Project 3

CS325 — Spring 2015

by Group 2
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May 24, 2015

1 Transshipment Model

Part A

Part B

Part C

Part D

2 Modified from DPV 7.16

Part A

Part B

Part C

3 Regression Solution via Linear Programming

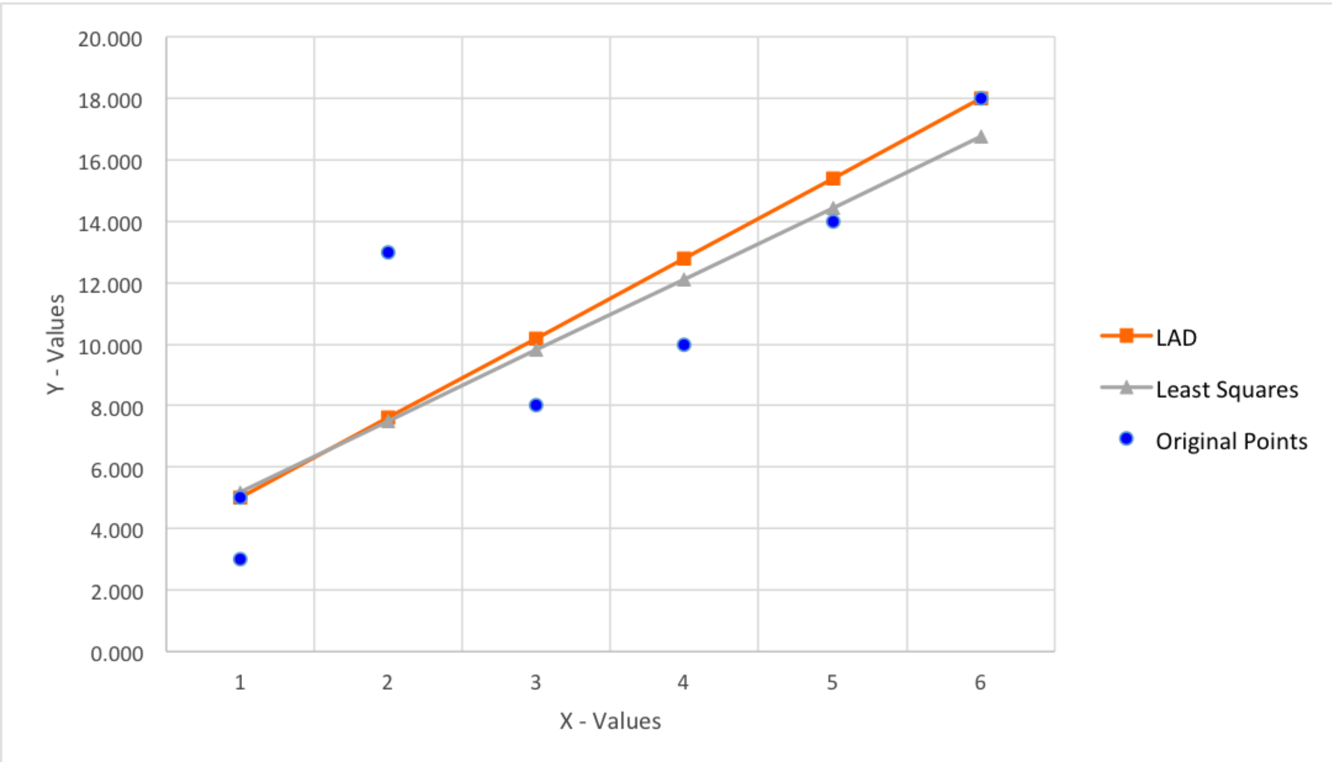
Part A

Objective: min $\sum_{i=1}^{n} |y_i - (a_1 x_i + a_0)|$ as an LP.

Constraint Equations

$a_0 + a_1 + z_1 \geq 3$	$a_0 + a_1 - z_1 \leq 3$
$a_0 + a_1 + z_2 \geq 5$	$a_0 + a_1 - z_2 \leq 5$
$a_0 + 2a_1 + z_3 \geq 13$	$a_0 + 2a_1 - z_3 \leq 13$
$a_0 + 3a_1 + z_4 \geq 8$	$a_0 + 3a_1 - z_4 \leq 8$
$a_0 + 4a_1 + z_5 \geq 10$	$a_0 + 4a_1 - z_5 \leq 10$
$a_0 + 5a_1 + z_6 \geq 14$	$a_0 + 5a_1 - z_6 \leq 14$
$a_0 + 6a_1 + z_7 \geq 18$	$a_0 + 6a_1 - z_7 \leq 18$

Sum of absolute deviations: 13.8



This was calculated in Lindo using the constraint equations listed above to obtain the LAD equation $y = 2.6x + 2.4$. In this case, the LAD is close to the original Least Squares solution, especially for x-values close to 0. It appears that as the value of x grows, the gap between the 2 lines will widen.

