Assignment 1

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The boundary of m

When p=0.6, $\alpha(0.6)$ is the probability of a type 1 error. When p>0.6(say p=0.8), $1-\alpha(0.8)$ is the probability of a type 2 error. Because increasing m makes a type 1 error less likely and a type 2 error more likely, we need to control m so that the probability of a type 1 error and a type 2 error is both less than 0.05. According to $\alpha(p)=\sum_{m\leqslant k\leqslant n} b(n,p,k)$, we can get that the smallest value of m is 69 when $\alpha(0.6)\leqslant 0.05$ and the smallest value of m is 73 when $1-\alpha(0.8)\leqslant 0.05$. The following is the code:

```
# The smallest value for  m
alpha<-function(m){
  1-pbinom(m-1,100,0.6)
}

for(m in 1:100){
  if(alpha(m)>0.05){
  }else{
    print(m)
    break
  }
}
```

```
## [1] 69
```

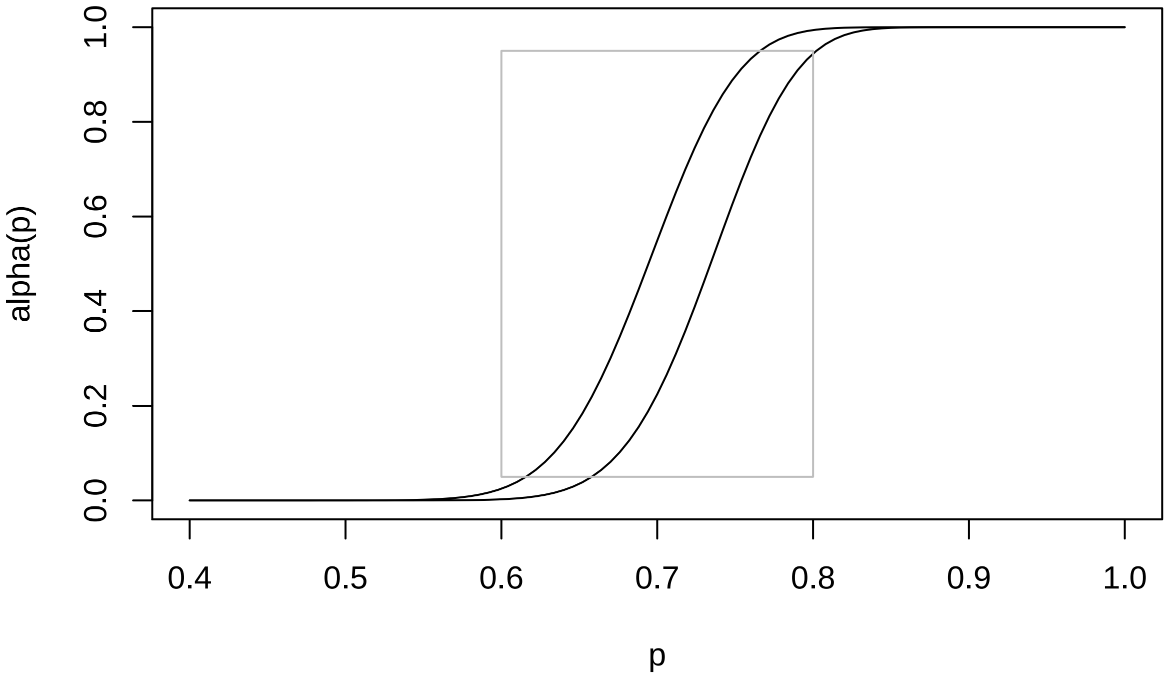
```
# The largest value for m
beta<-function(m){
  pbinom(m,100,0.8)
}

for(m in 1:100){
  if((beta(m))<0.05){
  }else{
    print(m)
    break
  }
}
```

```
## [1] 73
```

Plot

```
curve(1-pbinom(69,100,x), 0.4, 1,xlab = "p",ylab = "alpha(p)")
curve(1-pbinom(73,100,x),add=T)
rect(xleft = 0.6, ybottom = 0.05, xright = 0.8, ytop = 0.95,border = "gray")
```



Based on the plot, these two curves represent the function $\alpha(p)$ changing with p changing when m is equal to 69 and 73. As for m=69, when the graph of α enters the box from the bottom, the probability of type 1 error satisfies the requirement. As for m=73, when the graph of α leaves the box from the top, the probability of type 2 error satisfies the requirement.