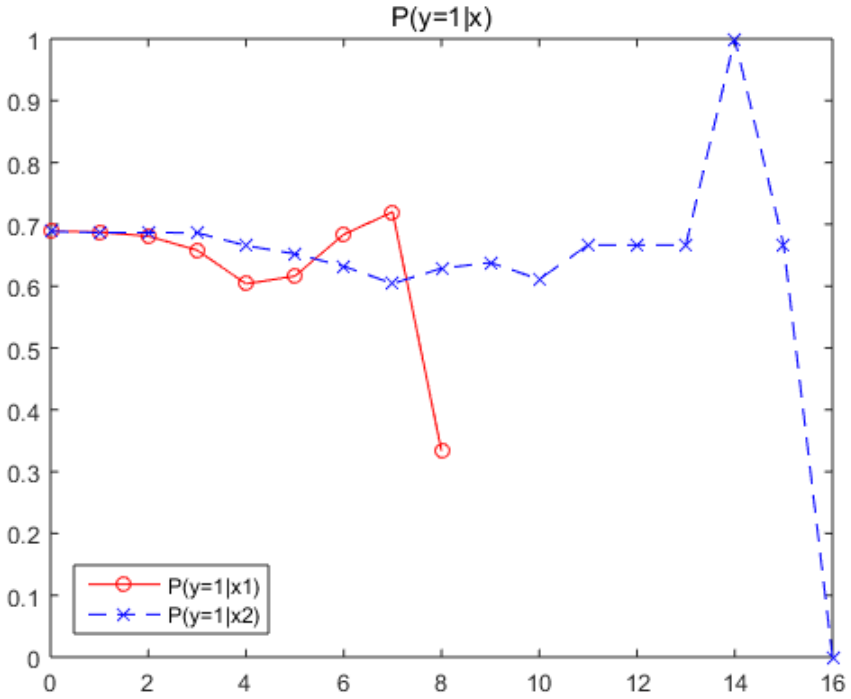
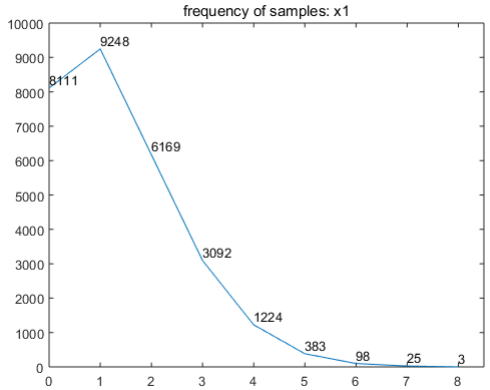
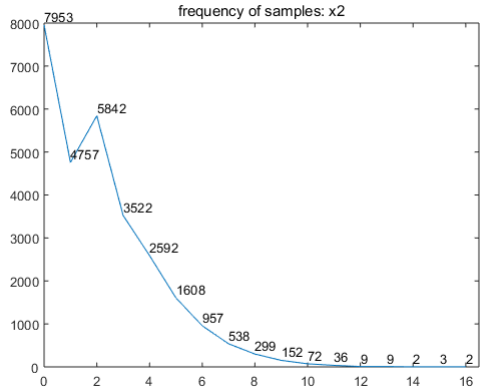
Report: Reachability Function(04/11/2016)

1. Summary

   - The data contains 30034 rows. After removing the rows with missing data, we have data for 28353 calls with columns for P(cover)(binary), number of busy calls(0-8 int), number of busy servers(0-16 int).
   - We denote y=I(covered), x_1=number of busy calls, x_2=number of busy servers.
   - For each x_1 and x_2, $P(y = 1|x_1)$ and x_2, $P(y = 1|x_2)$ is plotted as below.

