Statistics CH7

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7.1.0.2 Exercise

```
p1 = dbinom(125, size = 250, prob = 0.5)
p1
```

```
## [1] 0.05041221
```

```
p2 = dbinom(240, size = 250, prob = 0.5)
p2
```

```
## [1] 1.210475e-58
```

7.1.0.4 Exercise

a.

```
alpha = function(K){
  pbinom(125-K-1, size = 250, prob = 0.5) + pbinom(125+K, size = 250, prob = 0.5, lower.tail = FALSE)
}
sapply(c(5, 10, 20), alpha)
```

```
## [1] 0.48669185 0.18401511 0.00937517
```

b.

```
alpha1 = function(K){
  X = rbinom(1e5, size = 250, prob = 0.5)
  result = mean((X > 125+K) | (X < 125-K))
  return(result)
}
sapply(c(5, 10, 20), alpha1)
```

```
## [1] 0.48599 0.18211 0.00969
```

7.1.0.7 Exercise

```
alpha = function(K){
  pbinom(125-K-1, size = 250, prob = 0.5) + pbinom(125+K, size = 250, prob = 0.5, lower.tail = FALSE)
}
K = 1
result = alpha(K)
while (result > 0.05){
  K = K + 1
  result = alpha(K)
}
result
```

```
## [1] 0.04970679
```

```
K
```

```
## [1] 15
```

```
K = 1
result = alpha(K)
while (result > 0.1){
  K = K + 1
  result = alpha(K)
}
result
```

```
## [1] 0.08750233
```

```
K
```

```
## [1] 13
```

```
K = 1
result = alpha(K)
while (result > 0.01){
  K = K + 1
  result = alpha(K)
}
result
```

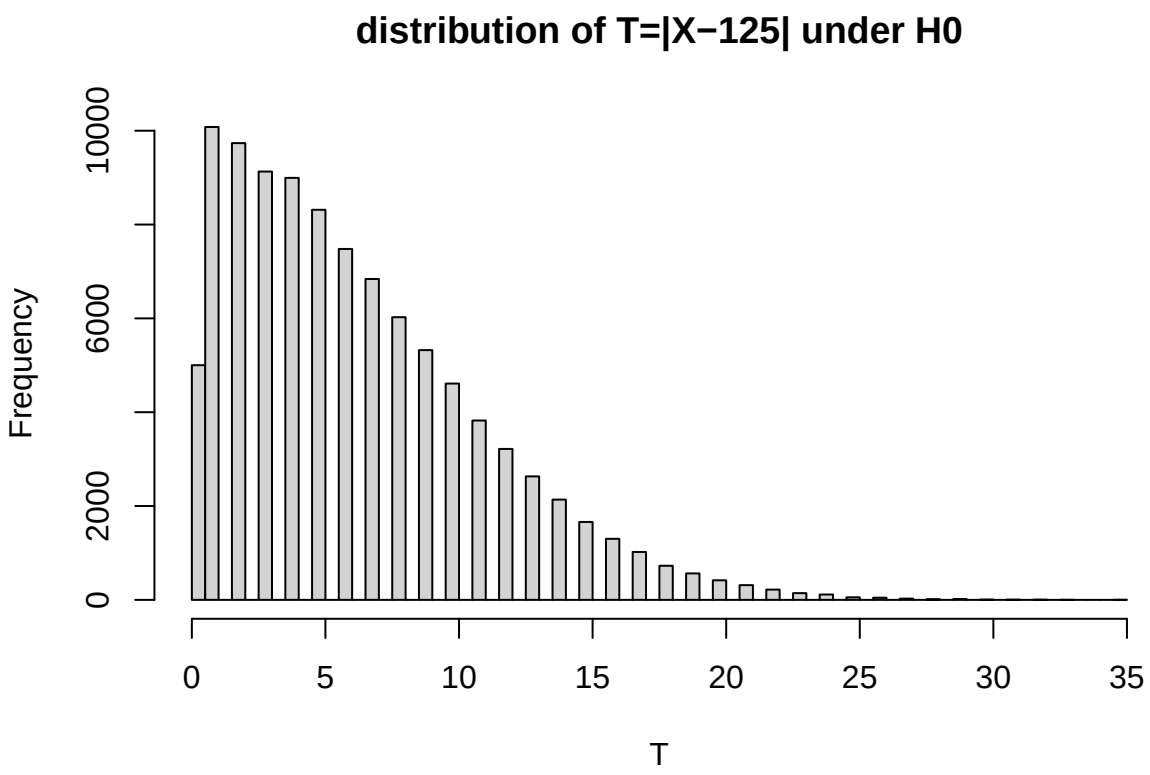
```
## [1] 0.00937517
```

```
K
```

```
## [1] 20
```

