

*(Session 19 Group Quiz)*

The body temperature in degrees Fahrenheit of  $n = 40$  randomly chosen healthy adults is measured. The standard deviation  $\sigma$  is known to be 0.68 degrees Fahrenheit. The sample mean for the measurements is  $\bar{x} = 98.37$ .

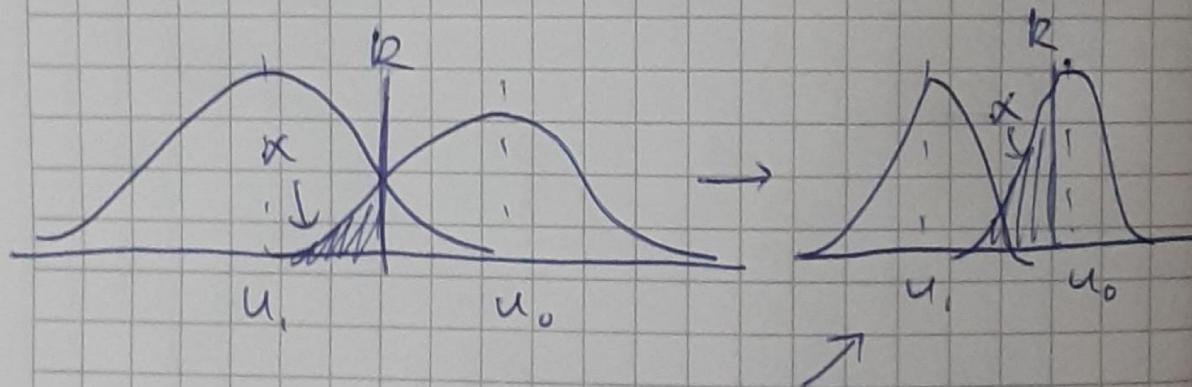
*(Do Not Repeat Solutions)* You already found a 99% confidence interval for the mean body temperature and explained its meaning.

*(Do Not Repeat Solutions)* Consider the simple hypothesis for the mean body temperature in degrees Fahrenheit,  $H_0 : \mu = 98.6$  versus  $H_1 : \mu = 98.4$ . You already gave the critical value for  $\bar{x}$ , the sample mean body temperature when the significance level  $\alpha = 0.05, 0.02$ , and  $0.01$ .

**q-worksheet**

- a. Do these critical values increase, decrease, or stay the same in the number of healthy adults chosen increases to  $n = 50$ ? Explain your answer.

(a) If the value of  $n$  increases from  $40$  to  $50$ , we see that the SD decreases. Therefore, to compensate for the Area  $\alpha$ , the value of  $k$  is taken further towards  $\mu_0$ . Therefore, if  $n$  increases, CRITICAL VALUE also INCREASES



Here, we see that the value of  $k$  increases.

- b. The data have sample mean  $\bar{x} = 98.37$ . For  $n = 40$  and each value of  $\alpha$ , report whether or not we reject the null hypothesis? Explain your answer.

(b) We reject null hypothesis when the value of  $\bar{X}$   $\leftarrow$  critical value, when it is to the left of ~~or R~~ R.

$\alpha$	R	Reject ?
0.05	98.42	$> \bar{X}$ so REJECT N.H
0.02	98.38	$> \bar{X}$ so REJECT N.H
0.01	98.35	$< \bar{X}$ so DO NOT REJECT N.H (FAIL TO REJECT)

Figure 1: Part(b)

c. Find the power of the test in part (b) for each significance level.

	significance		
	0.05	0.02	0.01
power			

```
z1<-(98.42315 - 98.4)/(0.68/sqrt(40))
z2<-(98.37919 - 98.4)/(0.68/sqrt(40))
z3<-(98.34988 - 98.4)/(0.68/sqrt(40))
cat("Value of power for alpha = 0.05: ", pnorm(z1), "\n")
```

```
## Value of power for alpha = 0.05: 0.5852387
```

```
cat("Value of power for alpha = 0.02: ", pnorm(z2), "\n")
```

