Length of Stay Analysis in Public Sector Hospital ED: A Pakistan Case Study

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Background

- Public sector hospital healthcare crisis
- 5% of GDP spent on healthcare→ Pakistan spends 2.6%
- 70% of health care in private sector hospitals
- Public sector EDs face major overcrowding issues

Project Goals

- Discrete event simulation to model
- Stochastic optimization to lower length of stay (LOS)

Data (limited)

Pt. No.	Making entry slip	EMO Room	From EMO room to bed	To undergo a test	Starting treatment	Availability of surgicals	Availability of medicines	Getting discharged	Getting discharge medicine from pharmacy	Patient counseling	Total time
1	1.5	3	-	10	2.5	-	-	5	-	1	23
2	1	30.5	-	47	6	-	2	100	-	2	188.5
3	1	50	1.5	78	20	5	2	5	-	2	164.5
4	0.16	3	1	-	7	-	15	240	-	1	267.16
5	1	5	1.5	24	9	2	1	60	2	2	107.5
6	1	3	1.5	16	9	1	2	105	3	1.5	143
7	1	0.5	1.5	26	5	2	2	90	-	-	128
8	1	0.5	2.25	14	19	5	2	50	3	0.5	97.25
9	1	0.5	2.5	26	8	2	3	125	2	1	171
10	1	-	1.5	37	4	1	2	85	-	-	131.5

| Node from Study	New Node Name	Mean	Mode	Min	Max
Making an Entry Slip	Registration	1.5	1	0.16	10
EMO Room	EMO	19.7	15	0.5	60
EMO to Bed	Phys_Ex	7.1	5	0.5	25
Undergo Test	Aux_Ex	105.3	60	10	384
Start Treatment	Start_Treat	17.2	5	1	90
Availability of Surgicals	Avail_Surg	3.7	2	1	20
Availability of Medicines	Avail_Meds	4.3	2	1	20
Getting Discharged	Get_Dis	107.0	60	1	380
Discharged from Pharmacy	Dis_Meds	4.0	2	1	25
Patient Counseling	Pt_Counsel	3.1	2	0.5	10