7.1.0.8 Exercise

```r
X = rbinom(1e5, size = 250, prob = 0.5)
T = abs(X-125)
hist(T, 100, main="distribution of T=|X-125| under H0")
```




```r
K1 = quantile(T, 0.90)
K1
```

```
## 90%
##  13
```

```r
K2 = quantile(T, 0.99)
K2
```

```
## 99%
##  20
```

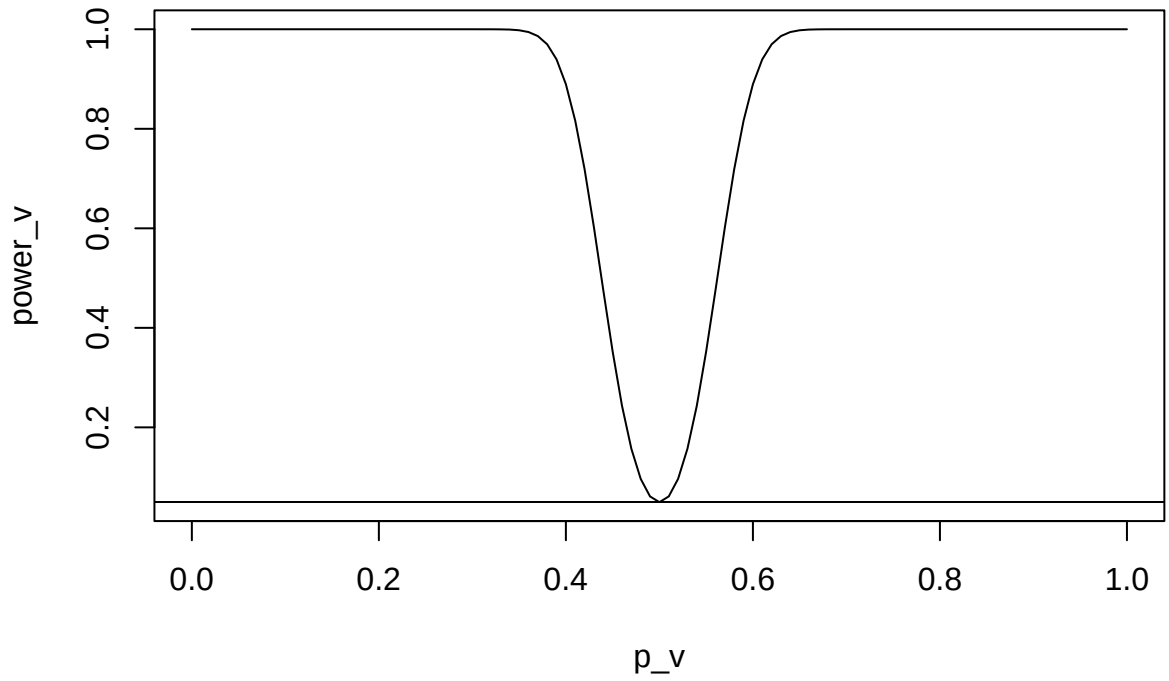
7.2.0.1 Exercise

```r
X = rbinom(1e5, size = 250, prob = 0.5)
T = X
K = quantile(T, 0.95)
K
```

```
## 95%
## 138
```

