Hw2

Philip Sweet

10/06/2020

1

Given {b1} = 0.5, the power of the test with 48 degrees of freedom, for a true slope of 1.7, and a null of 0 would be 0.84 then there would be a 84% change of rejecting the null given that the true β1 was 1.7.

$$\delta = \frac{\beta_1 - \beta_{1_0}}{\sigma\{b_1\}} = \frac{1.7-0}{0.5} = 3.4$$

$$df = 48 = n-2 = 50-2$$

table provides value of 0.84 power

Drawing.

2

A

Found by hand the 90% CI for a stoping distance given a starting speed of 15mph is...

point est. $\hat{Y}_h = b_0 + b_1 X_h = -17.58 + 3.93(15) = 41.37$

var. est. $s^2\{\hat{Y}_h\} = MSE\left[\frac{1}{n} + \frac{(X_h - \bar{X})^2}{\sum (X_i - \bar{X})^2}\right] = \cancel{1370}\ 236.53\left[\frac{1}{50} + \frac{(15-15.4)^2}{1370}\right]$

$= \sqrt{4.76} = 2.45$

For a 90% CI, α 0.10 and $df = 48$, $t = 1.684$

CI $CI = 41.37 \pm \cancel{4.76}\ 2.45(1.684) = (\cancel{33.35,\ 49.38}) = (37.24, 45.49)$

Drawing.

B

```
read.csv("Stop.csv", header = TRUE) -> data

n <-length(data)
X <-data$speed
Y <-data$dist

reg.stop <-lm(Y ~ X)

new.dat <-data.frame(X=15)
predict(reg.stop, newdata=new.dat, interval="confidence", level=0.90)
```

```
##        fit      lwr      upr
## 1 41.40704 37.74843 45.06564
```

```
ci <- predict(reg.stop, newdata=new.dat, interval="confidence", level=0.90)
```

C

We can be 90% confident that the mean stopping distance, in ft, at 15mph is somewhere between (37.748435), (45.065638)

3

A

90% prediction interval for the stopping distance of a new driver whose speed is 15 mph.

$$s^2\{pred\} = MSE + s^2\{\hat{Y}_h\} = 236.53 + 4.76$$
$$= \sqrt{241.29}$$
$$= 15.53$$

$$CI = 41.37 \pm 1.684(15.53$$
$$= (15.217, 67.472)$$

Drawing.

B

```
predict(reg.stop, newdata=new.dat, interval="predict", level=0.90)
```

```
##        fit      lwr      upr
## 1 41.40704 15.35386 67.46022
```

```
ci <- predict(reg.stop, newdata=new.dat, interval="predict", level=0.90)
```

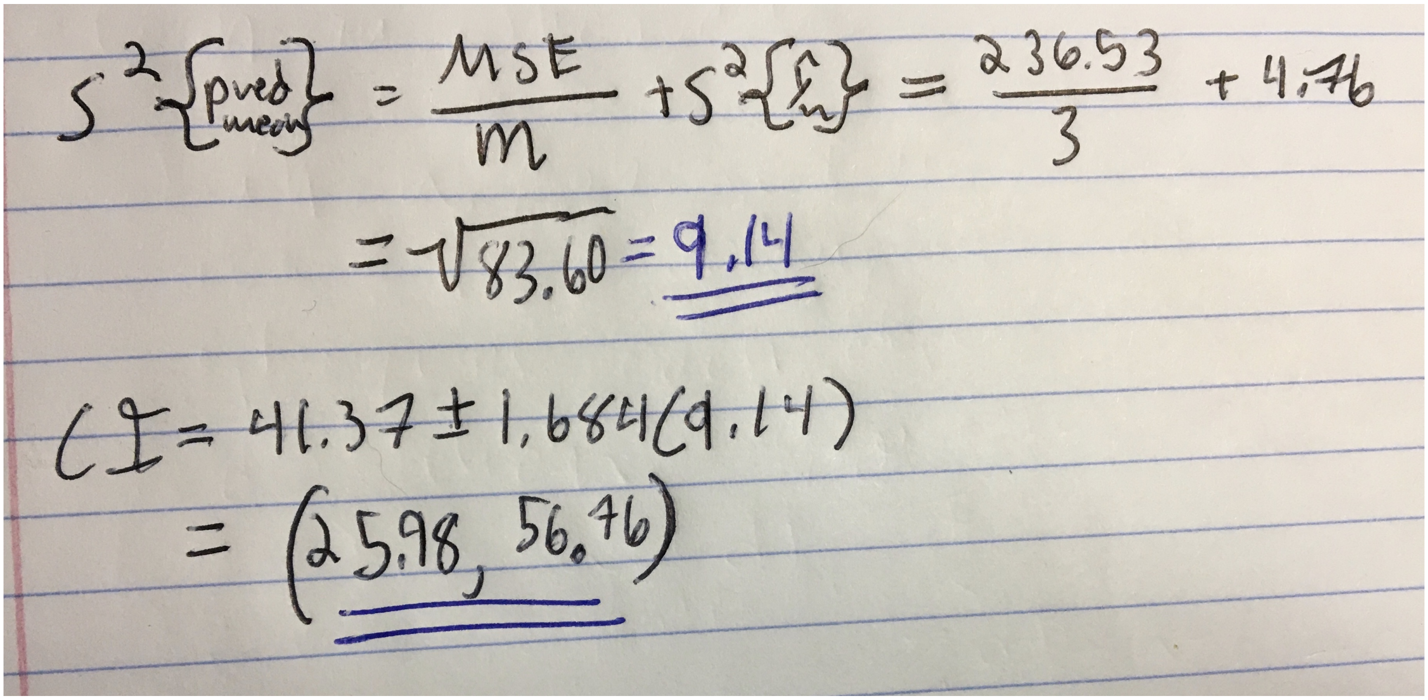
C

We can be 90% confident in predicting that a new stopping test conducted at 15mph would produce a stopping distance, in ft, somewhere between (15.3538569), (67.4602161)

4

A

A 90% prediction interval for the mean stopping distance of three new drivers each of whose speed is 15 mph.



