HW8 R

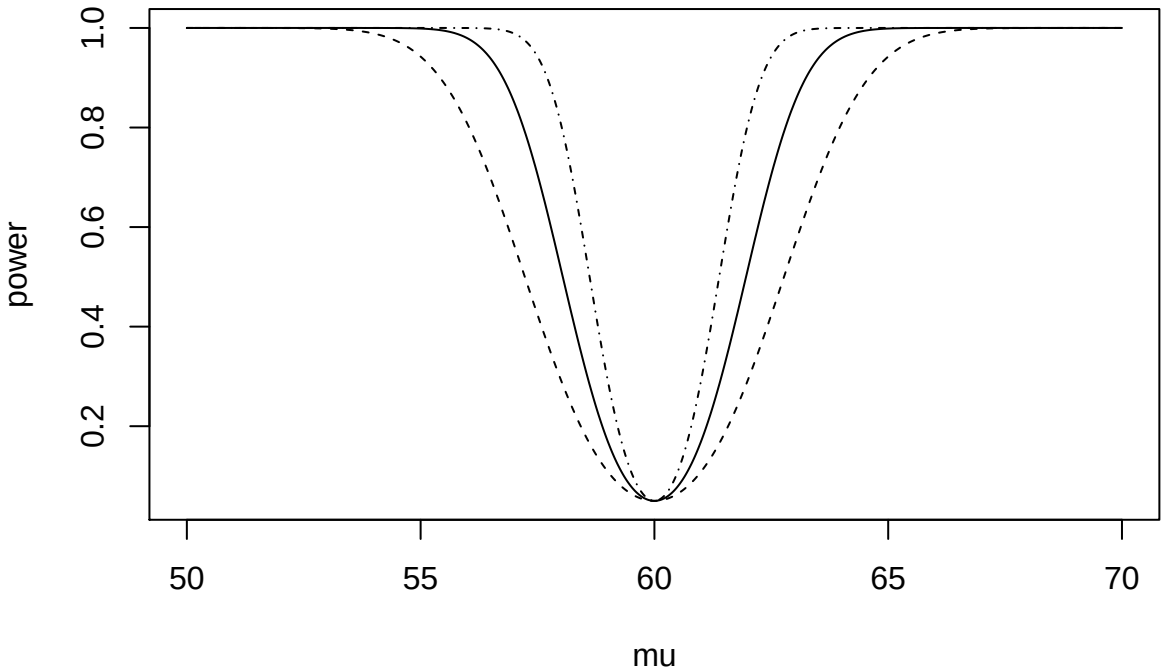
Stat 322 HW8 R problems

1. We are interested in testing $H_0 : \mu = 60$ vs. $H_1 : \mu \neq 60$. Initially, we consider a size .05 test on a random sample of size 16 from a normal distribution with $\sigma = 4$.

```
sigma <- 4
n <- 16
alpha <- .05
mu0 <- 60
mu <- seq(50,70,length=1000)
power <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
```

   a. generate a plot showing the effect of sample size on power (i.e. superimpose the graphs of three power functions representing 3 different sample sizes:$n = 16, n > 16$, and $n < 16$)

