a <- average.path.length(g)
    df <- rbind(df, data.frame(i=i, a=a))
}
```

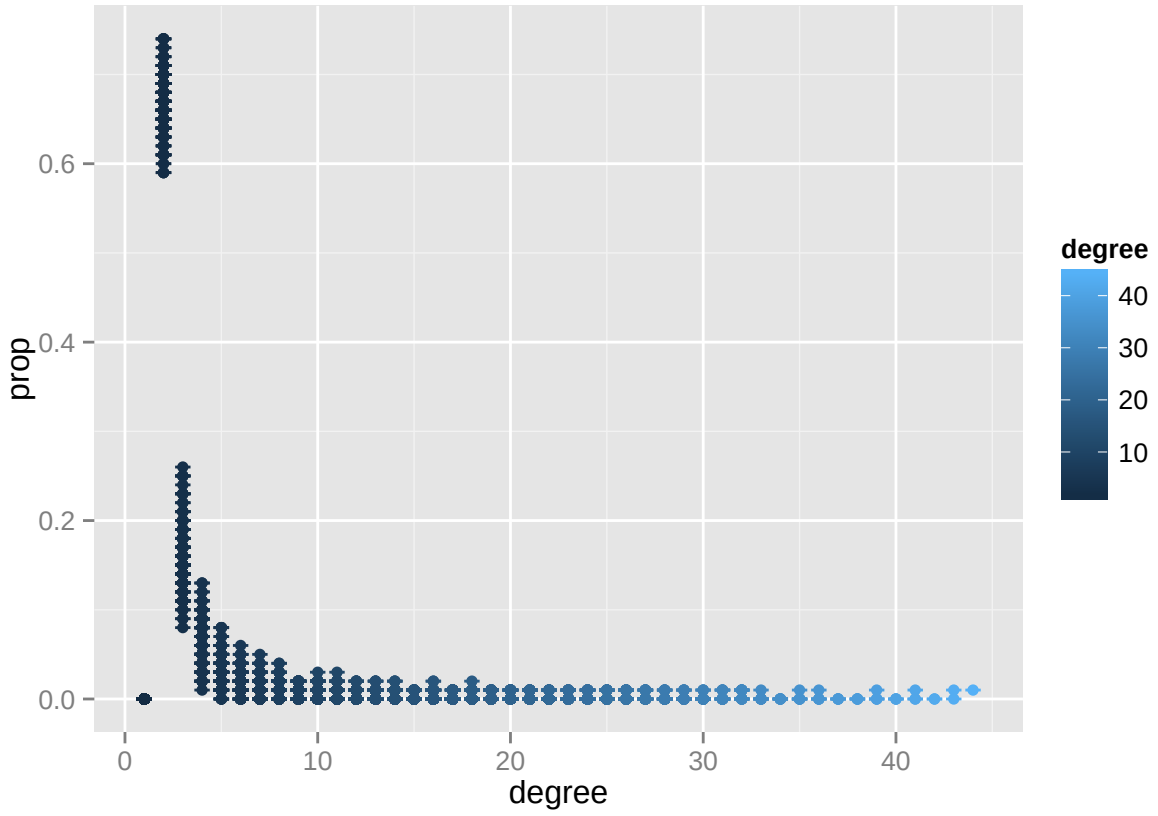
```
p <- ggplot(df, aes(x=log10(i), y=a))
p <- p + geom_point(alpha=0.2)
p <- p + geom_smooth()
p
```

