ITAO_80870_class_10_canvas

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#1. Loading iGraph, GGraph, and NetDiffuse

```
#loading in the needed libraries
library(igraph)
library(ggraph)
library(netdiffuseR)
```

#2. Loading in Egocentric Network Data

```
#loading in the edge and node data
edges <- read.csv('/Users/TomTheIntern/Desktop/Mendoza/Mod 4/Networks/Lab 2/edgelist.csv')
nodes <- read.csv('/Users/TomTheIntern/Desktop/Mendoza/Mod 4/Networks/Lab 2/nodelist.csv')
```

#3. Making a directed iGraph Object

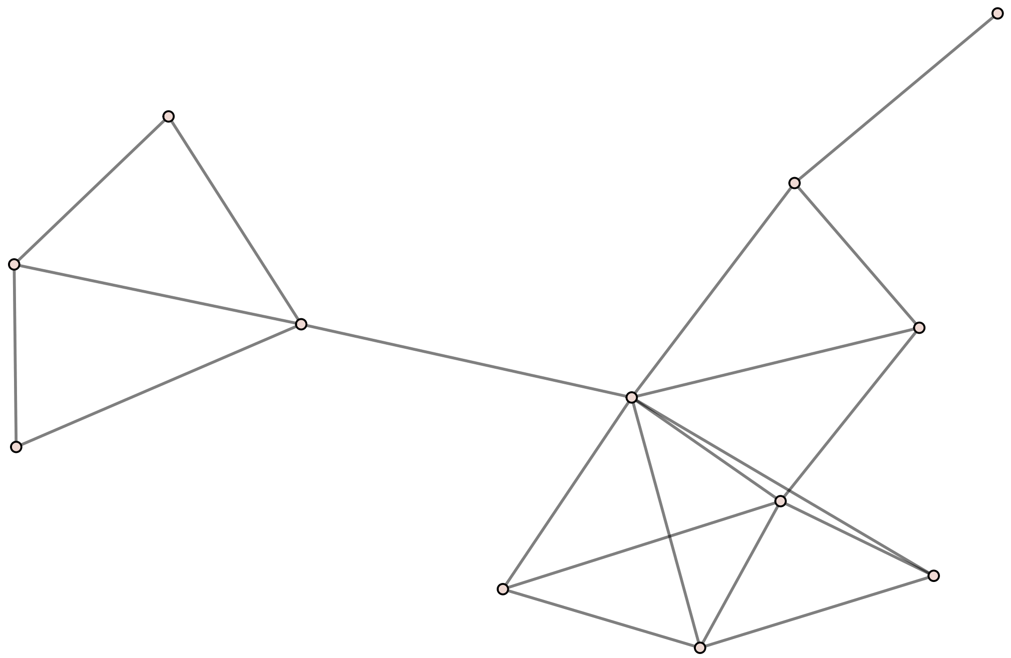
```
#making the iGraph
net <- graph_from_data_frame(edges, directed = F, vertices = nodes)
net
```

```
## IGRAPH 04c964a UN-- 12 40 --
## + attr: name (v/c), Name (v/c), Age (v/n), Gender (v/c), ego (e/c),
## | alter (e/c), type (e/c), strength (e/n)
## + edges from 04c964a (vertex names):
##  [1] 1 --2  1 --2  1 --5  1 --5  1 --3  1 --3  1 --4  1 --4  1 --6  1 --6
## [11] 1 --7  1 --7  1 --10 1 --10 2 --4  2 --4  2 --3  2 --3  3 --4  3 --4
## [21] 4 --6  4 --6  4 --5  4 --5  3 --5  3 --5  9 --10 9 --10 10--11 10--11
## [31] 10--12 10--12 9 --12 9 --12 11--12 11--12 6 --7  6 --7  7 --8  7 --8
```

#4. Visualize Your Network

```
#making the plot
ggraph(net) +
  geom_edge_link(color = "black", alpha = 0.3) +
  geom_node_point(color = "black", fill = "#efd9d3", shape = 21) +
  theme_graph()
```

```
## Using "stress" as default layout
```