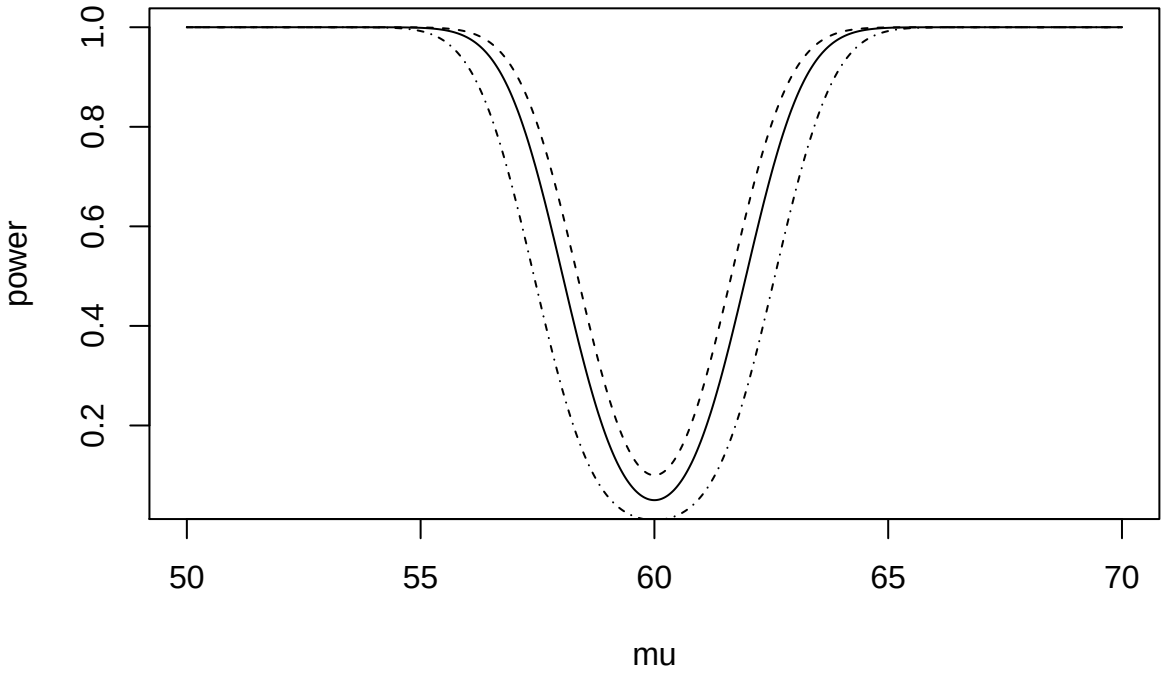
```
plot(mu,power,type="l")
n <- 8
power2 <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
lines(mu,power2,lty=2)
n <- 32
power3 <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
lines(mu,power3,lty=4)
```




```
n <- 16
```

   b. generate a plot showing the effect of test size on power (i.e. superimpose the graphs of three power functions representing 3 different test sizes: $\alpha(\delta) = .05, \alpha(\delta) > .05, \alpha(\delta) < .05$)

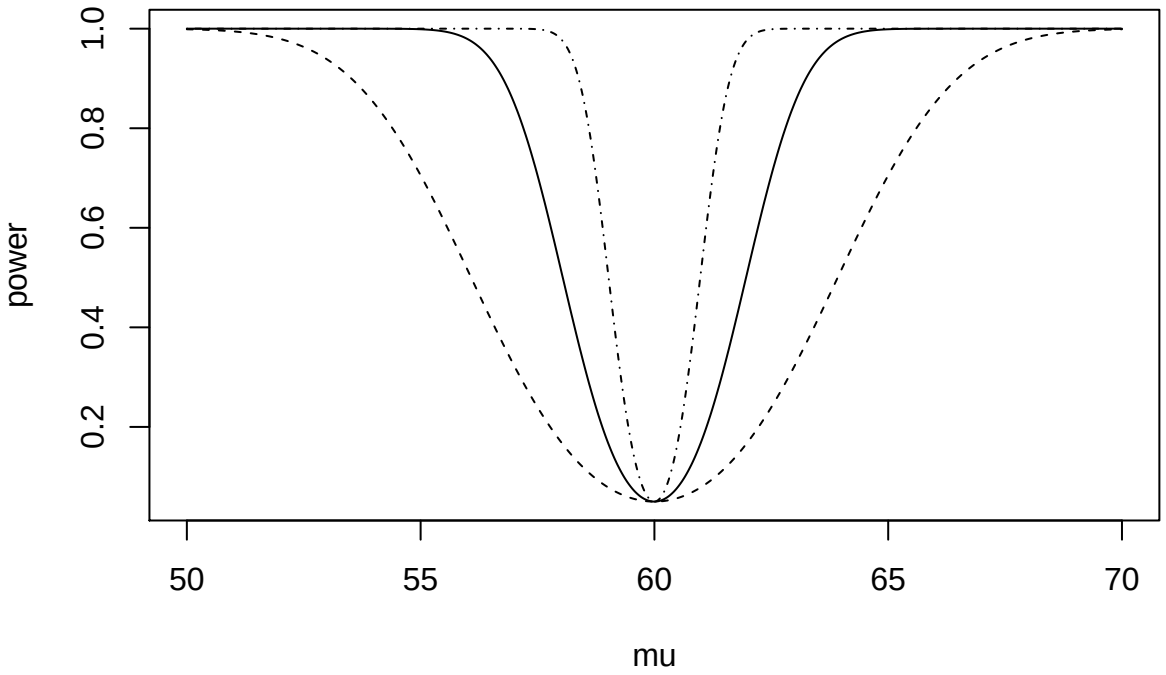
```
plot(mu,power,type="l")
alpha <- .10
power2 <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
lines(mu,power2,lty=2)
alpha <- .01
power3 <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
lines(mu,power3,lty=4)
```




```
alpha <- .05
```

