1.

```
> sample(1:2,1)
[1] 1
> sample(1:2,1)
[1] 2
> sample(1:2,1)
[1] 2
> sample(1:2,1)
[1] 2
> sample(1:2,1)
[1] 2
> sample(1:2,1)
[1] 1
> sample(1:2,1)
[1] 1
> sample(1:2,1)
[1] 1
> sample(1:2,1)
[1] 2
> sample(1:2,1)
[1] 2
>
```

When I ran it ten times, I got 4 heads.

2.

```
CoinResults=function(n){
  coinList<-sample(c("Heads","Tails"),n,repl=T)
  return(coinList)
}

ProbHeads=function(n){
  coinList<-CoinResults(n)
  numHeads<-sum(coinList=="Heads")
  return(numHeads/n)
}
```

```
> ProbHeads(1000)
[1] 0.486
```

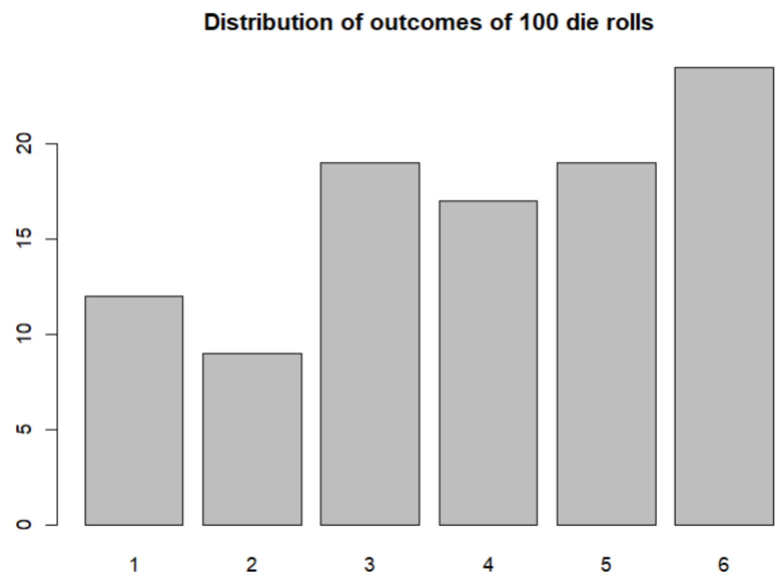
3.

```
MaxAndMinHeads=function(m,n){
  probHeadsList<-c(1:n);
  for(i in 1:n){
    probHeadsList[i]=ProbHeads(m)
  }
  max = max(probHeadsList)
  min = min(probHeadsList)
  return (c(max,min))
}
```

As m and n increase, the maximum and minimum probability gets closer nearly 50-50.

4.

n \ m	10	100	1000	10000
10	0.7 0.0	0.59 0.41	0.529 0.479	0.5019 0.4945
100	0.8 0.0	0.62 0.36	0.54 0.463	0.5123 0.4880
1000	0.9 0.1	0.33 0.66	0.55 0.459	0.5181 0.4854
10000	1 0	0.67 0.31	0.559 0.441	0.5199 0.4815