```
## geom_smooth: method="auto" and size of largest group is <1000, so using loess. Use 'method = x' to ch
```

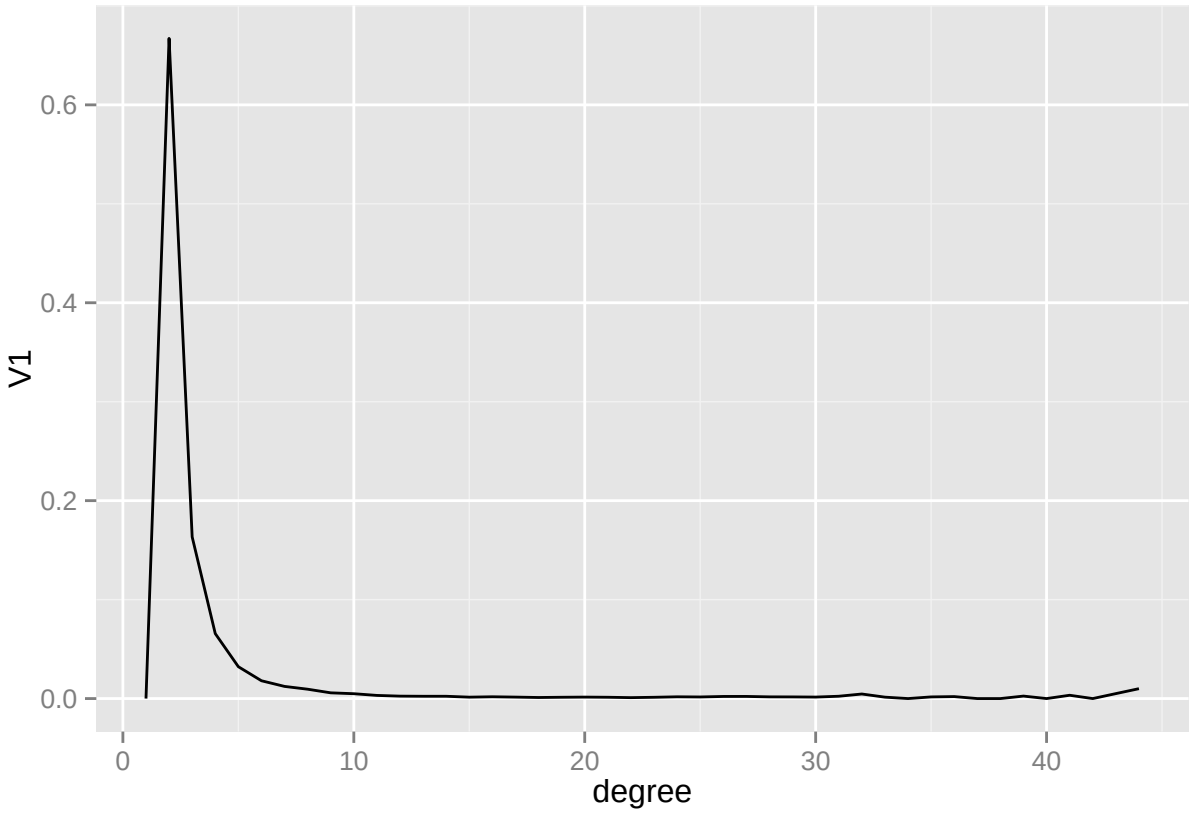



```
df <- data.frame(iteration=c(), degree=c(), prop=c())
for (i in 1:200) {
    g <- barabasi.game(100)
    p <- degree.distribution(g)
    d <- 1:length(p)
    tmp <- data.frame(iteration=i,
                      degree=d,
                      prop=p)
    df <- rbind(df, tmp)
}
```

```
dt <- data.table(df)
setkey(dt, degree)
p <- ggplot(dt, aes(x=degree,
                    y=prop,
                    group=iteration))
p <- p + geom_point(aes(colour=degree))
p <- p + geom_segment(aes(x=degree-0.4,
                          xend=degree+0.4,
                          y=prop,
                          yend=prop,
                          colour=degree)
                      )
p
```




```
dt <- dt[,j=mean(prop),by=degree]
p <- ggplot(dt, aes(x=degree,
                    y=V1)
            )
p <- p + geom_line()
p
```


0.6
0.4
0.2
0.0
V1
0
10
20
30
40
degree