Analysis of Data from Study
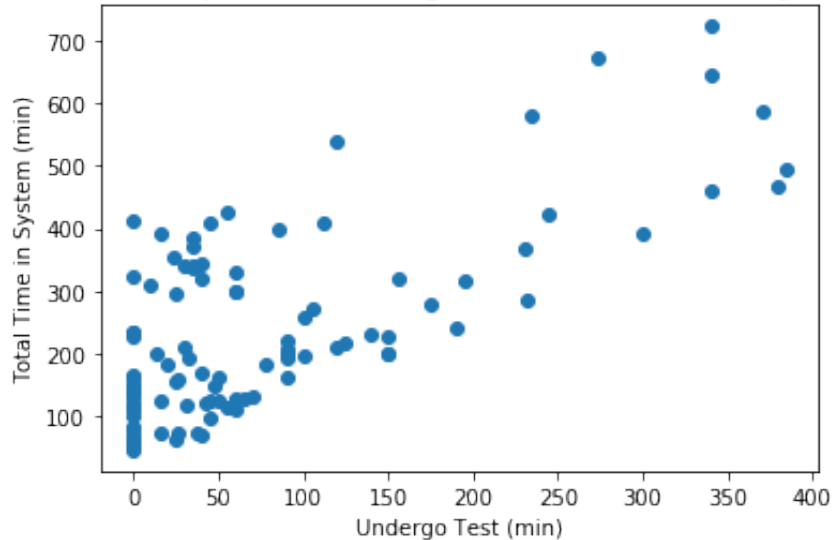
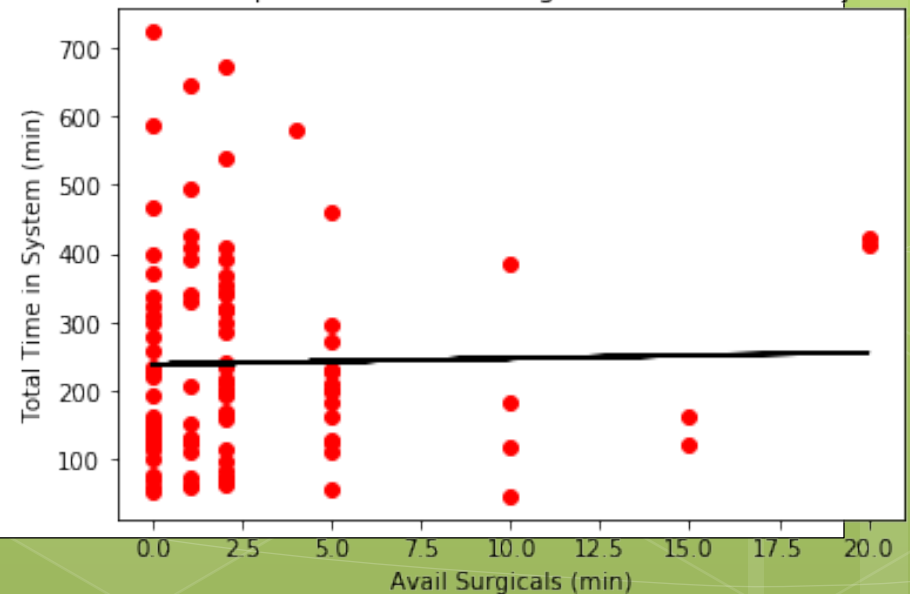Relationship between Undergo Test and Total Time in System
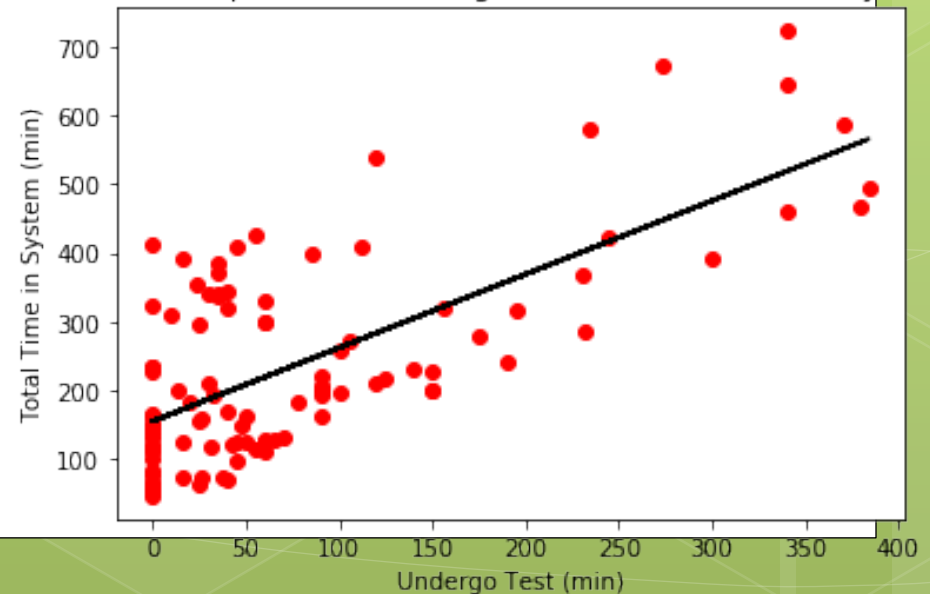
Analysis of Data from Study