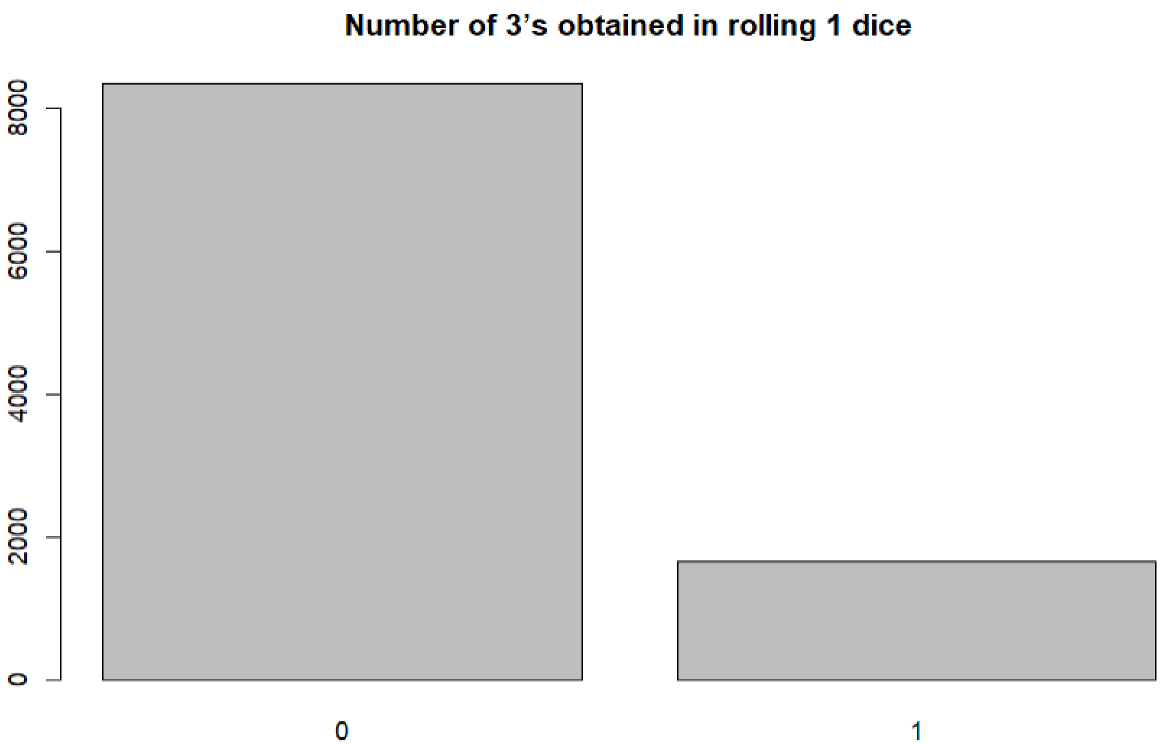
Distribution of outcomes of 100 die rolls bar plot is skewed left with 3 peaks at the number of 1's, 3's, and 6's.

Distribution of outcomes of 1000 die rolls bar plot is very close to uniform, just a peak at the number of 3's.

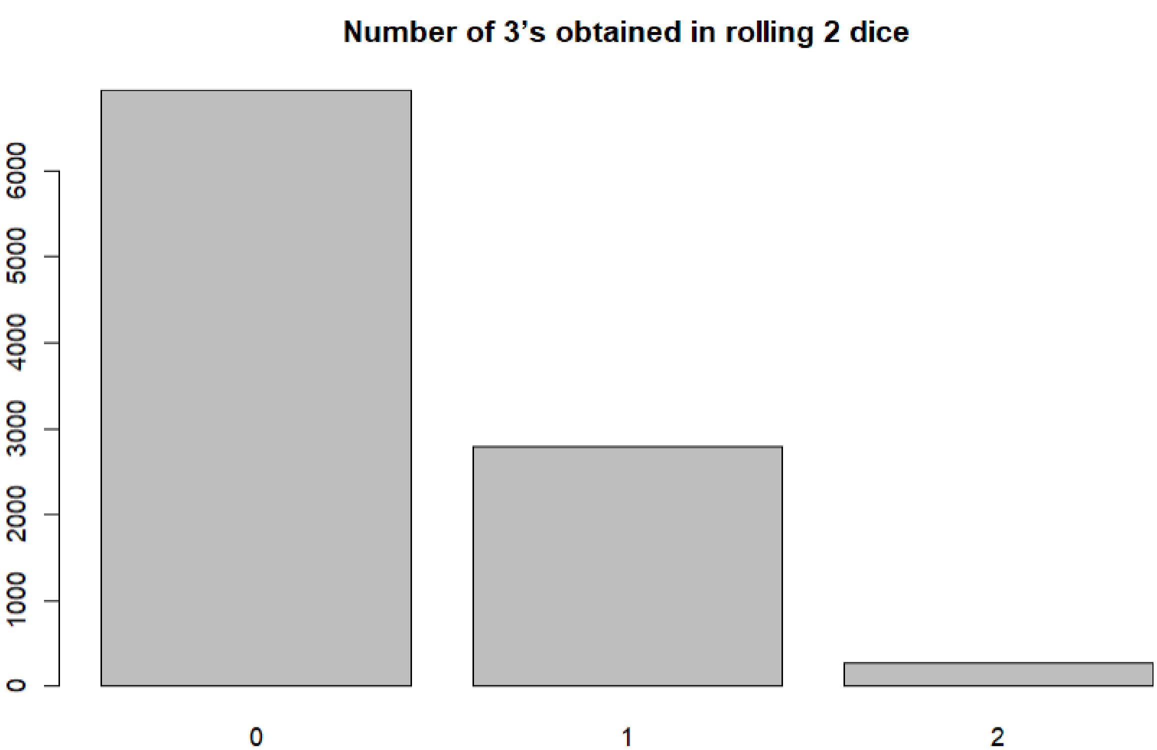
Distribution of outcomes of 10000 die rolls bar plot is almost uniform with all the numbers of rolling each number are nearly the same.

```
RollDie=function(n){
  dieRollList<-sample(c(1,2,3,4,5,6),n,repl=T)
  dieRollTable<-table(dieRollList)
  titleBarPlot = paste("Distribution of outcomes of",n,"die rolls")
  return (barplot(dieRollTable, main=titleBarPlot))
}
```

