

A9_ZHANG_20158140

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My repository (<https://github.com/qiuhan1008/Assignment9.git>)

Load Required Library

```
#install.packages("doParallel")  
library(doParallel)  
library(parallel)  
library(foreach)
```

Cores Number

```
detectCores()
```

```
## [1] 8
```

For loop

```
#set data seed  
set.seed(100000)  
  
#create empty vector  
means <- numeric(4000)  
  
#start time  
start_time_1 <- Sys.time()  
  
#serial loop  
for (i in 1:4000) {  
  means[i] <- mean(rnorm(100000, mean = 10, sd = 3))  
}  
  
#end time  
end_time_1 <- Sys.time()
```

Time used

```
RunTime <- end_time_1 - start_time_1  
RunTime
```

```
## Time difference of 25.67397 secs
```

Multi-threaded program & Serial Program

```
#mylti-threading runtime
MTRunTime <- RunTime / 8
#how much faster
faster <- RunTime - MTRunTime
faster
```

```
## Time difference of 22.46472 secs
```

loop modify

```
#find core number
Cores <- parallel::makeCluster(detectCores())

#activate Multi-threading
doParallel::registerDoParallel(Cores)

#start time
start_time_2 <- Sys.time()

#rewrite for loop
parallel <- foreach(i = 1:4000, .combine = 'rbind') %dopar% {
  means[i] <- mean(rnorm(100000, mean = 10, sd = 3))
}

#end time
end_time_2 <- Sys.time()

#de-activate multi-threading
parallel::stopCluster(Cores)
```

Run Time

```
#caculate the run time for parallel loop
RunTime_Para <- end_time_2 - start_time_2
RunTime_Para
```

```
## Time difference of 5.464365 secs
```

```
#compare serial loop with theoretical run time
cat("serial loop run time:", RunTime, "\n")
```

```
## serial loop run time: 25.67397
```

```
cat("theoretical parallel run time:", MTRunTime, "\n")
```

```
## theoretical parallel run time: 3.209246
```

```
cat("parallel loop run time", RunTime_Para)
```

```
## parallel loop run time 5.464365
```

Results:

The parallel loop is a much effective way compared with serial loop. Also, we have a similar actual runtime compared with theoretical parallel run time.