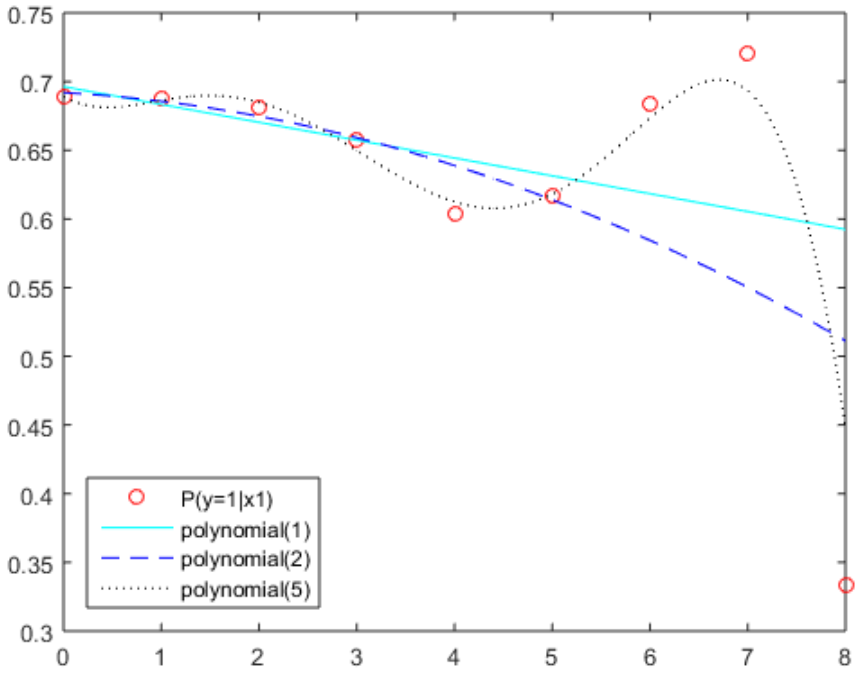


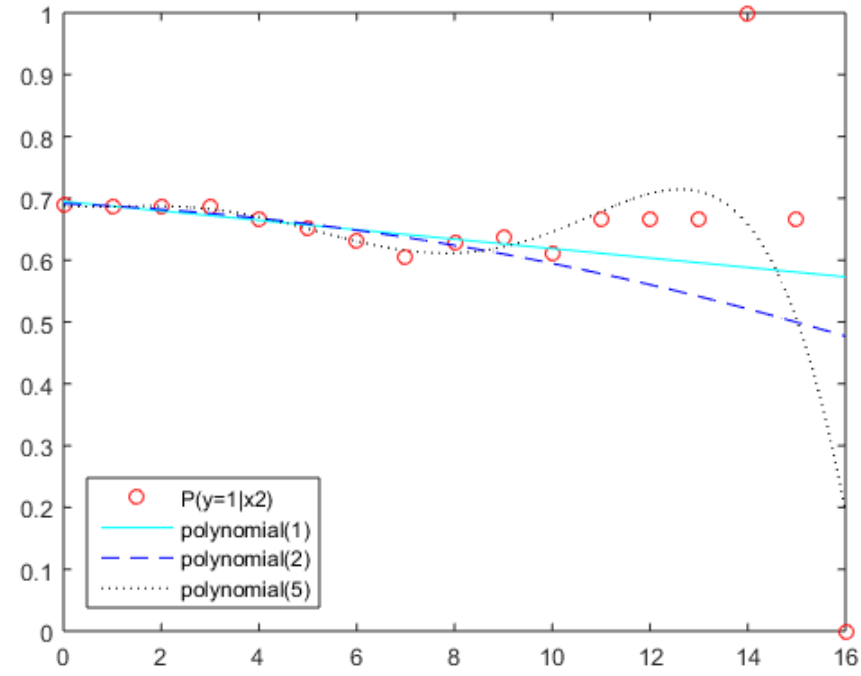




2. Polynomial Fitting

Using the polyfit function in MATLAB, the coverage indicator y was fitted on x_1 and x_2 separately by polynomial of degree 1, 2 and 5.





3. Binary Logistic Regression

The relationship between y and x_1, x_2 is studied through binary logistic regression using Minitab.