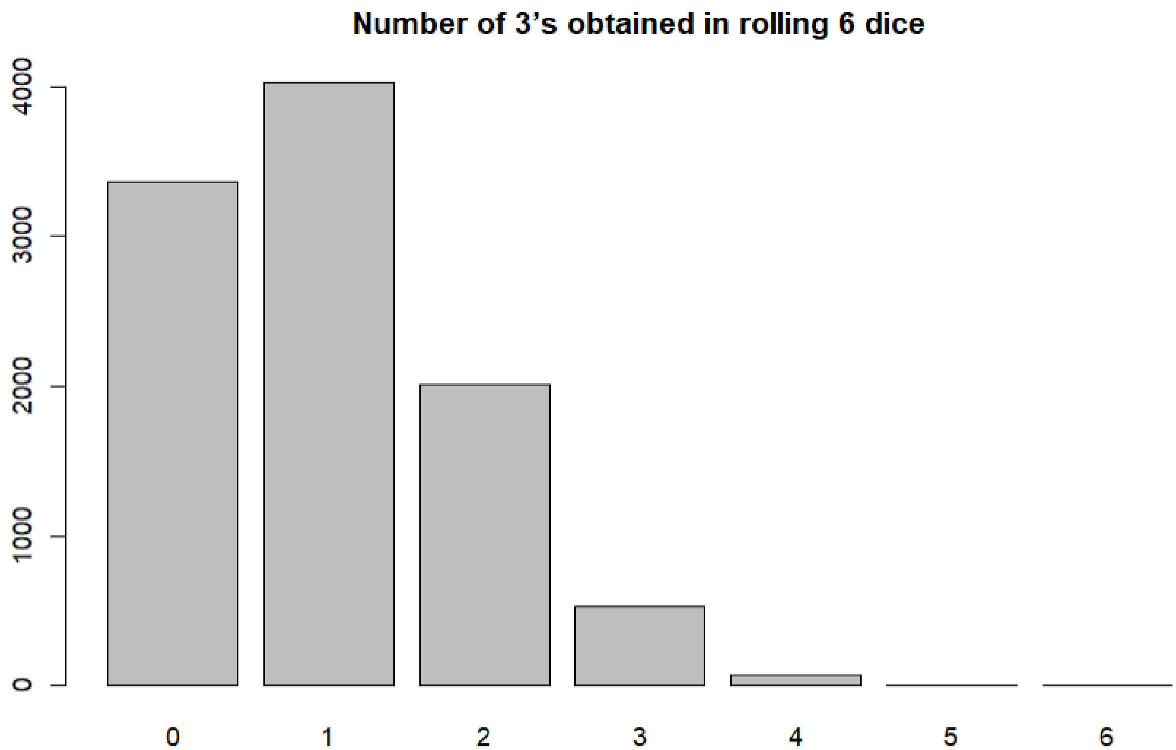
5.