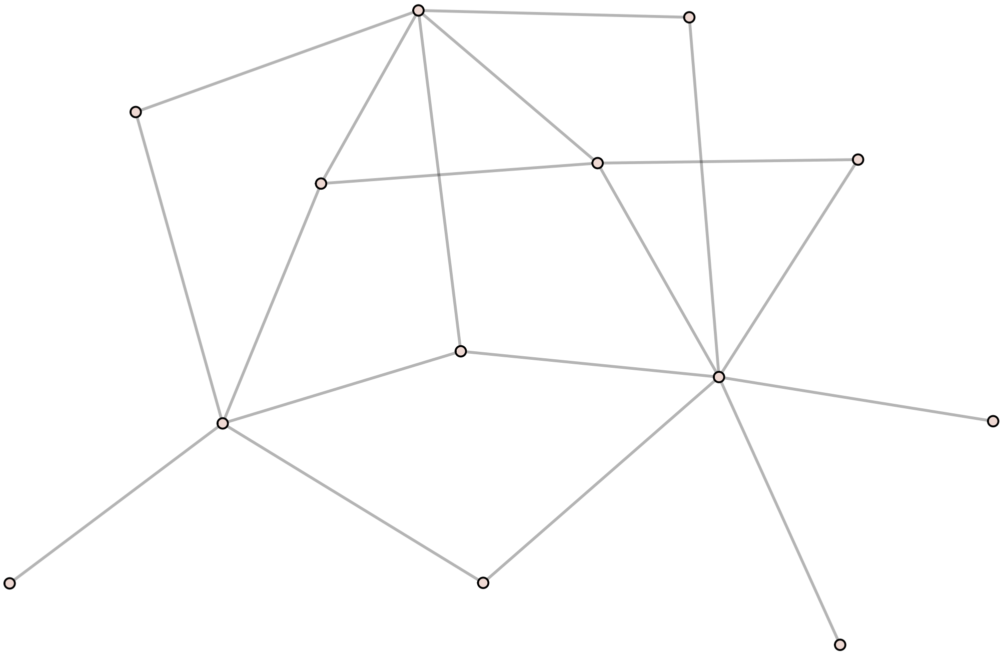
#5. Add 4 Ties, 4 Nodes, Remove 3 Ties, 3 Nodes And Rewire Network

```
library(igraph)

set.seed(000027)

# 1. Add your new ties
net2 <- igraph::add_edges(net, c(1, 8, 2, 9, 3, 12, 7, 12))

# 2. Delete those edges by ID
net2 <- igraph::delete_edges(net2, c(1, 10, 3, 4, 10, 11))

# 3. Add 4 brand-new vertices (scalar count)
net2 <- igraph::add_vertices(net2, 4)

# 4. Remove vertices 12, 5, and 4 by position
net2 <- igraph::delete_vertices(net2, c(12, 5, 4))

# 5. Re-name each node sequentially so name index stay in sync
V(net2)$name <- as.character(seq_len(vcount(net2)))

# 6. Randomly rewire 50% of edges, no loops
net2 <- igraph::rewire(net2, each_edge(p = 0.5, loops = FALSE))
```

#6. Plot the new network with GGraph

```
#plotting the new graph
ggraph(net2) +
  geom_edge_link(color = "black", alpha = 0.3) +
  geom_node_point(color = "black", fill = "#efd9d3", shape = 21) +
  theme_graph()
```

```
## Using "stress" as default layout
```



#7. Run a threshold model over the original vs new graph

```
#converting the og plot into a matrix
net_matrix <- as_adjacency_matrix(net)
n_nodes <- nrow(net_matrix)

#converting the new plot into a matrix
net2_matrix <- as_adjacency_matrix(net2)
n2_nodes <- nrow(net2_matrix)
```

