P5

```
library(igraph)
```

```
##
## Attaching package: 'igraph'
```

```
## The following objects are masked from 'package:stats':
##
##     decompose, spectrum
```

```
## The following object is masked from 'package:base':
##
##     union
```

```
CA.GrQc <- read.delim("CA-GrQc.txt", header=FALSE, comment.char="#")
G = graph_from_data_frame(CA.GrQc, directed = FALSE)
G = simplify(G)
v = V(G)
e = E(G)
```

5.1 central nodes

```
cd = centr_degree(G)
max_index = which.max(cd[["res"]])
c = v[max_index]
print(c)
```

```
## + 1/5242 vertex, named, from b22e3ec:
## [1] 21012
```

5.2 longest path

solution 1

```
sp1 = shortest.paths(G, v, v)
sp1[is.infinite(sp1)] = -1
longest_path = max(sp1)
print(longest_path)
```

```
## [1] 17
```

solution 2

```r
sp2_len = diameter(G)
sp2 = get_diameter(G)
print(sp2_len)
```

```
## [1] 17
```

```r
print(sp2)
```

```
## + 18/5242 vertices, named, from b22e3ec:
##  [1] 20255 8925  16505 15495 9264  24932 8862  22598 7350  1941  4241  10476
## [13] 4875  11844 17006 19551 7885  22190
```

5.3 largest clique

```r
lcq = largest_cliques(G)
print(lcq)
```

```
## [[1]]
## + 44/5242 vertices, named, from b22e3ec:
##  [1] 21012 22691 773   14807 3372  21847 2741  24955 6610  25758 11241 570
## [13] 6179  45    21281 23293 15003 20635 19423 18894 4164  7956  12365 17655
## [25] 25346 1653  9785  21508 14540 12781 2212  19961 2952  6830  8879  11472
## [37] 12496 12851 15659 17692 20108 20562 22887 4513
```

5.4 ego(s)

```r
my_ego = ego(
  G,
  order = 1,
  nodes = V(G),
  mode = c("all", "out", "in"),
  mindist = 0
)
maxegolength = 0
egores = 0
count = 0
for(i in 1:5242){
  if (maxegolength < length(my_ego[[i]])){
    maxegolength = length(my_ego[[i]])
    egores = i
  }
}
#check how many longest arrays in the list
#for(i in 1:5242){
#  if ( length(my_ego[[i]]) == 82) count = count + 1
#}
#print(count)
#count = 1
print(maxegolength)
```

```
## [1] 82
```

```
my_ego[[egores]]
```

```
## + 82/5242 vertices, named, from b22e3ec:
##  [1] 21012 10243 6610  22691 2980  18866 25758 11241 13597 3409  15538 570
## [13] 8503  18719 9889  773   9341  21847 6179  1997  2741  13060 14807 24955
## [25] 45    4511  21281 23293 9482  15003 20635 22457 19423 5134  3372  23452
## [37] 23628 2404  22421 18894 18208 1234  25053 18543 4164  7956  12365 17655
## [49] 25346 1653  9785  21508 14540 12781 1186  345   2212  231   46    19961
## [61] 2952  6830  8879  11472 12496 12851 15659 17692 20108 20562 22887 6774
## [73] 4513  25251 12503 22937 23363 5578  1841  16611 2450  8049
```

5.5 power_centrality

```
pc = power_centrality(
  G,
  nodes = V(G),
  loops = FALSE,
  exponent = 0.9,
  rescale = FALSE,
  tol = 1e-07,
  sparse = TRUE
)
max_pc = max(pc)
index_max_pc = which.max(pc)
print(max_pc)
```

```
## [1] 9.630753
```

```
print(v[index_max_pc])
```

```
## + 1/5242 vertex, named, from b22e3ec:
## [1] 15301
```