HW12

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Machine details:

**CPU:** 2 physical cores, 4 threads

**RAM:** 16.0 GB

**OS:** Windows 10

**Make/Model:** Microsoft Surface Pro 4

#1  
g.b1 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)  
g.b2 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)  
g.b3 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)  
g.b4 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)

#1a  
paths.avg <- vector(mode = "numeric", length = 4)  
  
start\_time <- Sys.time()  
  
paths.avg[1] <- average.path.length(g.b1)  
paths.avg[2] <- average.path.length(g.b2)  
paths.avg[3] <- average.path.length(g.b3)  
paths.avg[4] <- average.path.length(g.b4)  
  
paths.avg

## [1] 4.199678 4.210312 4.203548 4.189315

seq\_graphs <- Sys.time() - start\_time  
seq\_graphs

## Time difference of 4.289421 secs

#1b  
numParCores <- max(1, detectCores() - 1)  
cl <- makeCluster(numParCores)  
registerDoParallel(cl)  
  
start\_time <- Sys.time()  
  
results <- foreach(i = 1:4, .packages='igraph') %dopar%{  
 paths.avg[1] <- average.path.length(g.b1)  
 paths.avg[2] <- average.path.length(g.b2)  
 paths.avg[3] <- average.path.length(g.b3)  
 paths.avg[4] <- average.path.length(g.b4)  
}  
  
stopCluster(cl)  
paths.avg

## [1] 4.199678 4.210312 4.203548 4.189315

parallel\_graphs <- Sys.time() - start\_time  
parallel\_graphs

## Time difference of 9.322714 secs

#2  
g.er1 <- erdos.renyi.game(2000, p = (5/(2000-1)), directed = FALSE)  
g.er2 <- erdos.renyi.game(4000, p = (5/(4000-1)), directed = FALSE)  
g.er3 <- erdos.renyi.game(6000, p = (5/(6000-1)), directed = FALSE)  
g.er4 <- erdos.renyi.game(8000, p = (5/(8000-1)), directed = FALSE)

#2a  
paths.avg <- vector(mode = "numeric", length = 4)  
  
start\_time <- Sys.time()  
  
paths.avg[1] <- average.path.length(g.er1)  
paths.avg[2] <- average.path.length(g.er2)  
paths.avg[3] <- average.path.length(g.er3)  
paths.avg[4] <- average.path.length(g.er4)  
  
paths.avg

## [1] 4.932732 5.304484 5.547708 5.768554

seq\_graphs <- Sys.time() - start\_time  
seq\_graphs

## Time difference of 4.978941 secs

#2b  
numParCores <- max(1, detectCores() - 1)  
cl <- makeCluster(numParCores)  
registerDoParallel(cl)  
  
start\_time <- Sys.time()  
  
results <- foreach(i = 1:4, .packages='igraph') %dopar%{  
 paths.avg[1] <- average.path.length(g.er1)  
 paths.avg[2] <- average.path.length(g.er2)  
 paths.avg[3] <- average.path.length(g.er3)  
 paths.avg[4] <- average.path.length(g.er4)  
}  
  
stopCluster(cl)  
paths.avg

## [1] 4.932732 5.304484 5.547708 5.768554

parallel\_graphs <- Sys.time() - start\_time  
parallel\_graphs

## Time difference of 12.23483 secs

#3  
g.b1 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)  
g.b2 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)  
g.b3 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)  
g.b4 <- barabasi.game(5000, power = 1, m = 3, directed = FALSE)

#3a  
bw.avg <- vector(mode = "numeric", length = 4)  
  
start\_time <- Sys.time()  
  
bw.avg[1] <- mean(betweenness(g.b1, V(g.b1)))  
bw.avg[2] <- mean(betweenness(g.b2, V(g.b2)))  
bw.avg[3] <- mean(betweenness(g.b3, V(g.b3)))  
bw.avg[4] <- mean(betweenness(g.b4, V(g.b4)))  
  
bw.avg

## [1] 8032.075 7978.528 7957.466 8065.162

seq\_graphs <- Sys.time() - start\_time  
seq\_graphs

## Time difference of 10.28949 secs

#3b  
numParCores <- max(1, detectCores() - 1)  
cl <- makeCluster(numParCores)  
registerDoParallel(cl)  
  
start\_time <- Sys.time()  
  
results <- foreach(i = 1:4, .packages='igraph') %dopar%{  
 bw.avg[1] <- mean(betweenness(g.b1, V(g.b1)))  
 bw.avg[2] <- mean(betweenness(g.b2, V(g.b2)))  
 bw.avg[3] <- mean(betweenness(g.b3, V(g.b3)))  
 bw.avg[4] <- mean(betweenness(g.b4, V(g.b4)))  
}  
  
stopCluster(cl)  
bw.avg

## [1] 8032.075 7978.528 7957.466 8065.162

parallel\_graphs <- Sys.time() - start\_time  
parallel\_graphs

## Time difference of 21.02471 secs