Graphing Original Network

```
#setting the seed
set.seed(1)

#running the diffusion threshold model
diffnet_il <- rdiffnet(
  t = 10,
  seed.graph = net_matrix,
  seed.nodes = c(1, 7, 11), # chosen nodes
  seed.p.adopt = 0.1,
  rewire = F,
  threshold.dist = function(i) 0.25,
  exposure.args = list(normalized = T)
  )

#getting the info and plots
diffnet_il
```

```
## Dynamic network of class -diffnet-
##  Name               : A diffusion network
##  Behavior           : Random contagion
##  # of nodes         : 12 (1, 2, 3, 4, 5, 6, 7, 8, ...)
##  # of time periods  : 10 (1 - 10)
##  Type               : directed
##  Final prevalence   : 1.00
##  Static attributes  : real_threshold (1)
##  Dynamic attributes : -
```

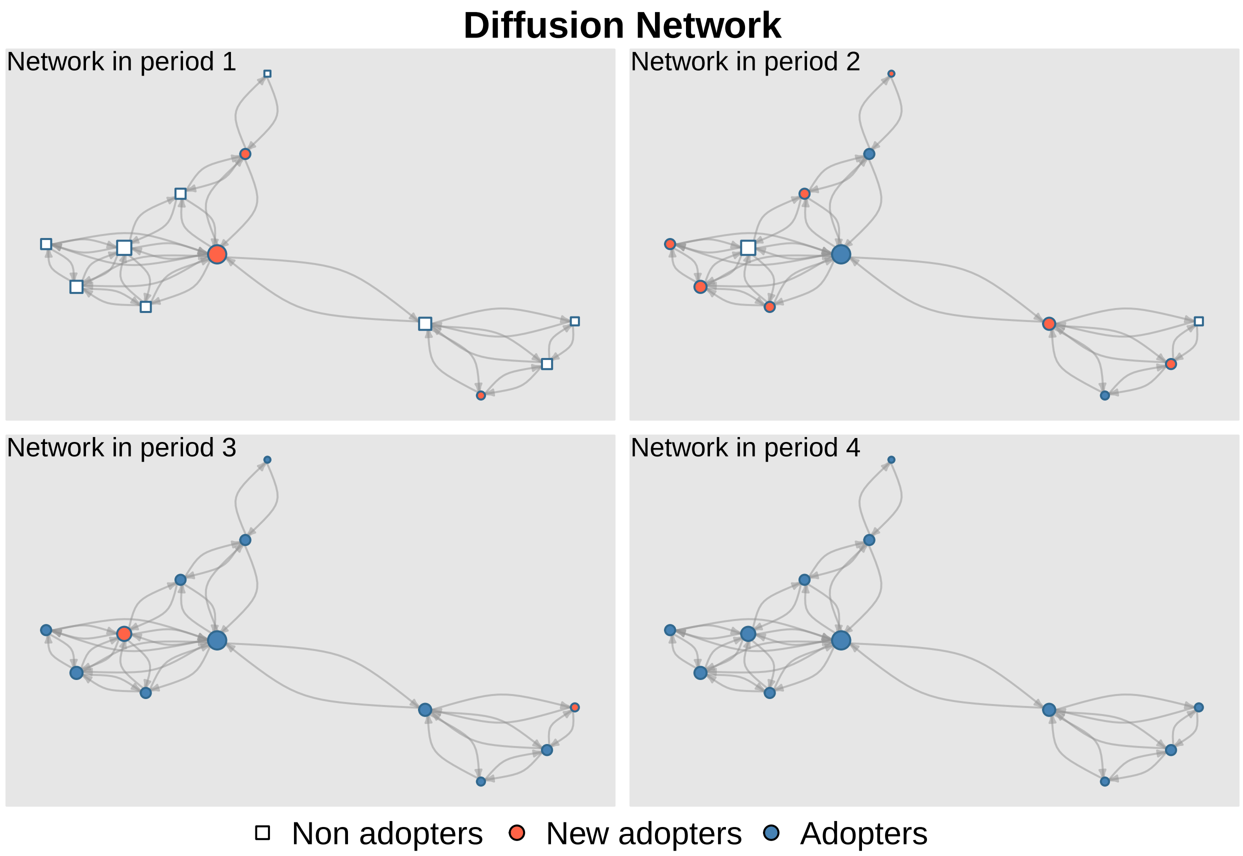
```
summary(diffnet_il)
```

```
## Diffusion network summary statistics
## Name     : A diffusion network
## Behavior : Random contagion
## -----------------------------------------------------------------------------
##  Period   Adopters   Cum Adopt. (%)   Hazard Rate   Density   Moran's I (sd)
## -------- ---------- ---------------- ------------- --------- ----------------
##        1          3         3 (0.25)             -      0.30 -0.13 (0.05)
##        2          7        10 (0.83)          0.78      0.30 -0.13 (0.05)
##        3          2        12 (1.00)          1.00      0.30                -
##        4          0        12 (1.00)          0.00      0.30                -
##        5          0        12 (1.00)          0.00      0.30                -
##        6          0        12 (1.00)          0.00      0.30                -
##        7          0        12 (1.00)          0.00      0.30                -
##        8          0        12 (1.00)          0.00      0.30                -
##        9          0        12 (1.00)          0.00      0.30                -
##       10          0        12 (1.00)          0.00      0.30                -
## -----------------------------------------------------------------------------
##  Left censoring  : 0.25 (3)
##  Right centoring : 0.00 (0)
##  # of nodes      : 12
##
##  Moran's I was computed on contemporaneous autocorrelation using 1/geodesic
##  values. Significane levels  *** <= .01, ** <= .05, * <= .1.
```