c. generate a plot showing the effect of standard deviation on power (i.e. superimpose the graphs of three power functions representing 3 different standard deviations: $\sigma = 4, \sigma = 4, \sigma = 4$)

```
plot(mu,power,type="l")
sigma <- 8
power2 <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
lines(mu,power2,lty=2)
sigma <- 2
power3 <- 1 - pnorm(qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma) +
  pnorm(-qnorm(1-alpha/2,0,1) + (mu0-mu)*sqrt(n)/sigma)
lines(mu,power3,lty=4)
```

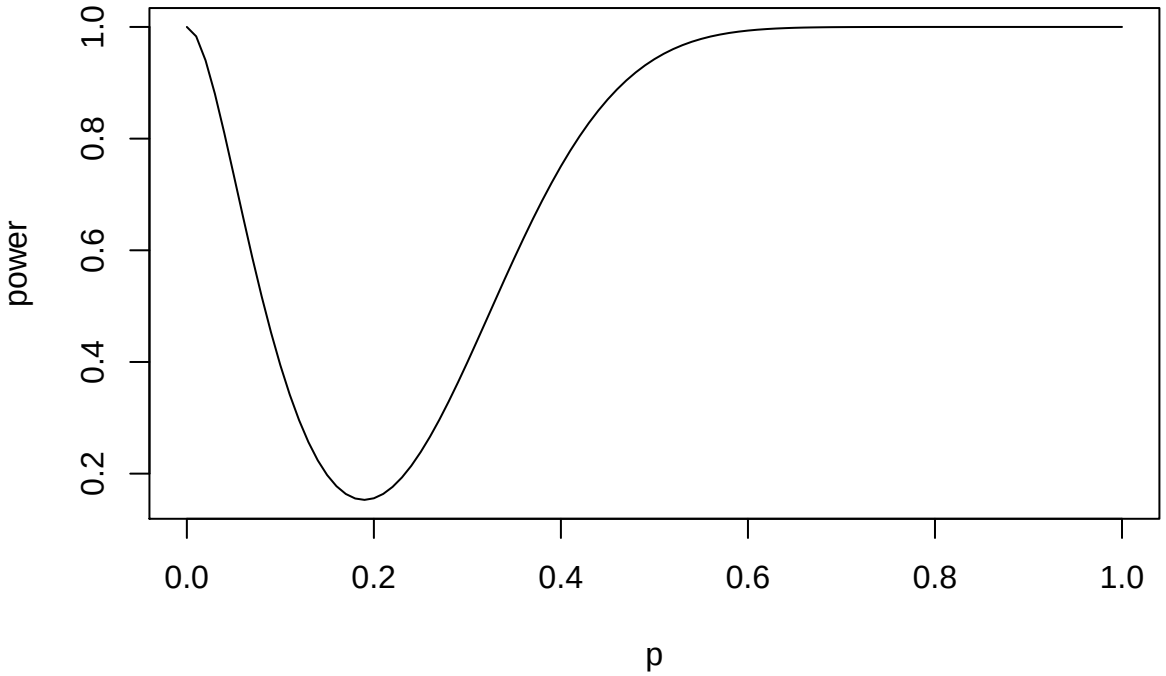



```
sigma <- 4
```

2. Based on the description for Exercise 9.1.3:

a. Sketch the power function described in (a).

```
p <- seq(0,1,by=.01)
power <- 1 - pbinom(6,size=20,prob=p) + pbinom(1,size=20,prob=p)
plot(p,power,type="l")
```



b. If we desire a level .05 test for $H_0 : p = 0.2$ vs $H_1 : p > 0.2$, define the appropriate critical region. What is the size of this test?