7.3.0.1 Exercise

```
power = function(p){
  pbinom(109, size = 250, prob = p)+pbinom(140, size = 250, prob = p, lower.tail = FALSE)
}
p_v = seq(0, 1, 0.01)
power_v = power(p_v)
plot(p_v, power_v, type = 'l')
abline(h=0.05)
```



7.3.0.2 Exercise

```
power(0.51)
```

```
## [1] 0.06118538
```

```
power(0.7)
```

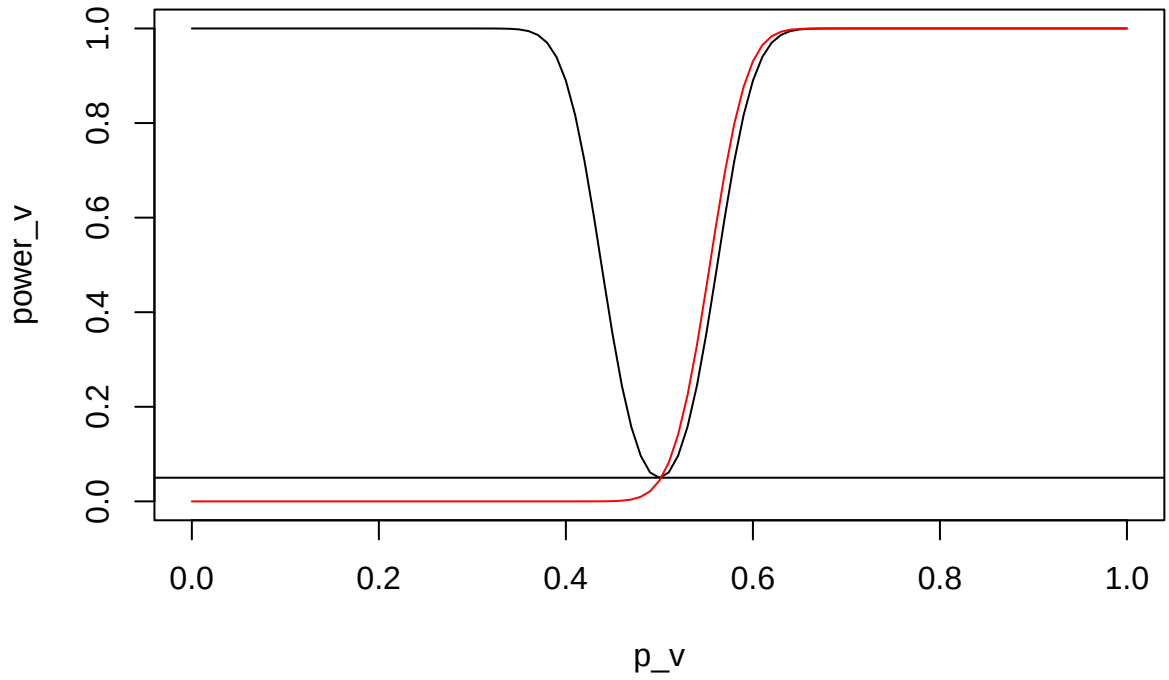
```
## [1] 0.999998
```

```r
X = rbinom(1e5, size = 250, prob = 0.7)
T = abs(X-125)
power = mean(T > 15)
power
```

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

7.3.0.3 Exercise

```r
power = function(p){
  pbinom(109, size = 250, prob = p)+pbinom(140, size = 250, prob = p, lower.tail = FALSE)
}
power1 = function(p){
  pbinom(138, size = 250, prob = p, lower.tail = FALSE)
}
p_v = seq(0, 1, 0.01)
power_v = power(p_v)
power1_v = power1(p_v)
plot(p_v, power_v, type = 'l', ylim = c(0, 1))
abline(h=0.05)
lines(p_v, power1_v, col = 'red')
```



