# Codes for generation of networks, RDS estimators, variance estimation and two types of #Confidence Intervals

# Generation of networks

library(igraph)

population\_size <- 10000

small\_world\_nei <- 5

# Barabási and Albert (1999) Scale-free network

network1 <- barabasi.game(n = population\_size, directed = FALSE)

# Watts and Strogatz (1998) Small-world network low p

network2 <- watts.strogatz.game(dim = 1, size = population\_size, nei = small\_world\_nei, p = 0.01)

# Watts and Strogatz (1998) Small-world network high p

network3 <- watts.strogatz.game(dim = 1, size = population\_size, nei = small\_world\_nei, p = 0.5)

# Computation of network metrics

avg\_deg <- mean(degree(network1))

max\_deg <- max(degree(network1))

avg\_path <- average.path.length(network1)

clustering <- transitivity(network1, type = "global")

metrics <- data.frame(

AverageDegree = round(avg\_deg, 2),

MaxDegree = max\_deg,

AvgPathLength = round(avg\_path, 2),

ClusteringCoeff = round(clustering, 2)

)

print(metrics)

# Computation of RDS estimators

library(RDS)

rds\_data <- as.rds.data.frame(dat, id = "id", recruiter.id = "recruiter.id", network.size = "degree")

# RDS-I estimator

rdsi <- RDS.I.estimates(rds\_data, outcome.variable = "y")

esti <- rdsi$estimate

print(esti)

# RDS-II estimator

rdsii <- RDS.II.estimates(rds\_data, outcome.variable = "y")

estii <- rdsii$estimate

print(estii)

# Gile's Successive Sampling RDS-SS

rds\_ss <- RDS.SS.estimates(rds\_data, outcome.variable = "y", N = 10000)

estss <- rds\_ss$estimate

print(estss)

# Variance estimation and Confidence Intervals for RDS estimators

library(RDS)

# RDS data frame conversion  
 rds\_data <- as.rds.data.frame(dat, id = "id", recruiter.id = "recruiter.id", network.size = "degree")

# Salganik Bootstrap (Sal-BS) (Salganik, 2006) Variance estimation and Quantile Confidence #Interval for RDS-I estimator  
 CI1 <- RDS.bootstrap.intervals(  
 rds.data = rds\_data,   
 weight.type = "RDS-I",

confidence.level = 0.95,  
 outcome.variable = "y",  
 ci.type="percentile",   
 number.of.bootstrap.samples = 100  
 )

print(CI1)

# Salganik Bootstrap (Sal-BS) (Salganik, 2006) Variance estimation and Quantile Confidence #Interval for RDS-II estimator  
 CI2 <- RDS.bootstrap.intervals(  
 rds.data = rds\_data,  
 weight.type = "RDS-II",

confidence.level = 0.95,  
 outcome.variable = "y",  
 ci.type="percentile",   
 number.of.bootstrap.samples = 100  
 )

print(CI2)

# Successive Sampling Bootstrap (SS-BS) Variance estimation and Studentized Confidence Interval #for Successive Sampling (RDS-SS) estimator  
 CI3 <- RDS.bootstrap.intervals(  
 rds.data = rds\_data,  
 weight.type = "Gile's SS",   
 confidence.level = 0.95,

outcome.variable = "y",  
 N = population\_size,

ci.type="t",  
 number.of.bootstrap.samples = 100  
 )

print(CI3)