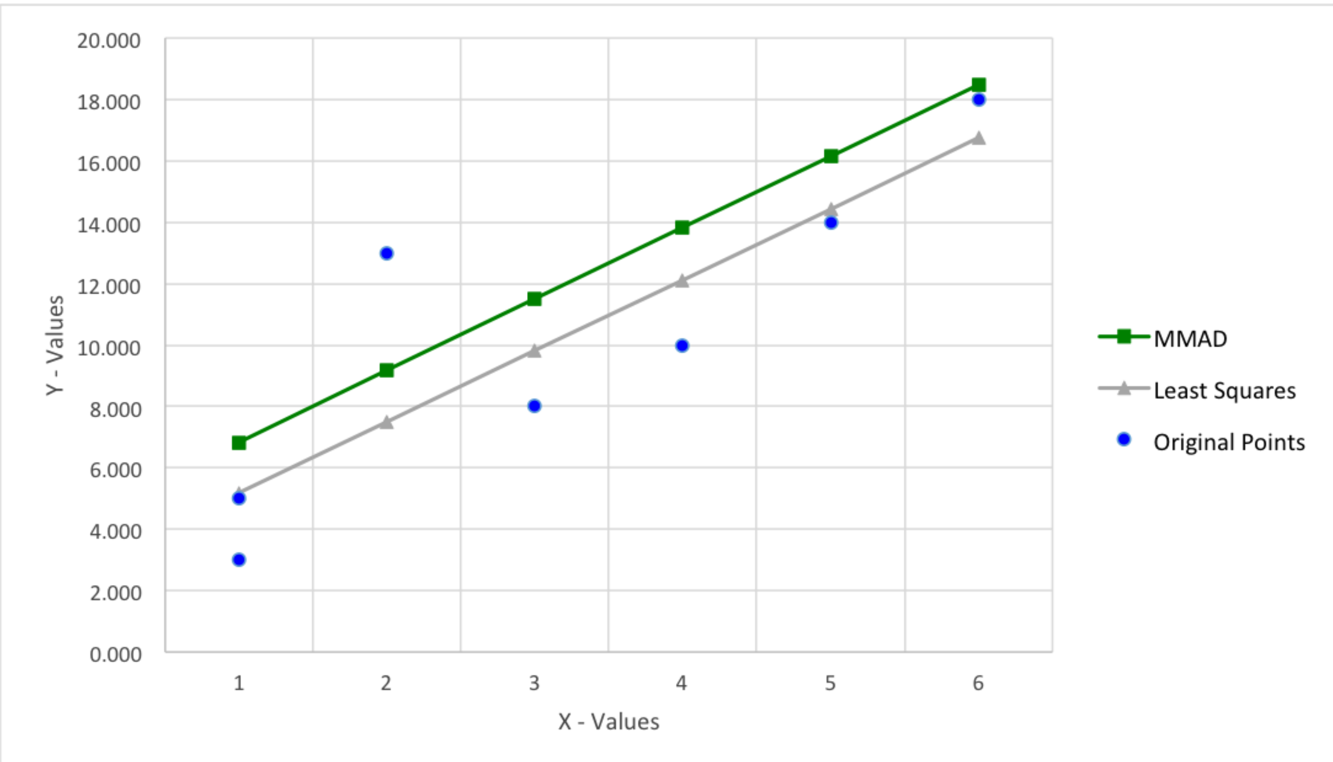
Part B

Objective: min $max|y_i - (a_1 x_i + a_0)|$ as an LP.

Constraint Equations

$$
\begin{aligned}
a_0 + a_1 + z &\geq 3 & a_0 + a_1 - z &\leq 3 \\
a_0 + a_1 + z &\geq 5 & a_0 + a_1 - z &\leq 5 \\
a_0 + 2a_1 + z &\geq 13 & a_0 + 2a_1 - z &\leq 13 \\
a_0 + 3a_1 + z &\geq 8 & a_0 + 3a_1 - z &\leq 8 \\
a_0 + 4a_1 + z &\geq 10 & a_0 + 4a_1 - z &\leq 10 \\
a_0 + 5a_1 + z &\geq 14 & a_0 + 5a_1 - z &\leq 14 \\
a_0 + 6a_1 + z &\geq 18 & a_0 + 6a_1 - z &\leq 18
\end{aligned}
$$

min of the max absolute deviations: 3.8333



This was calculated again in LIndo using the constraint equations above to obtain the MMAD equation $y = 2.3x + 4.5$. By contrast, the MMAD parallels the Least Squares by almost a full y-value above the Least Squares line. This makes sense since we are merely optimizing or taking the minimum of the maximum possible deviation.

Part C

Objective: min $\sum_{i=1}^{n} |y_i - (a_2 x_{2i} + a_1 x_{1i} + a_0)|$ as an LP.

Constraint Equations

$$
\begin{array}{ll}
a_2 + a_1 + a_0 + z_1 \geq 5 & a_2 + a_1 + a_0 - z_1 \leq 5 \\
2a_2 + a_1 + a_0 + z_2 \geq 9 & 2a_2 + a_1 + a_0 - z_2 \leq 9 \\
2a_2 + 2a_1 + a_0 + z_3 \geq 12 & 2a_2 + 2a_1 + a_0 - z_3 \leq 12 \\
a_2 + 0a_1 + a_0 + z_4 \geq 3 & a_2 + 0a_1 + a_0 - z_4 \leq 3 \\
0a_2 + 0a_1 + a_0 + z_5 \geq 0 & 0a_2 + 0a_1 + a_0 - z_5 \leq 0 \\
3a_2 + a_1 + a_0 + z_6 \geq 11 & 3a_2 + a_1 + a_0 - z_6 \leq 11
\end{array}
$$

This was again calculated in Lindo using the constraint equations above to obtain the LAD equation $y = 3x_2 + 3x_1$.