(a) Binary Logistic Regression : y versus x_1

- Logistic Regression Table

Predictor	Coefficient	P value
Constant	0.828907	0.000
x_1	-0.0590362	0.000

- Goodness-of-Fit tests

Method	Chi-Square	Degree of Freedom	P value
Pearson	18,5787	7	0.010
Deviance	18.5569	7	0.010
Hosmer-Lemeshow	7.2159	2	0.027

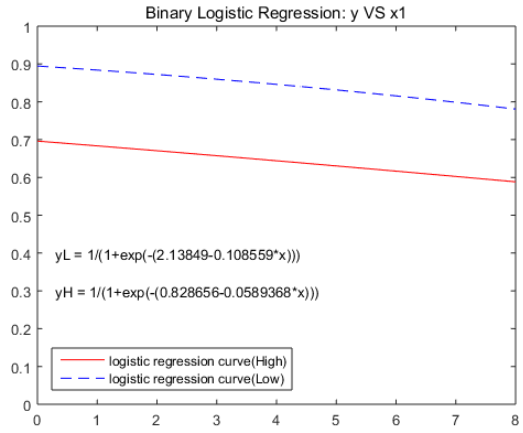
(b) Binary Logistic Regression : y versus x_2

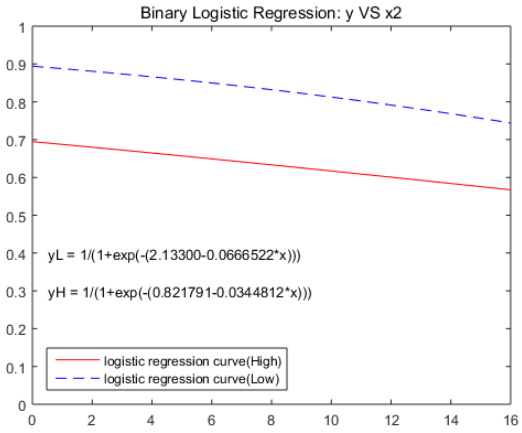
- Logistic Regression Table

Predictor	Coefficient	P value
Constant	0.822024	0.000
x_2	-0.0345365	0.000

- Goodness-of-Fit tests

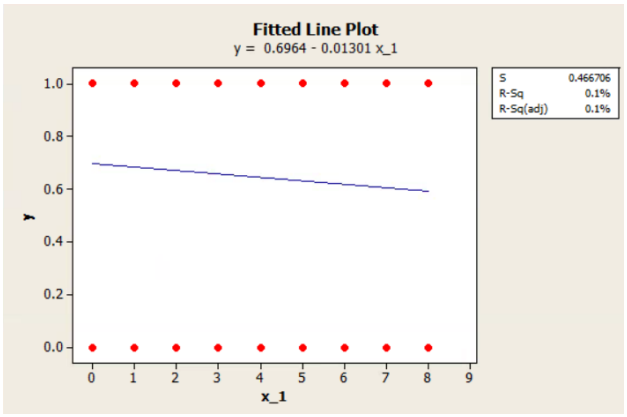
Method	Chi-Square	Degree of Freedom	P value
Pearson	15.4608	15	0.419
Deviance	16.9091	15	0.324
Hosmer-Lemeshow	6.4477	3	0.092