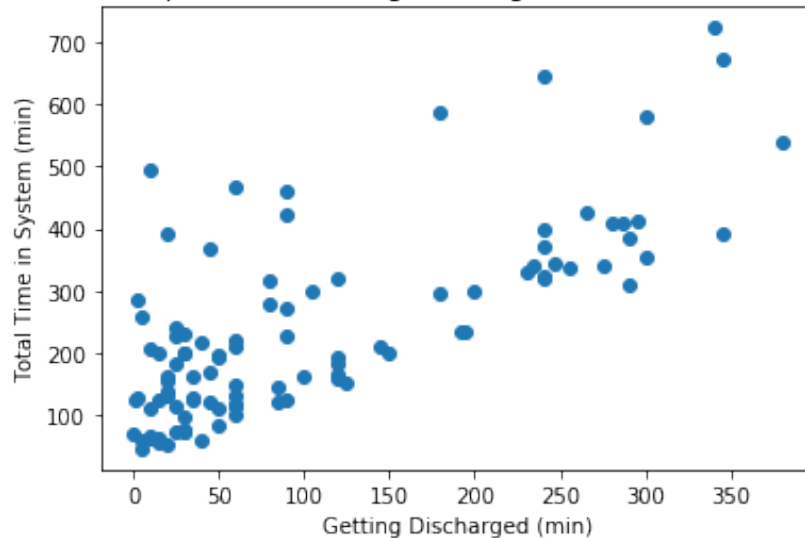Relationship between Avail Surg and Total Time in System
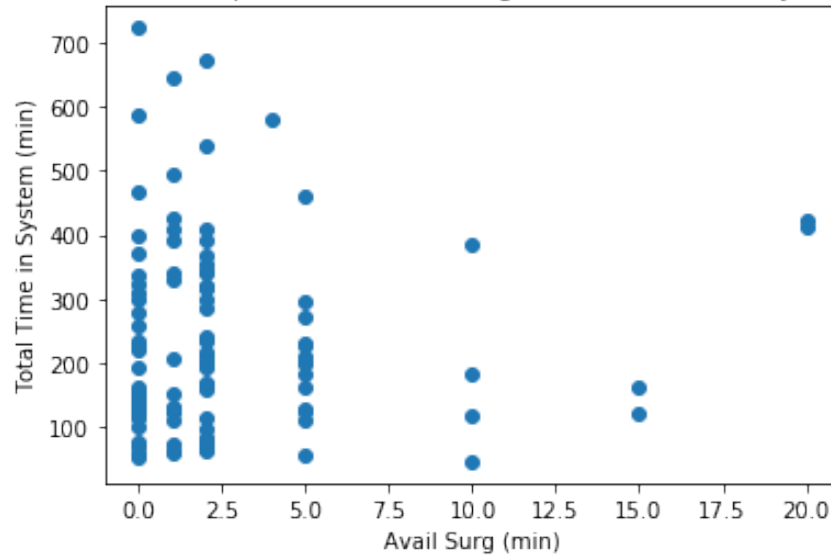
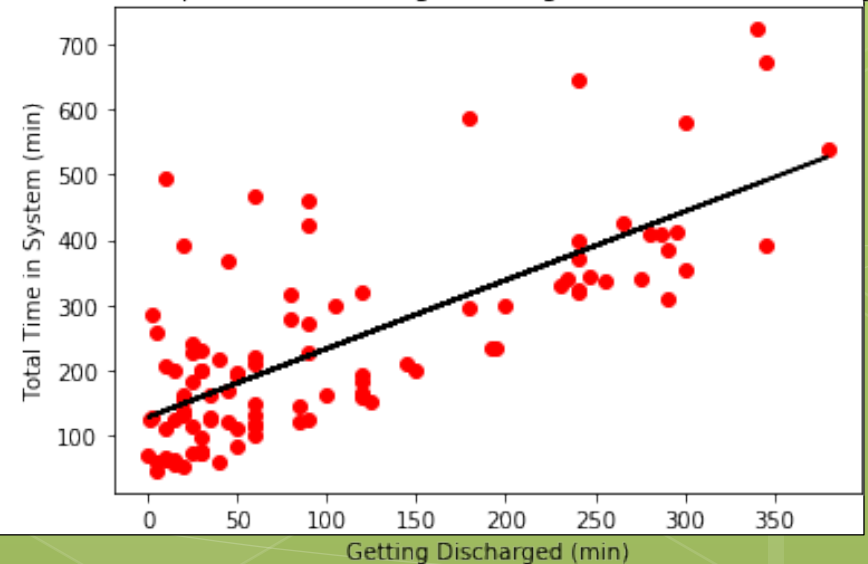Relationship between Avail Surg and Total Time in System

Analysis of Data from Study

Relationship between Getting Discharged and Total Time in System

Relationship between Getting Discharged and Total Time in System

Correlation Matrix

	availability of surgicals	total
availability of surgicals	1.000000	0.022315
total	0.022315	1.000000

	Undergo Test	total
Undergo Test	1.000000	0.698141
total	0.698141	1.000000

	getting discharged	total
getting discharged	1.000000	0.730307
total	0.730307	1.000000