Drawing.

B

```
ci.reg(reg.stop, new.dat, type = 'nm', alpha=0.10,m=3) -> threeRep

threeRep[3:4]
```

```
##   Lower.Band Upper.Band
## 1   26.07147    56.7426
```

C

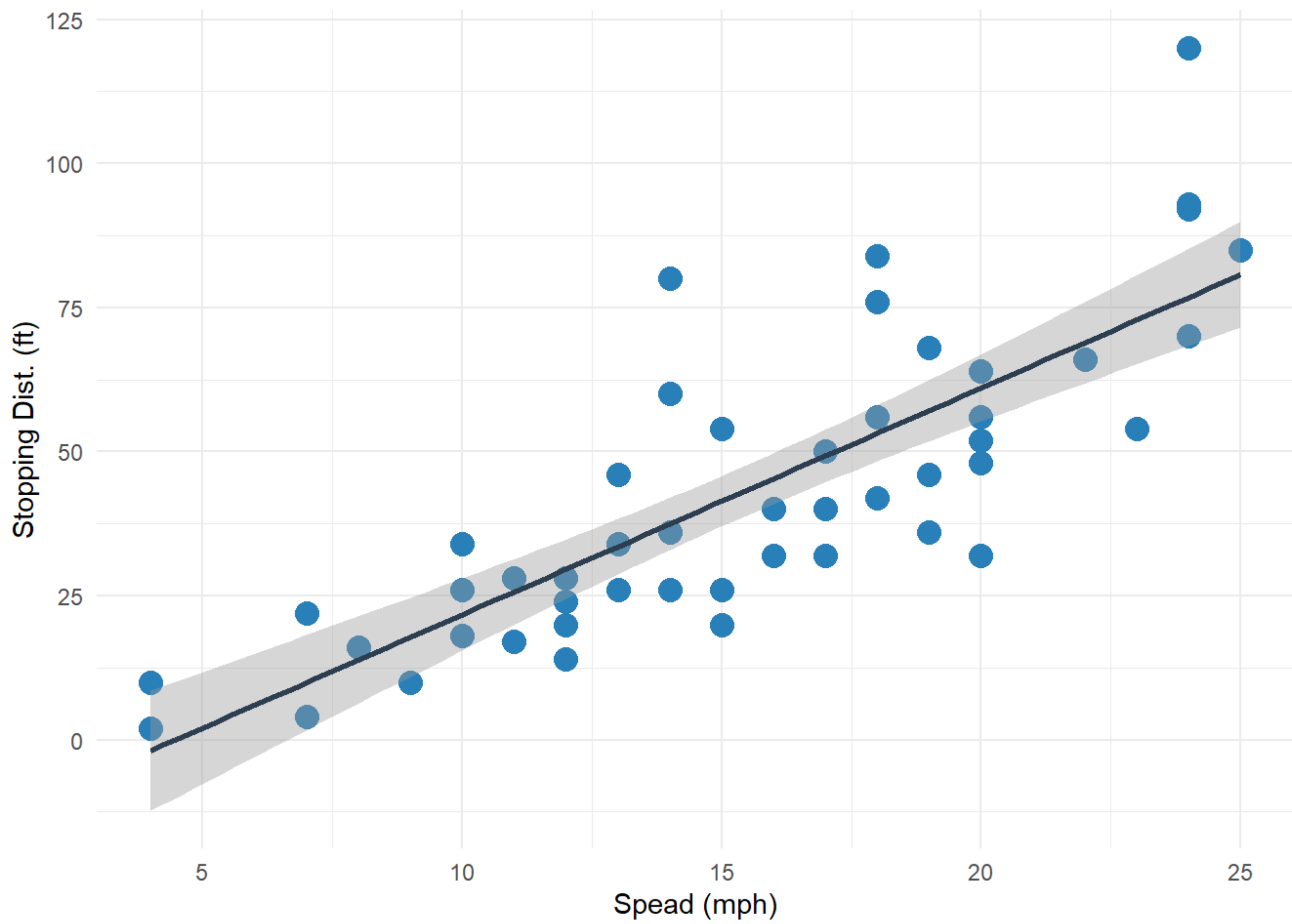
The interval for the total stopping distance for all three tests would be between 78.2144069 and 170.2278121

5

A 95% confidence band for the simple linear regression line predicting stopping distance using speed.

```
ggplot(data, aes(x=speed, y=dist)) +
  geom_point(color='#2980B9', size = 4) +
  geom_smooth(method=lm, color='#2C3E50') +
  xlab("Spead (mph)") +
  ylab("Stopping Dist. (ft)") +
  theme_minimal()
```

```
## `geom_smooth()` using formula 'y ~ x'
```



125
100
75
50
25
0
Stopping Dist. (ft)
5
10
15
20
25
Spead (mph)