

project3

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Overall Structure

Since the graph is NOT strongly connected, we have to find the diameter and radius using the largest strongly connected sub component.

The dataset also does not have duplicate sender -> receiver pairs, so we will analyze the dataset as an unweighted graph.

```
# Read the text file into a dataframe
df <- read.table("email-Eu-core.txt", header = FALSE, sep = " ")
colnames(df) <- c("From", "To")
# The dataset does not have duplicate sender -> receiver pairs
# df_weighted <- aggregate(weight ~ From + To, data = transform(df, weight = 1), FUN = sum)

g <- graph_from_data_frame(df, directed = TRUE)
# g <- graph_from_data_frame(df_weighted, directed = TRUE)

num_nodes = vcount(g)
num_edges = ecount(g)

# Check strong connectivity
components <- components(g, mode="strong")

# Extract the vertices belonging to the largest strongly connected component
largest_comp_vertices <- V(g)[components$membership == which.max(components$ccsize)]
g_largest <- induced_subgraph(g, largest_comp_vertices)

# Calculate diameter and radius on the largest SCC
diameter_largest <- diameter(g_largest, directed = TRUE)
radius_largest <- radius(g_largest, mode = "out")

output <- paste(
  "Graph Summary",
  paste("Number of nodes:", num_nodes),
  paste("Number of edges:", num_edges),
  paste("Density:", round(edge_density(g), 6)),
  paste(""),
  "Strong Connectivity",
  paste("Number of strongly connected components:", components$no),
  paste("Size of largest strongly connected component:", max(components$ccsize)),
  paste("fraction of elements belonging to the largest strong subcomponent: ", max(components$ccsize)/num_nodes),
  "The graph is NOT strongly connected",
```

```

paste("Largest diameter:", diameter_largest),
paste("Largest radius:", radius_largest),
"-----",

sep = "\n"
)
cat(output)

## Graph Summary
## Number of nodes: 1005
## Number of edges: 25571
## Density: 0.025342
##
## Strong Connectivity
## Number of strongly connected components: 203
## Size of largest strongly connected component: 803
## fraction of elements belonging to the largest strong subcomponent: 0.799004975124378
## The graph is NOT strongly connected
## Largest diameter: 6
## Largest radius: 3
## -----

```