Full Model in Simio

Simulation Example

Auxiliary Exam Histogram
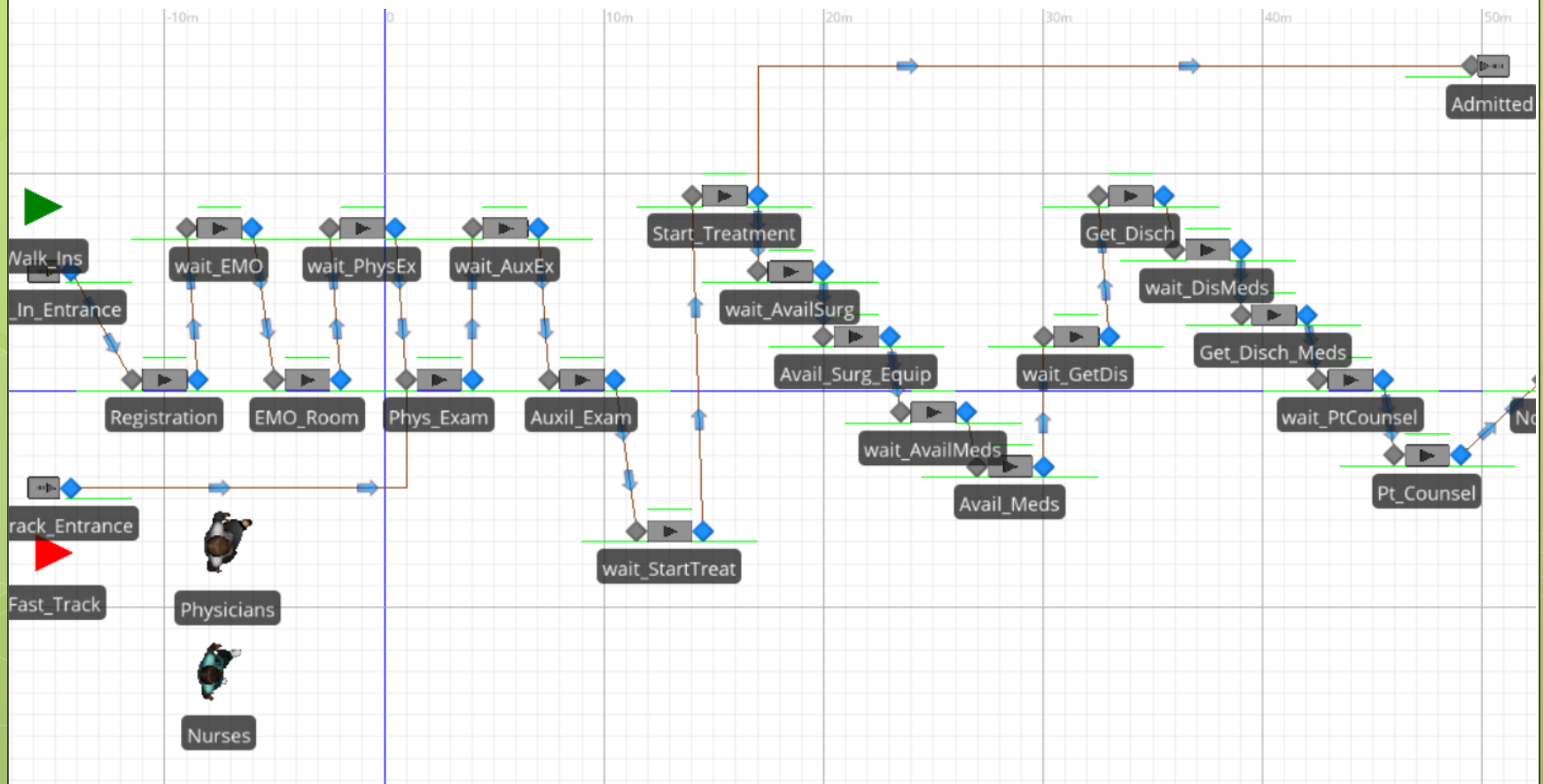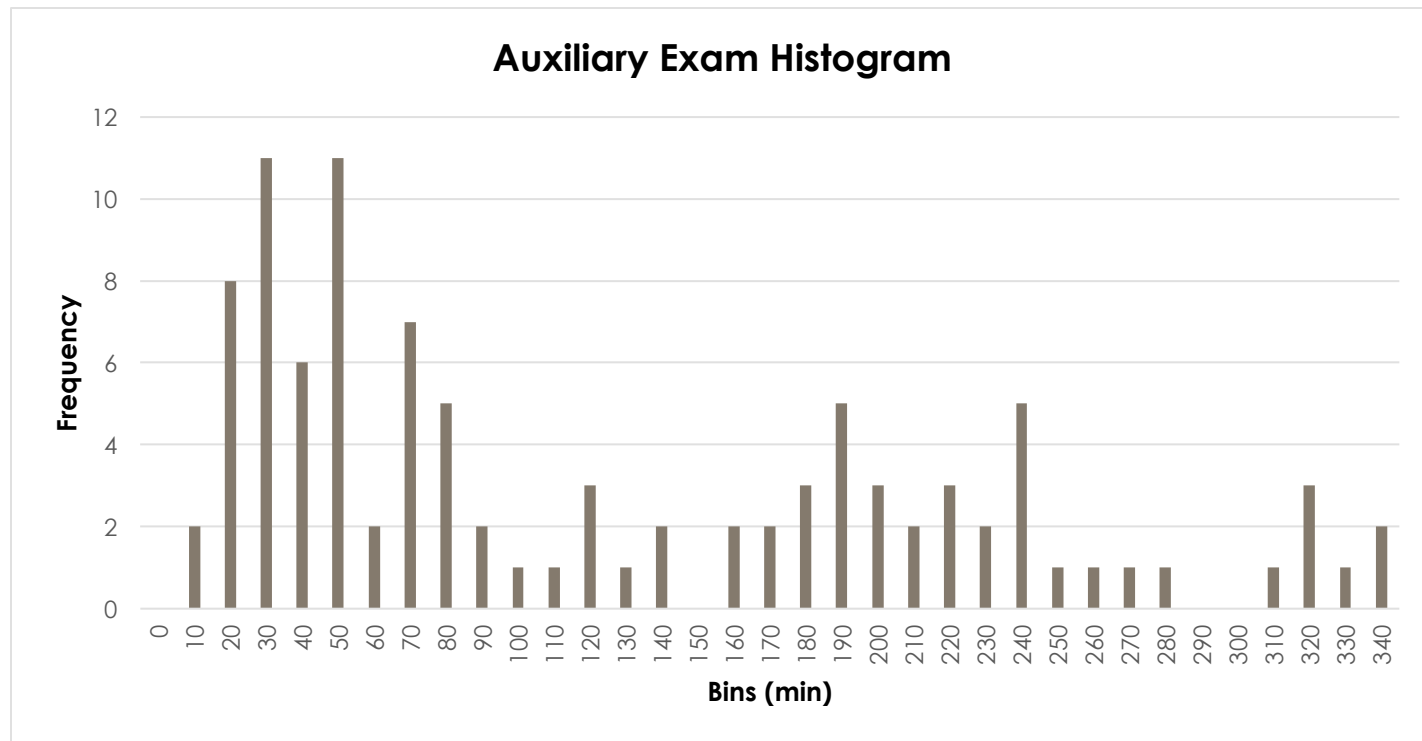
Data After Simulation