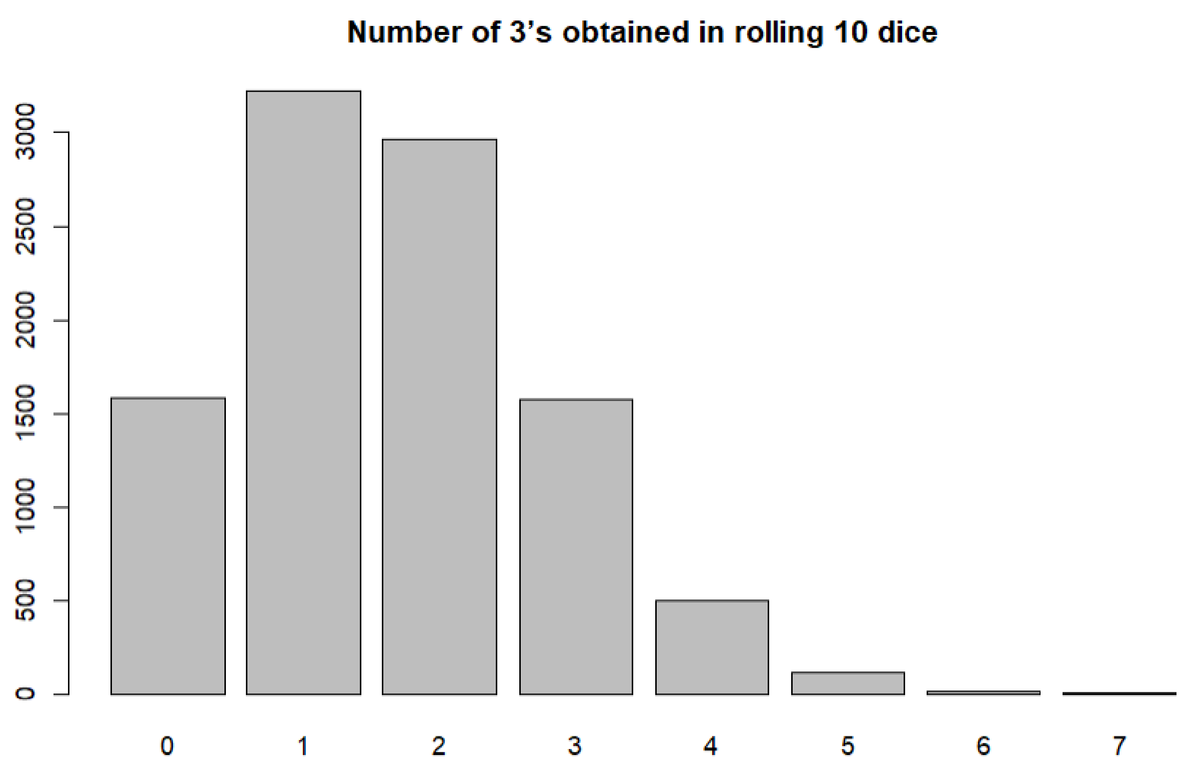
Number of 3's obtained in rolling 1 dice has significantly higher probability of rolling 0 die has number 3's (>8000 3's).