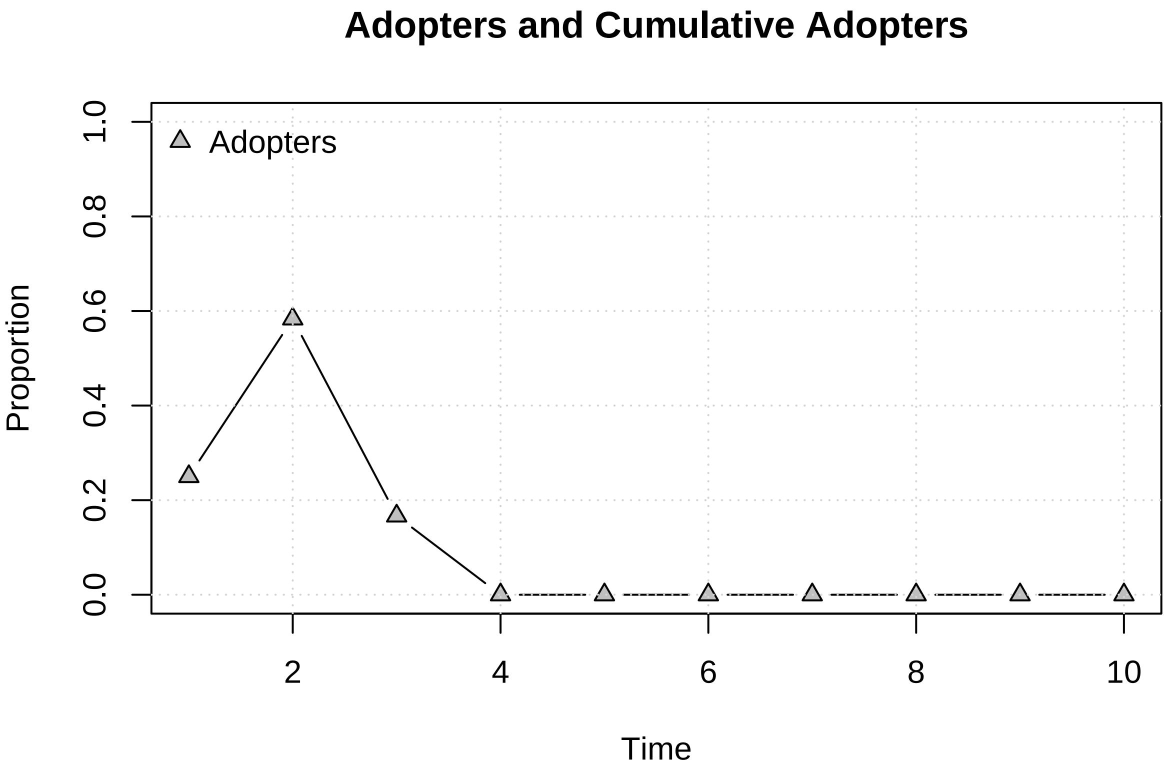
```
table(diffnet_il$toa) # time of adoption
```

```
##
## 1 2 3
## 3 7 2
```

