**Delivery Time Data Set**

**The following are the regression results:**

> # Simple Linear Regression model

> reg <- lm(delivery\_time1 ~ sorting\_time) # lm(Y ~ X)

>

> summary(reg)

Call:

lm(formula = delivery\_time1 ~ sorting\_time)

Residuals:

Min 1Q Median 3Q Max

-5.1729 -2.0298 -0.0298 0.8741 6.6722

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 6.5827 1.7217 3.823 0.00115 \*\*

sorting\_time 1.6490 0.2582 6.387 3.98e-06 \*\*\*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.935 on 19 degrees of freedom

Multiple R-squared: 0.6823, Adjusted R-squared: 0.6655

F-statistic: 40.8 on 1 and 19 DF, p-value: 3.983e-06

The R-Squared value without any transformation is 0.6823

**With Log Transformation:**

> reg\_log <- lm(delivery\_time1 ~ log(sorting\_time)) # lm(Y ~ X)

>

> summary(reg\_log)

Call:

lm(formula = delivery\_time1 ~ log(sorting\_time))

Residuals:

Min 1Q Median 3Q Max

-4.0829 -2.0133 -0.1965 0.9351 7.0171

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.160 2.455 0.472 0.642

log(sorting\_time) 9.043 1.373 6.587 2.64e-06 \*\*\*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.873 on 19 degrees of freedom

Multiple R-squared: 0.6954, Adjusted R-squared: 0.6794

F-statistic: 43.39 on 1 and 19 DF, p-value: 2.642e-06

>

The R-Squared value from log transformation is 0.6954

**Using Exponential Model:**

> reg\_exp <- lm(log(delivery\_time1) ~ sorting\_time)

>

> summary(reg\_exp)

Call:

lm(formula = log(delivery\_time1) ~ sorting\_time)

Residuals:

Min 1Q Median 3Q Max

-0.29209 -0.13364 0.02065 0.08421 0.41892

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.12137 0.10297 20.601 1.86e-14 \*\*\*

sorting\_time 0.10555 0.01544 6.836 1.59e-06 \*\*\*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1755 on 19 degrees of freedom

Multiple R-squared: 0.7109, Adjusted R-squared: 0.6957

F-statistic: 46.73 on 1 and 19 DF, p-value: 1.593e-06

The R-Squared value from exponential transformation is 0.7109

**Using Polynomial model with 2 degrees.**

> reg2degree <- lm(log(delivery\_time1) ~ sorting\_time+ I(sorting\_time\*sorting\_time))

>

> summary(reg2degree)

Call:

lm(formula = log(delivery\_time1) ~ sorting\_time + I(sorting\_time \*

sorting\_time))

Residuals:

Min 1Q Median 3Q Max

-0.21194 -0.11776 -0.03034 0.10550 0.35975

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.69970 0.22843 7.441 6.77e-07 \*\*\*

sorting\_time 0.26592 0.08022 3.315 0.00385 \*\*

I(sorting\_time \* sorting\_time) -0.01284 0.00632 -2.032 0.05722 .

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1627 on 18 degrees of freedom

Multiple R-squared: 0.7649, Adjusted R-squared: 0.7387

F-statistic: 29.28 on 2 and 18 DF, p-value: 2.197e-06

The R-squared value improved from 0.7109 to 0.7649

**Polynomial model with 3 degree**

m(log(delivery\_time1)~sorting\_time+ I(sorting\_time\*sorting\_time) + I(sorting\_time\*sorting\_time\*sorting\_time))

>

> summary(reg3degree)

Call:

lm(formula = log(delivery\_time1) ~ sorting\_time + I(sorting\_time \*

sorting\_time) + I(sorting\_time \* sorting\_time \* sorting\_time))

Residuals:

Min 1Q Median 3Q Max

-0.23291 -0.08697 -0.00472 0.09220 0.31701

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.071553 0.590824 1.814 0.0874 .

sorting\_time 0.649456 0.342562 1.896 0.0751 .

I(sorting\_time \* sorting\_time) -0.080891 0.059452 -1.361 0.1914

I(sorting\_time \* sorting\_time \* sorting\_time) 0.003636 0.003159 1.151 0.2656

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1612 on 17 degrees of freedom

Multiple R-squared: 0.7819, Adjusted R-squared: 0.7434

F-statistic: 20.31 on 3 and 17 DF, p-value: 7.372e-06

The R-squared value improved from 0.7649 to 0.7819

Of all the transformations, the polynomial model with 3 degree transformation provides the best R-squared value of 0.7819 in predicting the delivery time based on the independent variable sorting time.