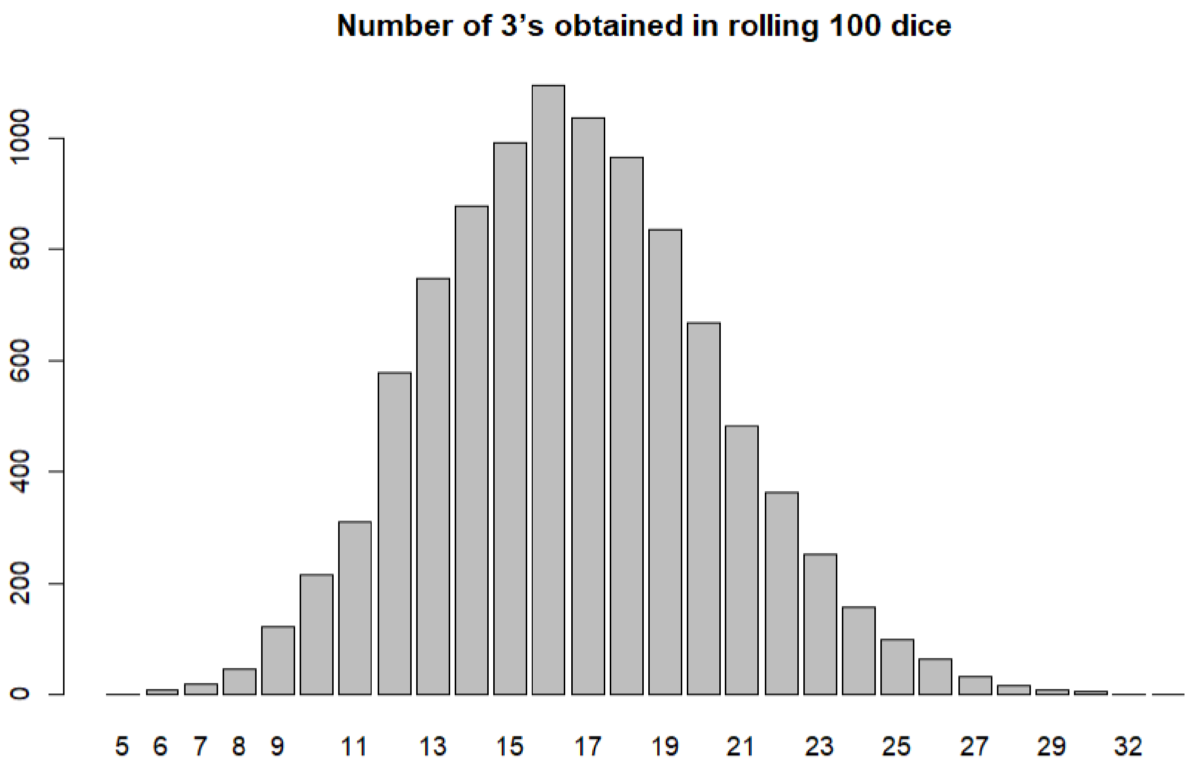
Number of 3's obtained in rolling 2 dice is skewed right with most of the chances rolling 0 dice having number of 3's (>6000 3's) and very few chances of getting 2 dice of number 3's (<500 3's).



Number of 3’s obtained in rolling 6 dice is skewed right with most of the chances rolling 1 die having number of 3’s (>4000 3’s) and 0 chances of getting 5 and 6 dice of number 3’s.



Number of 3’s obtained in rolling 10 dice is skewed right with most of the chances rolling 1 and 2 dice having number of 3’s (>3000 3’s) and slight chances of getting 6 and 7 dice having 3’s, but no chances of getting more than 7 dice having number of 3’s.