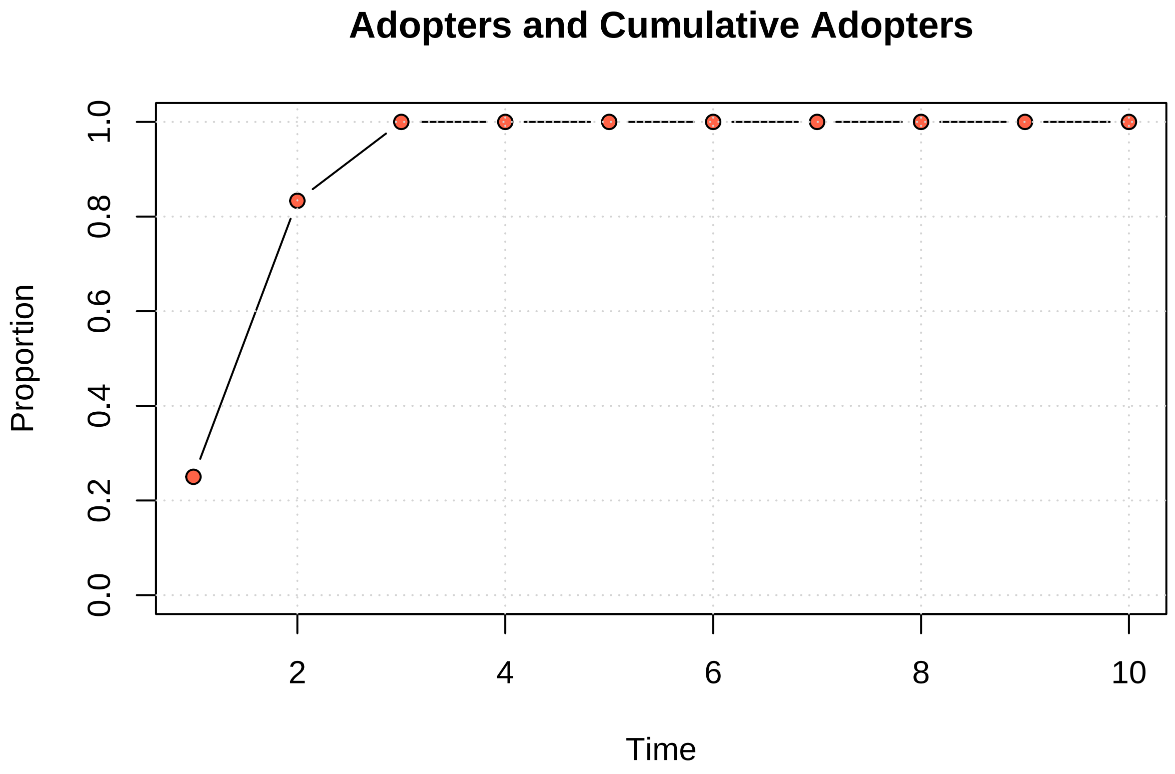
```
plot_diffnet(diffnet_il, slices = c(1, 2, 3, 4))
```



```
plot_adopters(diffnet_il, what = "adopt")
```



```r
plot_adopters(diffnet_il, what = "cumadopt", include.legend = FALSE)
```



```r
#setting the seed
set.seed(1)

#running the diffusion network
diffnet_il2 <- rdiffnet(
  t = 10,
  seed.graph = net2_matrix,
  seed.nodes = c(1, 7, 11), # chosen nodes
  seed.p.adopt = 0.1,
  rewire = F,
  threshold.dist = function(i) 0.25,
  exposure.args = list(normalized = T)
  )

#plotting the graph
diffnet_il2
```

```
## Dynamic network of class -diffnet-
##  Name                 : A diffusion network
##  Behavior             : Random contagion
##  # of nodes           : 13 (1, 2, 3, 4, 5, 6, 7, 8, ...)
##  # of time periods    : 10 (1 - 10)
##  Type                 : directed
##  Final prevalence     : 1.00
##  Static attributes    : real_threshold (1)
##  Dynamic attributes : -
```

