

# Problem 1

```
library(doParallel)
```

```
## Loading required package: foreach
```

```
## Loading required package: iterators
```

```
## Loading required package: parallel
```

```
library(parallel)  
library(pracma)
```

```
time_consuming_func <- function() {  
  Sys.sleep(5)  
}
```

## Normal Computation

```
start_time <- Sys.time()  
result = foreach(1:8) %do% time_consuming_func()  
t1 <- Sys.time() - start_time  
sprintf("t1: %f sec", t1)
```

```
## [1] "t1: 40.067693 sec"
```

## Embarrassingly Parallel Computation

```
n <- 8

muCluster <- makeCluster(detectCores(), type = 'PSOCK')
registerDoParallel(muCluster)

start_time_2 <- Sys.time()
result = foreach(1:n) %dopar% time_consuming_func()
tp <- Sys.time() - start_time_2

stopCluster(muCluster)

sprintf("tp: %f sec", tp)
```

```
## [1] "tp: 5.063500 sec"
```

```
speedup <- function(t1, tp){
  return(as.double(t1)/as.double(tp))
}
efficiency <- function(speedup){
  return((speedup/detectCores()) * 100)
}

speedup_ <- speedup(t1, tp)
efficiency_ <- efficiency(speedup_)

sprintf("speedup: %f", speedup_)
```

```
## [1] "speedup: 7.913043"
```

```
sprintf("efficiency: %f", efficiency_)
```

```
## [1] "efficiency: 98.913038"
```

## For different number of n

for n = 8

```
n1 <- 8

muCluster <- makeCluster(detectCores(), type = 'PSOCK')
registerDoParallel(muCluster)

start_time_2 <- Sys.time()
result = foreach(1:n1) %dopar% time_consuming_func()
tp1 <- Sys.time() - start_time_2

stopCluster(muCluster)
tp1
```

```
## Time difference of 5.038137 secs
```

```
speedup_1 <- speedup(t1, tp1)
efficiency_1 <- efficiency(speedup_1)

sprintf("for n: %d, speedup: %f, efficiency: %f", n1, speedup_1, efficiency_1)
```

```
## [1] "for n: 8, speedup: 7.952879, efficiency: 99.410986"
```

## for n = 54

```
n2 <- 54

muCluster <- makeCluster(detectCores(), type = 'PSOCK')
registerDoParallel(muCluster)

start_time_3 <- Sys.time()
result = foreach(1:n2) %dopar% time_consuming_func()
tp2 <- Sys.time() - start_time_3

stopCluster(muCluster)
tp2
```

```
## Time difference of 35.06779 secs
```

```
speedup_2 <- speedup(n2*5, tp2)
efficiency_2 <- efficiency(speedup_2)

sprintf("for n: %d, speedup: %f, efficiency: %f", n2, speedup_2, efficiency_2)
```

```
## [1] "for n: 54, speedup: 7.699374, efficiency: 96.242175"
```

## for n = 400

```
n3 <- 400

muCluster <- makeCluster(detectCores(), type = 'PSOCK')
registerDoParallel(muCluster)

start_time_4 <- Sys.time()
result = foreach(1:n3) %dopar% time_consuming_func()
tp3 <- Sys.time() - start_time_4

stopCluster(muCluster)
tp3
```

```
## Time difference of 4.173773 mins
```

```
speedup_3 <- speedup(n3*5, tp3*60)
efficiency_3 <- efficiency(speedup_3)

sprintf("for n: %d, speedup: %f, efficiency: %f", n3, speedup_3, efficiency_3)
```

```
## [1] "for n: 400, speedup: 7.986380, efficiency: 99.829750"
```