Stat 482

Homework #3 Solutions

(1.) exp unit = service call
input = number of copiers serviced
response = time to complete the service (in minutes)

$x_h = 3$, CI for $\mu_h = [41.15, 47.90]$

(2.) PI for $Y_h = [26.235, 62.816]$

(3.) A confidence interval is for the mean service time for all calls with 3 copiers serviced.

A prediction interval is for the service time for a particular call with 3 copiers to be serviced.

(4.) $m = 10$, PI for $\bar{Y}_{h(new)} = [37.91, 51.14]$

(5.) Based on the observed data, we estimate/predict that the sample mean service time for 10 calls with 3 copiers to be serviced on each call is between 37.91 and 51.14 minutes.

(6.) $\text{Var}(\text{pred. mean}) = \text{Var}(\bar{Y}_{h(new)}) + \text{Var}(\hat{Y}_h)$. $\left(\text{Var}(\bar{Y}_{h(new)}) = \frac{\sigma^2}{m}\right)$

As $m \to \infty$, $\text{Var}(\text{pred. mean}) \to \text{Var}(\hat{Y}_h)$ (PI for $\bar{Y}$) $\to$ (CI for μ)

A CI estimate of the mean μ_h can be interpreted as a prediction of the sample mean $\bar{Y}_{h(new)}$ for a large number of responses.

HW #3 Computing

Data from Exercise 1.20

A sample of service calls is selected to investigate the relationship between the number of copiers to be serviced (x) and the service time (y)

:

```
hw3.data = read.table(
'http://users.stat.ufl.edu/~rrandles/sta4210/Rclassnotes/data/textdatasets/KutnerData/Chapter%20%201%20Data%20Sets/CH01PR20.txt')
colnames(hw3.data)=c("time","number")

attach(hw3.data)



hw3.mod = lm(time ~ number, data=hw3.data)

predict(hw3.mod, data.frame(number=3), interval="confidence")

##        fit     lwr      upr
## 1 44.52559 41.1476 47.90357



predict(hw3.mod, data.frame(number=3), interval="predict")

##        fit      lwr      upr
## 1 44.52559 26.23515 62.81603



b0 = hw3.mod$coefficients[1]
b1 = hw3.mod$coefficients[2]

e = hw3.mod$residuals
n = length(e)
sse = sum(e^2)
mse = sse / (n-2)

x = number
x.bar = mean(x)
ssx = sum( (x-x.bar)^2 )

x.h = 3
y.hat = b0 + b1*x.h
```

```r
m=10
var.pred.mean = mse*(1/m + 1/n + (x.h-x.bar)^2/ssx)

lower.ynew = y.hat - qt(.025,n-2,lower.tail = FALSE)*sqrt(var.pred.mean)
upper.ynew = y.hat + qt(.025,n-2,lower.tail = FALSE)*sqrt(var.pred.mean)
print(c(lower.ynew,upper.ynew),digits=6)
```

```
## (Intercept) (Intercept)
##     37.9132     51.1380
```