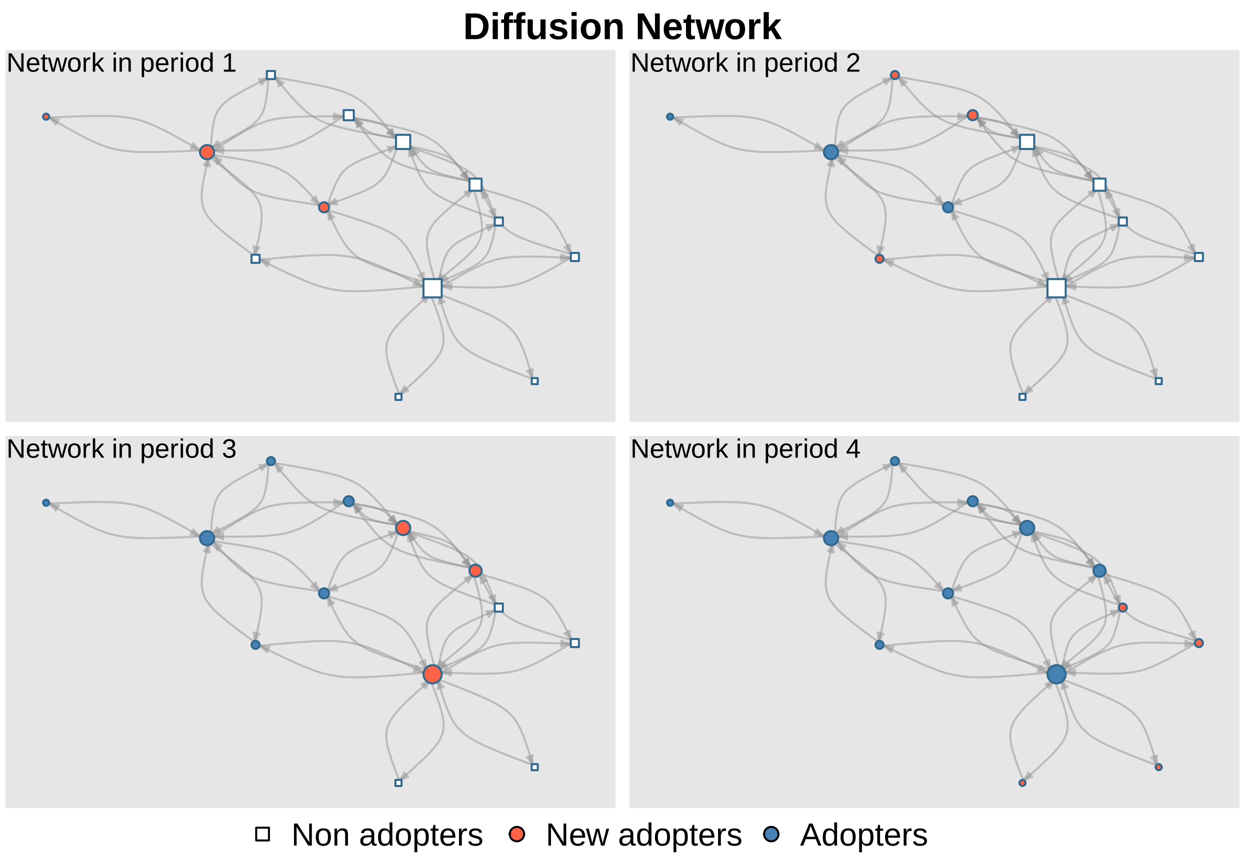
```r
summary(diffnet_il2)
```

```
## Diffusion network summary statistics
## Name     : A diffusion network
## Behavior : Random contagion
## -----------------------------------------------------------------------------
##  Period   Adopters   Cum Adopt. (%)   Hazard Rate   Density   Moran’s I (sd)
## -------- ---------- ---------------- ------------- --------- ----------------
##        1          3        3 (0.23)             -      0.24  0.03 (0.04) ***
##        2          3        6 (0.46)          0.30      0.24  0.08 (0.05) ***
##        3          3        9 (0.69)          0.43      0.24 -0.02 (0.04)
##        4          4       13 (1.00)          1.00      0.24                -
##        5          0       13 (1.00)          0.00      0.24                -
##        6          0       13 (1.00)          0.00      0.24                -
##        7          0       13 (1.00)          0.00      0.24                -
##        8          0       13 (1.00)          0.00      0.24                -
##        9          0       13 (1.00)          0.00      0.24                -
##       10          0       13 (1.00)          0.00      0.24                -
## -----------------------------------------------------------------------------
##  Left censoring  : 0.23 (3)
##  Right centoring : 0.00 (0)
##  # of nodes      : 13
##
##  Moran’s I was computed on contemporaneous autocorrelation using 1/geodesic
##  values. Significane levels  *** <= .01, ** <= .05, * <= .1.
```

