chapter12

Simulate tossing a coin 10 times

```
sample(c(0,1), 10, replace=TRUE) #0 represents tails, 1 heads. Randomly
sample 10 times from the set 0, 1. Allow repeats of 0 or 1.

##  [1] 1 1 1 0 1 1 0 0 1 0
```

What did you get? What proportion were heads? (heads=1) Run again. Did you get the same thing?

```
v=sample(c(0,1), 10, replace=TRUE)
v

##  [1] 0 1 0 0 1 0 1 0 1 1

numberheads=sum(v)

 propheads=numberheads/10
 propheads

## [1] 0.5
```

Repeat the above with 10 change to 100. What proportion were heads?

Repeat the above with 100 changed to 10000. What proportion were heads?

How could you apply this to statistical sampling?

Chance behavior is unpredictable in short run but follows a predictable pattern in the long run.

Probability of a outcome of a random phenomenon - proportion of times the outcome would occur in a very long series of repetitions.

Sample space S of a random phenomenon: all possible outcomes

Event: outcome or set of outcomes

Probability model: a sample space S and a way of assigning outcomes to events

Example: roll two dice and compute the sum S:

What is the probability of a 2? Will be computing later. But we will estimate it right now by simulation.

```
twodice=replicate(2,sample(6,1000,replace=TRUE)) #Roll a dice (the 6) 1000
times.Repeat another time the 2.
twodice[1,] #first roll of two dice
```

```
## [1] 6 1
```

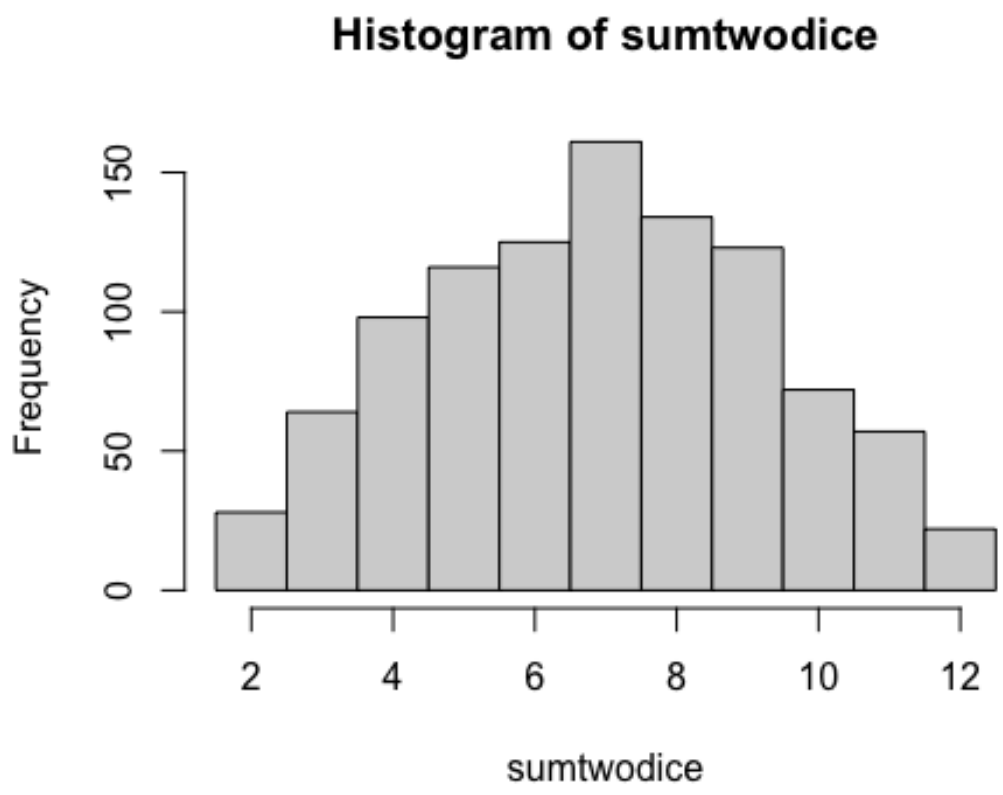
```
sumtwodice=twodice[,1]+twodice[,2]
sumtwodice[1] # the sum of the first two dice, the sum of the 1000th roll of two dice
```

```
## [1] 7
```

```
sumtwodice[1000]
```

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

```
h=hist(sumtwodice,breaks=seq(1.5,12.5,by=1))
```




```
h
```

```
## $breaks
##  [1]  1.5  2.5  3.5  4.5  5.5  6.5  7.5  8.5  9.5 10.5 11.5 12.5
##
## $counts
##  [1]  28  64  98 116 125 161 134 123  72  57  22
##
## $density
##  [1] 0.028 0.064 0.098 0.116 0.125 0.161 0.134 0.123 0.072 0.057 0.022
```

```
##
## $mids
##  [1]  2  3  4  5  6  7  8  9 10 11 12
##
## $xname
## [1] "sumtwodice"
##
## $equidist
## [1] TRUE
##
## attr(,"class")
## [1] "histogram"
```

Probability rules:

$0 \leq P(A) \leq 1$ for any event A

P(S)=1

If A and B are disjoint $P(A \; or \; B) = P(A) + P(B)$

$P(not \; A) = 1 - P(A)$

Finite probability models: S is finite

Examples-sum of two dice,or flipping 3 coins, number of heads:Notes written on board for this

SRS of size n-every subset of size n has equal probability

Completely randomized design: three men, three women, treatment or placebo: Sample space?:

Discrete probability models: S is equivalent to the integers

Continuous probability models: example N(3,4)

Random variable:

a variable whose value is a numerical outcome of a random phenomena

probability distribution of random variable X is the probabilties for the various values of X.

Discrete Random variables

Continuous random variable