```
# ============================================================================
# Service Calls Data
# ============================================================================


# In R, using windows() on a PC, or quartz() on a Mac will allow you to
# use a new graphics window (so your graphs will not be overwritten).
# If you are using RStudio, you need not include these functions.
# I will use windows() only in this file.


repair = read.csv("repair.csv",header=TRUE)
head(repair)
attach(repair)
#Y = Length of Computer Service Calls
#X = Number of Units Repaired

windows()   #mac users: quartz()
# Histograms
hist(Y, col="cyan", xlab="Y")
hist(X, col="cyan", xlab="X")


windows()
#Scatterplot of Y versus X
plot(X,Y, main="Scatterplot of Y vs X", ylab="Length of Service Call (in
Min)",xlab="Number of Repaired Units",pch=1)

# Pearson product-moment correlation of X and Y
cor(X,Y)
cor.test(X,Y)


# ============================================================================
# SLR model of Y on X
# ============================================================================
# Fit an SLR model of Y on X
mod1 = lm(Y~X)
summary(mod1)                          # coefficients, std errors, df, p, R^2
anova(mod1)                            # SS, MS, F test

yhat<-mod1$fitted.values               # fitted or predicted values
e   <-mod1$residuals                   # residuals
CIbs<- confint(mod1)                   # CI for regression coefficients

windows()
# Scatterplot with fitted line
plot(X,Y, main="Scatterplot with SLR Fit", ylab="Length of Call", xlab="Number
of Units")
abline(coef(mod1))

windows()
# Plots of Y vs Yhat
plot(Y,yhat)
abline(0,1,col=2)
```

```
windows()
par(mfrow=c(2,3))
# Some diagnostic plots of residuals
hist(e, col="cyan", xlab="e")
qqnorm(e, main="Normal Q-Q Plot for Residuals")
qqline(e,col=2)

boxplot(e,ylab="Residuals", col="lightblue", main="Boxplot of Residuals")
points(1, mean(e),pch="+",col=2,cex=2)

plot(yhat, e, xlab="Fitted Length of Service Call (in Min)", ylab="Residuals",
     main="Residual vs. Fit Plot")

plot(X, e, xlab="Number of Repaired Units", ylab="Residuals",
     main="Residual vs. X Plot")



# ============================================================================
# Standardized residuals
# ============================================================================
e <- resid(mod1)
estand <- rstandard(mod1)
head(cbind(e,estand))



# ============================================================================
# CI and PI
# ============================================================================
# CI ("fit") & 95% CI (mean)
CI<-predict(mod1, se.fit=TRUE, interval = c("confidence"))
CI$fit
CI$se.fit  # std error mean predict
cbind(Y,CI$fit,CI$se.fit)  # binds obs, fit and CIs
head(cbind(Y,CI$fit,CI$se.fit))  # shows first few values

# predicted values ("fit") and 95% PI
PI<-predict(mod1, interval = c("prediction"))
head(PI)


# ============================================================================
# MLR model using X and X^2 as predictors
# ============================================================================
# include X^2:
X2 = X^2
mod2 = lm(Y~X + X2)
anova(mod2)
summary(mod2)

yhat<-mod2$fitted.values              # fitted or predicted values
e   <-mod2$residuals                  # residuals
```

```
CI<-predict(mod2, se.fit=TRUE, interval = c("confidence"))
CI$fit
CI$se.fit  # std error mean predict
cbind(Y,CI$fit,CI$se.fit)
head(cbind(Y,CI$fit,CI$se.fit))

# predicted values ("fit") and 95% PI
PI<-predict(mod2, interval = c("prediction"))
head(PI)


windows()
par(mfrow=c(2,3))
# Some diagnostic plots
hist(e, col="cyan", xlab="e")
qqnorm(e, main="Normal Q-Q Plot for Residuals")

boxplot(e,  ylab="Residuals", col="lightblue", main="Boxplot of Residuals")
points(1, mean(e),pch="+")

plot(yhat, e, xlab="Fitted Length of Service Call (in Min)", ylab="Residuals",
     main="Residual vs. Fit Plot")

# End of Code
# ============================================================================
```