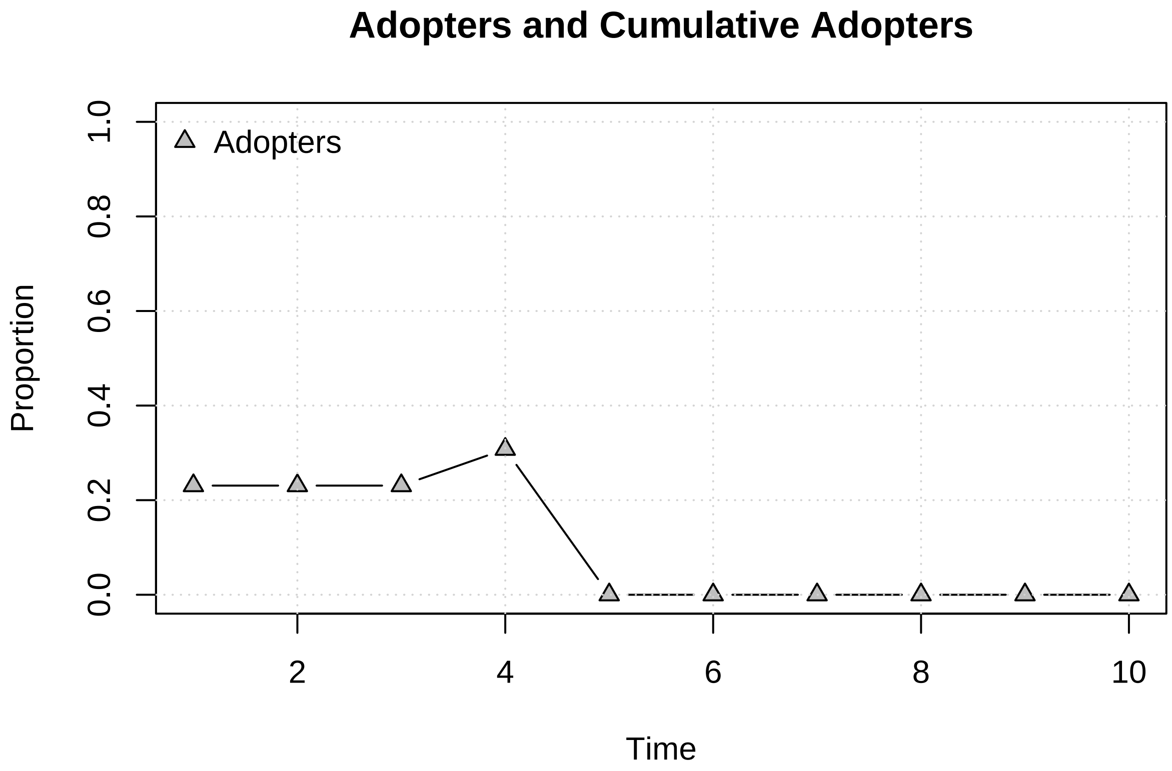
```r
table(diffnet_il$toa) # time of adoption
```

```
##
## 1 2 3
## 3 7 2
```