7.3.0.4 Exercise ## a.

```r
ptype1 = dbinom(0, size = 10, prob = 0.5) + dbinom(10, size = 10, prob = 0.5)
ptype1
```

```
## [1] 0.001953125
```

b.

```r
alpha = ptype1
alpha
```

```
## [1] 0.001953125
```

c.

```r
ptype2 = 1 - dbinom(0, size = 10, prob = 0.3) - dbinom(10, size = 10, prob = 0.3)
ptype2
```

```
## [1] 0.9717466
```

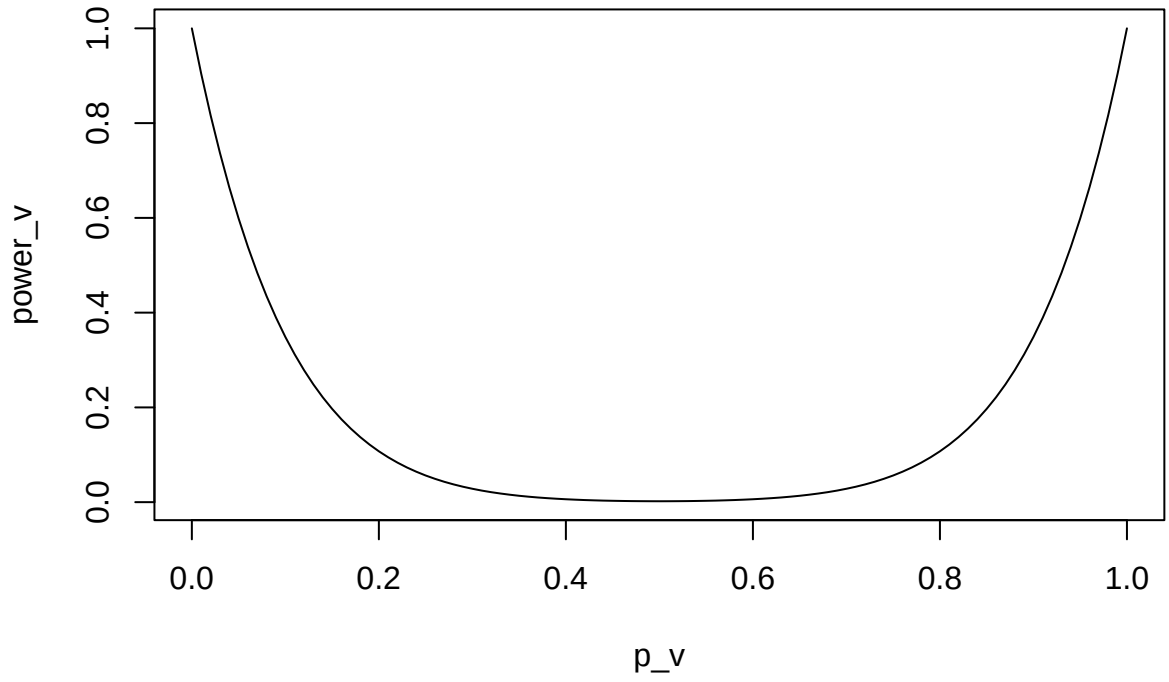
d.

```r
power1 = dbinom(0, size = 10, prob = 0.3) + dbinom(10, size = 10, prob = 0.3)
power1
```

```
## [1] 0.02825343
```

e.

```r
power = function(p){
  dbinom(0, size = 10, prob = p) + dbinom(10, size = 10, prob = p)
}
p_v = seq(0,1,0.01)
power_v = power(p_v)
plot(p_v, power_v, type = 'l')
```