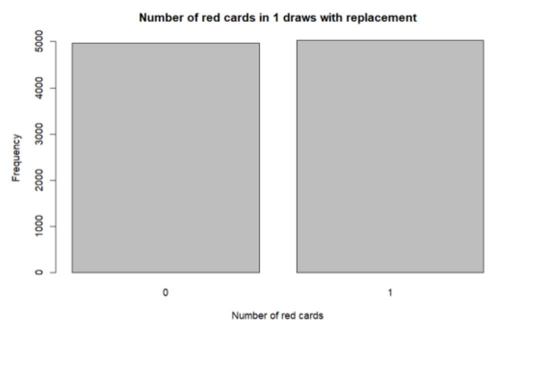
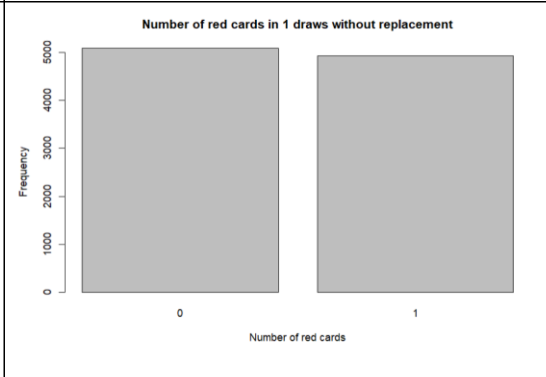
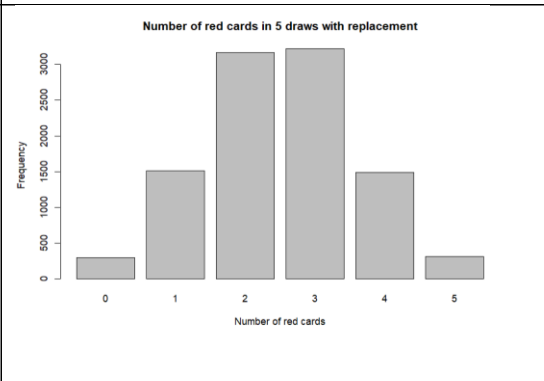
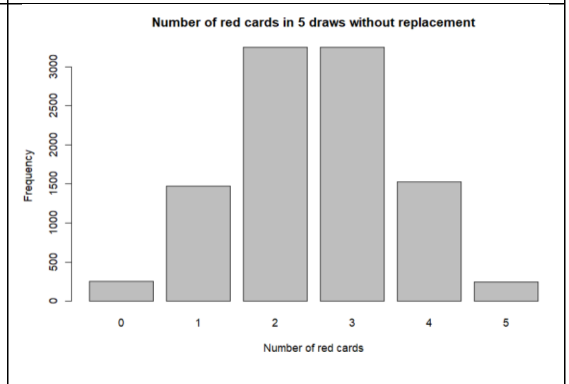
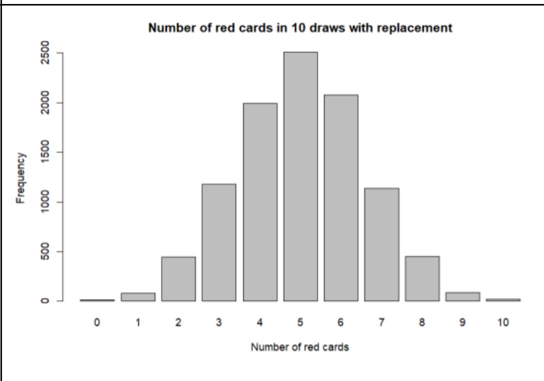
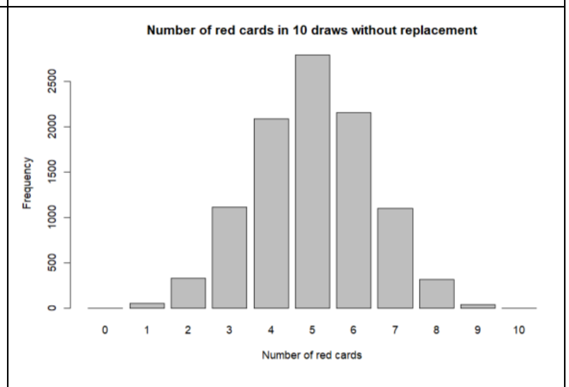
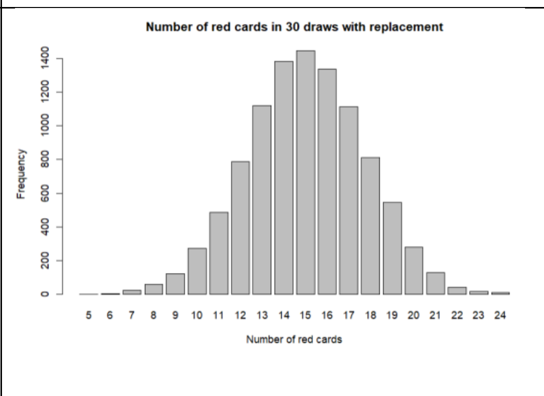
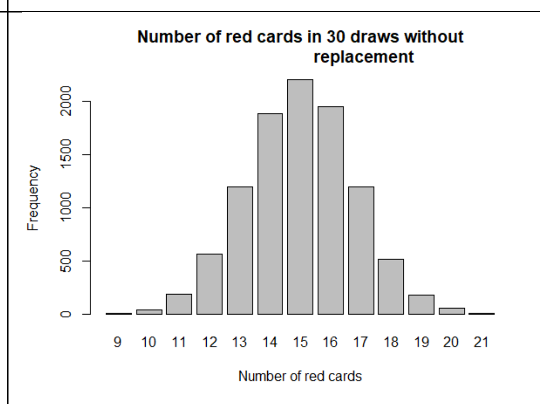
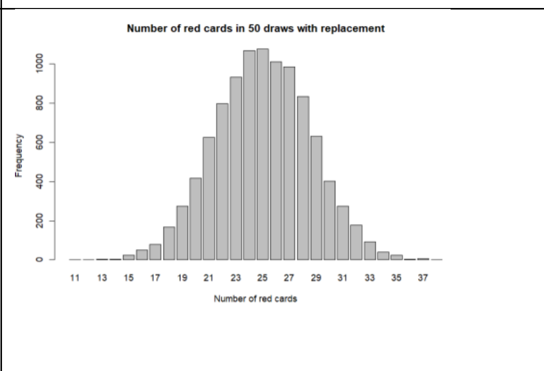
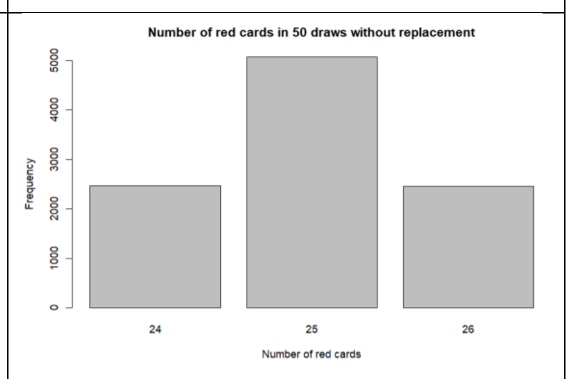
Number of 3's obtained in rolling 100 dice is unimodal with most of the chances rolling number of 3's falling between 12-20 dice but there are no chances to get less than 5 dice or more than 33 dice that have number of 3's.

```

RollSomeDice=function(n,m){
  numOf3s<-c(1:n)
  for (i in 1:n){
    numOf3s[i]<-sum(sample(c(1,2,3,4,5,6),m,repl=T)==3)
  }
  numOf3sTable<-table(numOf3s)
  titleNumOf3s = paste("Number of 3's obtained in rolling",m, "dice")
  return (barplot(numOf3sTable, main=titleNumOf3s))

}
```