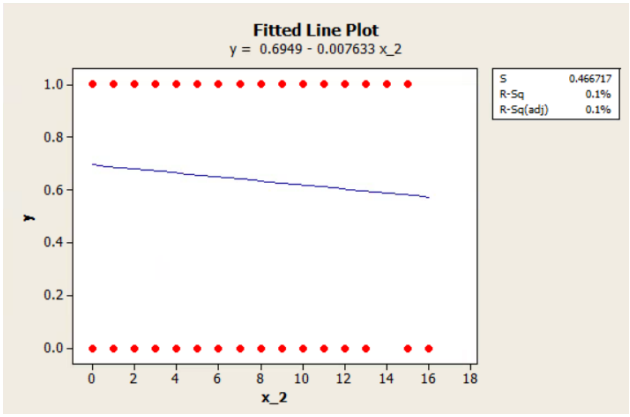


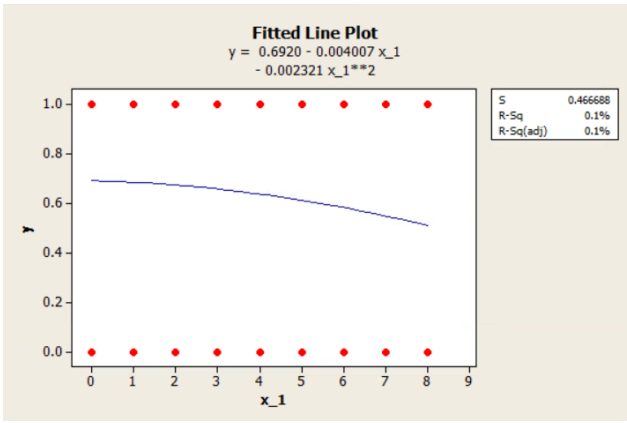


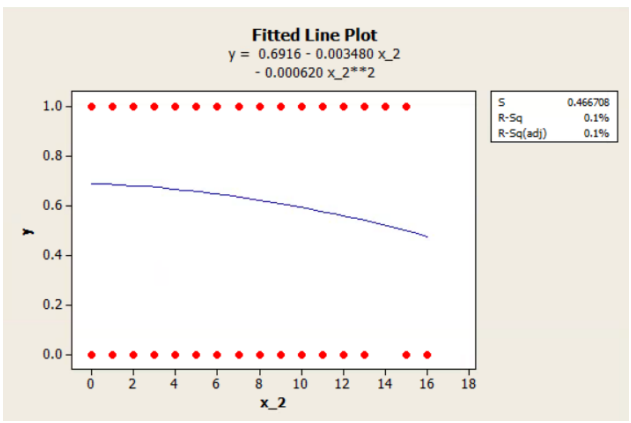
4. Linear/Quadratic Regression

   The relationship between y and x_1, x_2 is studied through linear/quadratic regression using Minitab.





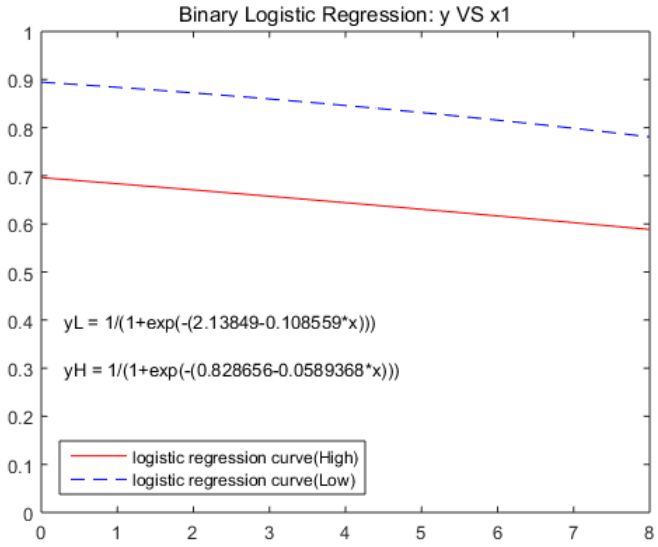




5. Logistic Regression Revisited

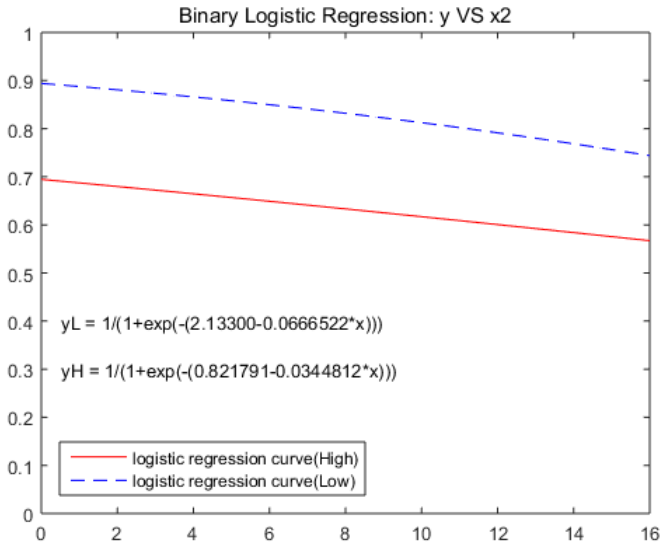
   High priority curve was drawn upon $P(t < 9|x)$.

   Low priority curve was drawn upon $P(t < 13|x)$.



$y = 1/(1 + exp(-(0.828656 - 0.0589368x)))$ for high priority,

$y = 1/(1 + exp(-(2.13849 - 0.108559x)))$ for low priority.



$y = 1/(1 + exp(-(0.821791 - 0.0344812x)))$ for high priority,

$y = 1/(1 + exp(-(2.13300 - 0.0666522x)))$ for low priority.