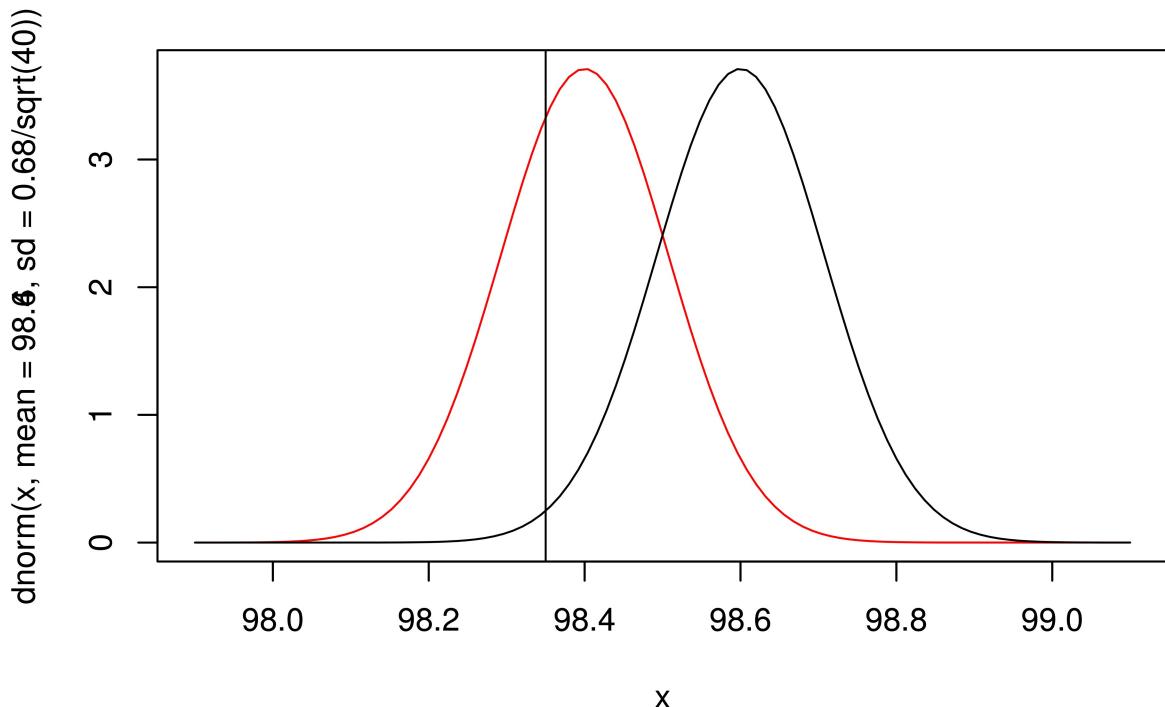
```
## Value of power for alpha = 0.02: 0.4232641
```

```
cat("Value of power for alpha = 0.01: ", pnorm(z3), "\n")
```

```
## Value of power for alpha = 0.01: 0.3205516
```

- d. For  $\alpha = 0.01$ , indicate the power using the critical value for the test and drawing the density of the sample mean  $\bar{X}$  for the null and alternative hypothesis.

```
curve(dnorm(x, mean = 98.4, sd = 0.68/sqrt(40)), from = 97.9, to = 99.1, col = "red")
par(new = TRUE)
curve(dnorm(x, mean = 98.6, sd = 0.68/sqrt(40)), from = 97.9, to = 99.1)
abline(v = 98.35)
```



The shaded area indicated on the next page is the power, that is, the area to the left of the critical value under the curve for the alternative hypothesis.

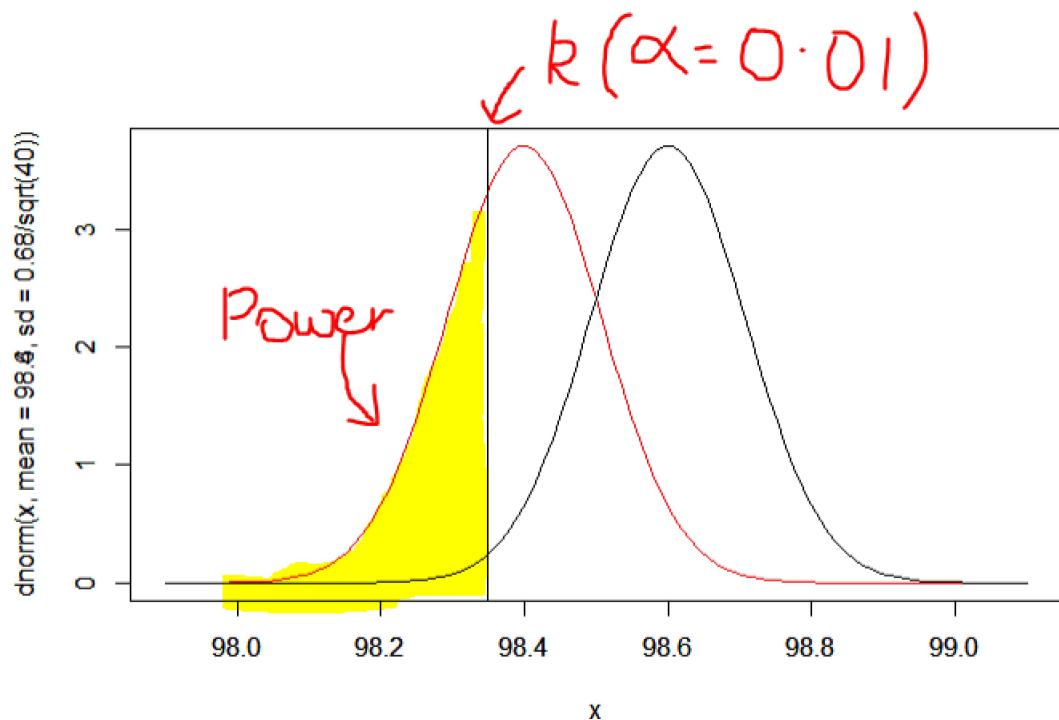


Figure 2: Part(d)