7.3.0.5 Exercise ## a.

```
X = rbinom(1e5, size = 10, prob = 0.5)
ptype1 = mean((X == 0) | (X == 10))
ptype1
```

```
## [1] 0.00189
```

b.

```
alpha = ptype1
alpha
```

```
## [1] 0.00189
```

c.

```
X = rbinom(1e5, size = 10, prob = 0.3)
ptype2 = 1 - mean((X == 0) | (X == 10))
ptype2
```

```
## [1] 0.97194
```

d.

```
power1 = mean((X == 0) | (X == 10))
power1
```

```
## [1] 0.02806
```

7.3.0.6 Exercise

c.

```
X = rbinom(1e5, size = 102, prob = 1/6)
T = abs(X - 17)
cv = quantile(T, 0.95)
cv
```

```
## 95%
##   7
```

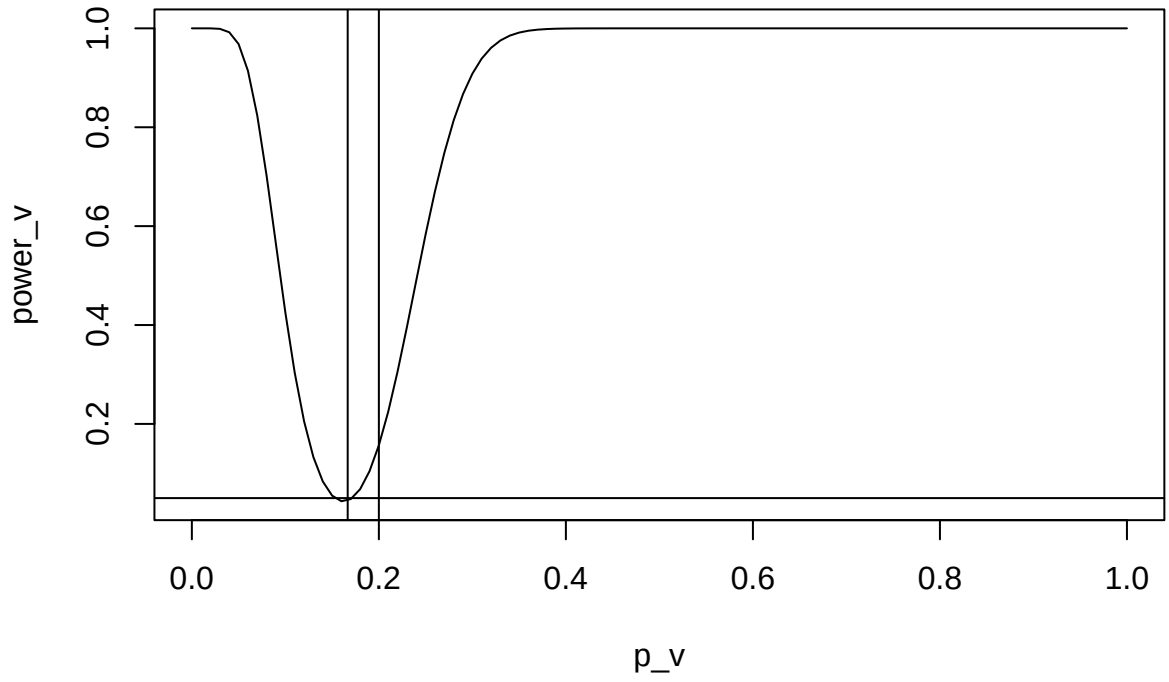
e.

```
power = function(p){
  pbinom(17-cv-1, size = 102, prob = p) + pbinom(17+cv, size = 102, prob = p, lower.tail = FALSE)
}
power(1/5)
```

```
##       95%
## 0.1567949
```

f.

```
p_v = seq(0, 1, 0.01)
power_v = power(p_v)
plot(p_v, power_v, type = 'l')
abline(h=0.05)
abline(v=1/6)
abline(v=1/5)
```



7.3.0.7 Exercise ## c.

```
X = rbinom(1e5, size = 102, prob = 1/6)
T = abs(X - 17)
cv = quantile(T, 0.9)
cv
```

```
## 90%
##   6
```

e.

```
power = function(p){
  pbinom(17-cv-1, size = 102, prob = p) + pbinom(17+cv, size = 102, prob = p, lower.tail = FALSE)
}
power(1/5)
```

```
##       90%
## 0.2228226
```

