HW1

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Homework1

1. Read Chapter 1 in textbook (givens and Hoeting) FINISHED!
2. Install R and Rstudion in your computer FINISHED!
3. Go through the Rmarkdown and R codes in Intro.Rmd FINISHED!
4. If you take cards numbered from 1-10 and shuffle them, and lay them down in order, what is the probability that at least one card matches its position. For example card 3 comes down third? Using simulation to find the answer and compare it to the theoretical value. FINISHED!

Q4

1. Define a function to judge whether there is at least one card matches its position. Yes = 1, No = 0

```
IdenticalVector <- function(x,y){
  numTrue <-  0
  for(i in 1:length(x)){
    if(x[i]==y[i]){
      numTrue <-  numTrue + 1
    }
  }
  if(numTrue >0){
    return(1)
  }else{
    return(0)
  }
}
```

For n trials, find successful times:

```
cPostion <- c(1:10)
for(numTrials in c(10, 100, 1000, 10000,100000)){
numSuccess <-  0
for(i in 1:numTrials){
  afterShuffle <- sample(cPostion, replace = F)
  numSuccess <- numSuccess + IdenticalVector(cPostion, afterShuffle)
}
print(sprintf("After %d trials, the frequency is %.4f", numTrials, numSuccess/numTrials))}
```

```
## [1] "After 10 trials, the frequency is 0.7000"
## [1] "After 100 trials, the frequency is 0.6300"
## [1] "After 1000 trials, the frequency is 0.6170"
## [1] "After 10000 trials, the frequency is 0.6392"
## [1] "After 100000 trials, the frequency is 0.6328"
```

And the theoretical value is

$$1 - \frac{10! \sum_{i=0}^{n} \frac{(-1)^i}{i!}}{\mathrm{P}_{10}^{10}}$$

Hence, we can get theoretical result:

```
sum = 0
for(i in c(0:10)){
  eachFactor <-  factorial(10)*(-1)^(i)/factorial(i)/factorial(10)
  sum <- sum + eachFactor
}
print(1-sum)
```

```
## [1] 0.6321205
```