

2.4.1: SAS - Simultaneous Inference and Regression Through Origin

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Example: Toluca dataset

```
# Input data
library(stat5100)
data(toluca)

# Create linear model and obtain 95% confidence interval of beta parameters,
# but this time use the simultaneous comparison adjustment
toluca_lm <- lm(workhours ~ lotsize, data = toluca)
coefficient_confidence_lm(toluca_lm, confidence = 0.95, simul = TRUE)

## lower.est and upper.est are the 97.5% confidence limits.
## The Bonferroni adjustment for simultaneous confidence levels was made.
##           Estimate Std. Error   t value    Pr(>|t|) lower.est upper.est
## (Intercept) 62.365859 26.1774339   2.382428 2.585094e-02 -0.4043574 125.136075
## lotsize      3.570202  0.3469722  10.289592 4.448828e-10  2.7382061   4.402198
```

Simultaneous 90% interval estimation of mean workhours (Bonferroni and Working-Hotelling)

```
toluca_sites_A <- data.frame(lotsize = c(30, 65, 100))
simul_mean_prediction_limits(toluca_lm, toluca_sites_A, confidence = 0.90)

##   lotsize    yhat   se_yhat WH_lower WH_upper B_lower B_upper
## 1     30 169.4719 16.969741 131.1542 207.7897 131.0570 207.8868
## 2     65 294.4290  9.917579 272.0351 316.8229 271.9783 316.8797
## 3    100 419.3861 14.272328 387.1591 451.6130 387.0774 451.6947
```

Simultaneous 95% prediction limits for two lots (Bonferroni and Scheffe)

```
toluca_sites_B <- data.frame(lotsize = c(80, 100))
simul_prediction_limits(toluca_lm, toluca_sites_B, confidence = 0.95)

##   lotsize    yhat se_yhat_pred S_lower S_upper B_lower B_upper
## 1     80 347.9820  49.91095 217.4073 478.5568 228.3018 467.6622
## 2    100 419.3861  50.86664 286.3111 552.4610 297.4142 541.3579
```

Regression through origin example

This dataset is called “warehouse”: a plumbing supplies company that is looking at the relation between work units (X) and labor costs (Y) at its 12 warehouses.

```

data(warehouse)
head(warehouse)

##    work cost
## 1    20  114
## 2   196  921
## 3   115  560
## 4    50  245
## 5   122  575
## 6   100  475

# Fit a linear model through the origin
warehouse_lm_origin <- lm(cost ~ 0 + work, data = warehouse)

# Look at some statistics
anova(warehouse_lm_origin)

## Analysis of Variance Table
##
## Response: cost
##           Df Sum Sq Mean Sq F value    Pr(>F)
## work         1 4191980 4191980   18762 < 2.2e-16 ***
## Residuals   11    2458      223
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

summary(warehouse_lm_origin)

##
## Call:
## lm(formula = cost ~ 0 + work, data = warehouse)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -24.720  -4.020   4.432  11.141  21.194
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## work  4.68527    0.03421    137   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 14.95 on 11 degrees of freedom
## (1 observation deleted due to missingness)
## Multiple R-squared:  0.9994, Adjusted R-squared:  0.9994
## F-statistic: 1.876e+04 on 1 and 11 DF, p-value: < 2.2e-16

# What does the fit look like?
fit_plot(warehouse_lm_origin, xlab = "work", ylab = "cost",
          main = "Regression through origin")

```

Regression through origin