7.3.0.8 Exercise

```
X = rbinom(1e5, size = 204, prob = 1/6)
T = abs(X - 204/6)
cv = quantile(T, 0.95)
cv
```

```
## 95%
##  10
```

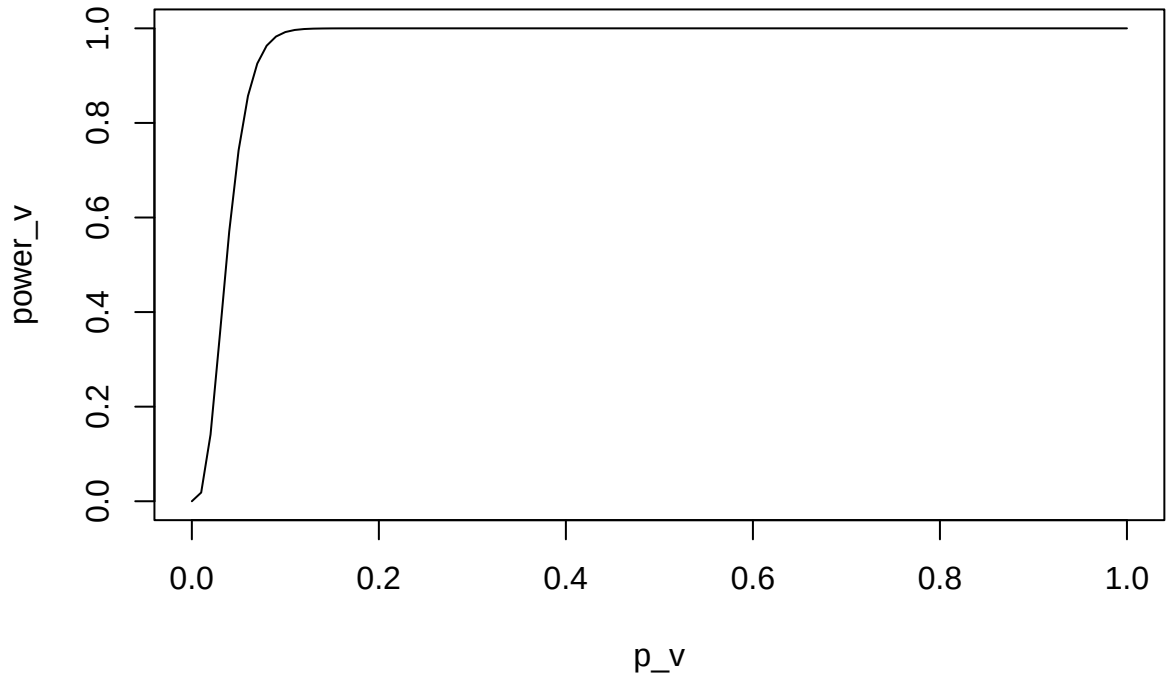
```
power = function(p){
  pbinom(204/6-cv-1, size = 204, prob = p) + pbinom(204/6+cv, size = 204, prob = p, lower.tail = FALSE)
}
power(1/5)
```

```
##       95%
## 0.2560256
```

7.3.0.9 Exercise

c.

```
X = rbinom(1e5, size = 100, prob = 0.01)
T = abs(X - 100*0.01)
cv = quantile(T, 0.95)
power = function(p){
  pbinom(100*0.01-cv-1, size = 100, prob = p) + pbinom(100*0.01+cv, size = 100, prob = p, lower.tail = F
}
p_v = seq(0, 1, 0.01)
power_v = power(p_v)
plot(p_v, power_v, type = 'l')
```



7.4.0.3 Exercise

```
X = 140
Z = abs((X - 125) / 62.5**0.5)
cv = qnorm(0.975, mean = 0, sd = 1)
cv = qnorm(0.95, mean = 0, sd = 1)
```