6.

<table>
<tr><th>m</th><th>With replacement</th><th>Without replacement</th></tr>
<tr><td>1</td><td>
</td><td>
</td></tr>
<tr><td>5</td><td>
</td><td>
</td></tr>
<tr><td>10</td><td>
</td><td>
</td></tr>
<tr><td>30</td><td>
</td><td>
</td></tr>
<tr><td>50</td><td>
</td><td>
</td></tr>
</table>

As m increases, the same possibility of drawing numbers of red cards with replacement is maintained (all the graphs have unimodal shape with peak at the middle value range), while with replacement, the possibility of drawing red cards is significantly higher after increasing number of draws (when it comes to 50 draws, there is a guarantee of being able to draw 24-26 number of red cards). The differences is with replacement, we don’t put back the card that is already drawn, therefore the more we draw, the more we can get red cards.

```r

DrawCardsWithReplacement=function(n,m){
  numOfRed<-c(1:n)
  for (i in 1:n) {
    numOfRed[i]=sum(sample(c("Red","Black"),m,repl=T)=="Red")
  }
  numOfRedTable<-table(numOfRed)
  titleNumOfRed = paste("Number of red cards in",m,"draws with replacement")
  return (barplot(numOfRedTable, main=titleNumOfRed, xlab="Number of red cards", ylab="Frequency"))
}

DrawCardsWithoutReplacement=function(n,m){
  deckOfCards<-c(1:52)
  for (i in 1:26){deckOfCards[i]="Red"}
  for (i in 27:52){deckOfCards[i]="Black"}
  numOfRed<-c(1:n)
  for (i in 1:n) {
    numOfRed[i]=sum(sample(deckOfCards,m,repl=F)=="Red")
  }
  numOfRedTable<-table(numOfRed)
  titleNumOfRed = paste("Number of red cards in",m,"draws without replacement")
  return (barplot(numOfRedTable, main=titleNumOfRed, xlab="Number of red cards", ylab="Frequency"))
}
```