MA677 HW1

Aoyi Li

2021/2/9

Find critical values

```
n = 100

# Generate a function for alpha(p)
alpha <- function(m, n, p){
  sum(dbinom(m:n, n, p))
}

# Get critical value for the experiment
for(i in 60:n){
  if (alpha(i,n,0.6)<0.05){
    cat("The critical value for type-I error is",i)
    break;
  }
}
```

```
## The critical value for type-I error is 69
```

```
for(j in 80:1){
  if ((1-alpha(j,n,0.8))<0.05){
    cat("The critical value for type-II error is",j)
    break;
  }
}
```

```
## The critical value for type-II error is 73
```

Explanation for the critical value m.

For type-I error we choose p=0.6 and for type-II error we choose p=0.8. As the book mentioned that increasing m above the most probable value np which is 100*0.6 = 60 will make type-I error less likely. Similarly, decreasing m below 80 will make type-II error less likely. Since we want both type-I and II error less than 0.05, we choose the critical value to be the smallest number making type-I error less than 0.05 and to be the largest number making type-II error less than 0.05. Then we can find that the critical value should be between 69 and 73 people cured.

Plot

```r
# Sequence for values on x axis when p is between 0.4 to 1.
x <- seq(0.4, 1, by = 0.01)

# Generate a function to get values of alpha(p) when p is between 0.4 to 1.
n_y<-c()
y<- function(m){
  for(g in x){
    a<-alpha(m,n,g)
    n_y<-c(n_y,a)
  }
  n_y
}

# plot
ggplot()+
  geom_rect(aes(xmin = 0.6, xmax = 0.8, ymin = 0.05, ymax = 0.95), fill="transparent",color="gray44")+
  geom_line(aes(x,y(69)))+
  geom_line(aes(x,y(73)))+
  theme_classic()+
  theme(axis.title.x = element_blank())+
  theme(axis.title.y = element_blank())+
  labs(title = 'Figure 3.7: The power curve')
```

Figure 3.7: The power curve