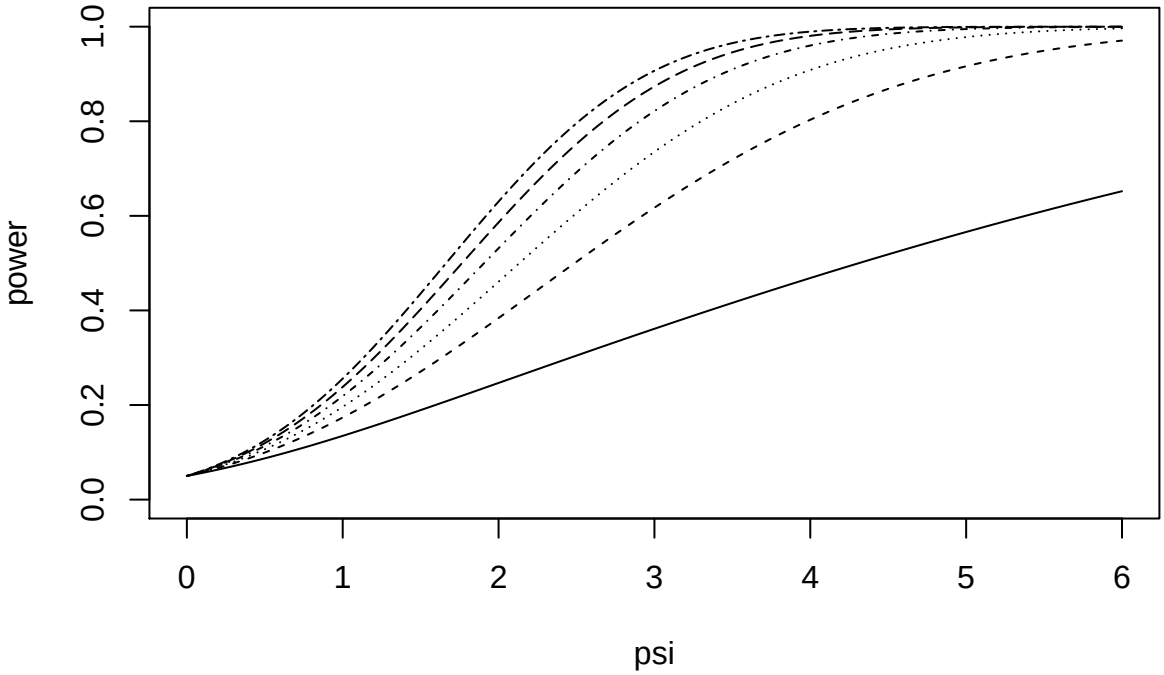
```
y <- 1:20
probtype1error <- 1 - pbinom(y-1,size=20,prob=.20)
cbind(y,probtype1error)
```

```
##        y probtype1error
##  [1,]  1   9.884708e-01
##  [2,]  2   9.308247e-01
##  [3,]  3   7.939153e-01
##  [4,]  4   5.885511e-01
##  [5,]  5   3.703517e-01
##  [6,]  6   1.957922e-01
##  [7,]  7   8.669251e-02
##  [8,]  8   3.214266e-02
##  [9,]  9   9.981786e-03
## [10,] 10   2.594827e-03
## [11,] 11   5.634137e-04
## [12,] 12   1.017288e-04
## [13,] 13   1.516284e-05
## [14,] 14   1.845006e-06
## [15,] 15   1.802764e-07
## [16,] 16   1.380346e-08
## [17,] 17   7.977672e-10
## [18,] 18   3.272604e-11
## [19,] 19   8.493206e-13
## [20,] 20   1.043610e-14
```

Reject Ho if Y>=8; size of test = .032

3. Duplicate the two plots in Figure 9.12 (p. 580)'

```
psi <- seq(0,6,length=1000)
alpha <- .05
degfr <- c(1,2,3,5,10,60)
power <- 1 - pt(qt(1-alpha,df=degfr[1]),df=degfr[1],ncp=psi)
plot(psi,power,type="l",ylim=c(0,1))
for (i in 2:6)  {
  power <- 1 - pt(qt(1-alpha,df=degfr[i]),df=degfr[i],ncp=psi)
  lines(psi,power,lty=i)  }
```




```
alpha <- .01
degfr <- c(1,2,3,5,10,60)
power <- 1 - pt(qt(1-alpha,df=degfr[1]),df=degfr[1],ncp=psi)
plot(psi,power,type="l",ylim=c(0,1))
for (i in 2:6)  {
  power <- 1 - pt(qt(1-alpha,df=degfr[i]),df=degfr[i],ncp=psi)
  lines(psi,power,lty=i)  }
```