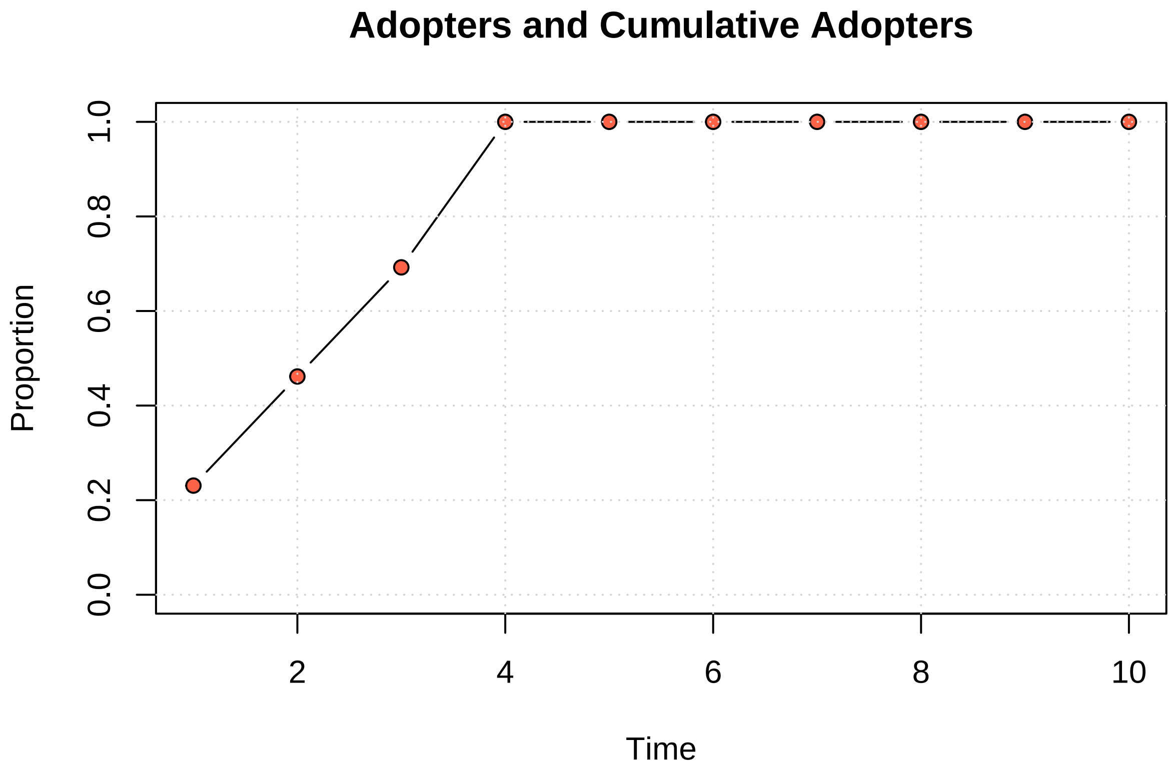
```r
plot_diffnet(diffnet_il2, slices = c(1, 2, 3, 4))
```



```r
plot_adopters(diffnet_il2, what = "adopt")
```



```
plot_adopters(diffnet_il2, what = "cumadopt", include.legend = FALSE)
```



#8. Changes in Network Structure on Diffusion Looking at the adopters and cumulative adopters plot, the original network had a much earlier peak in adopters, with the peak hitting a proportion of 60% around time = 2. The newer network started off very slowly (as did the original plot!) but peaked at time = 4, around 30% before plateauing and staying at 0% for the rest of the plot.

This means that the original network had a much quicker rate of diffusion compared to the second network.

When I changed the slices on the diffusion plot (thank you for the help by the way!) I saw that the newer network had a more linear growth (hence it taking longer) whereas the original network was much exponential, which is why it maxed out at time = 3

My main takeaway is that the original plot (because it was highly structured by design) was a much more tightly connected plot compared to the new network (which had the random ties + random nodes)