Node from Study	New Node Name	Distribution	Mean (after simulation)	Min (after simulation)	Max (after simulation)
Making an Entry Slip	Registration	Exponential (0.05)	15.0	0.4	32.8
EMO Room	EMO	Exponential (1)	18.8	4.1	30.9
EMO to Bed	Phys_Ex	Triangular (0.1,2,7)	22.4	9.9	32.9
Undergo Test	Aux_Ex	Triangular (1,2,50)	27.5	21.3	35.6
Start Treatment	Start_Treat	Exponential (15)	22.9	15.2	32.8
Availability of Surgicals	Avail_Surg	Exponential (0.5)	16.0	5.4	28.7
Availability of Medicines	Avail_Meds	Exponential (0.5)	23.0	11.9	32.9
Getting Discharged	Get_Dis	Exponential (30)	25.6	24.3	39.5
Discharged from Pharmacy	Dis_Meds	Exponential (3)	2.9	2.5	3.4
Patient Counseling	Pt_Counsel	Exponential (2)	1.9	1.4	2.4

|	
Average Time in System minutes (study)	240.74
Average Time in System minutes (simulation)	229.85

Correlation Matrix

```
                    Start Treatment Real   Start Treatment Sim
Start Treatment Real             1.000000             -0.011231
Start Treatment Sim             -0.011231              1.000000
                  Undergo Test Real   Undergo Test Sim
Undergo Test Real          1.000000           0.022966
Undergo Test Sim           0.022966           1.000000
                    Patient Counseling Real   Patient Counseling Sim
Patient Counseling Real             1.000000               0.053719
Patient Counseling Sim              0.053719               1.000000
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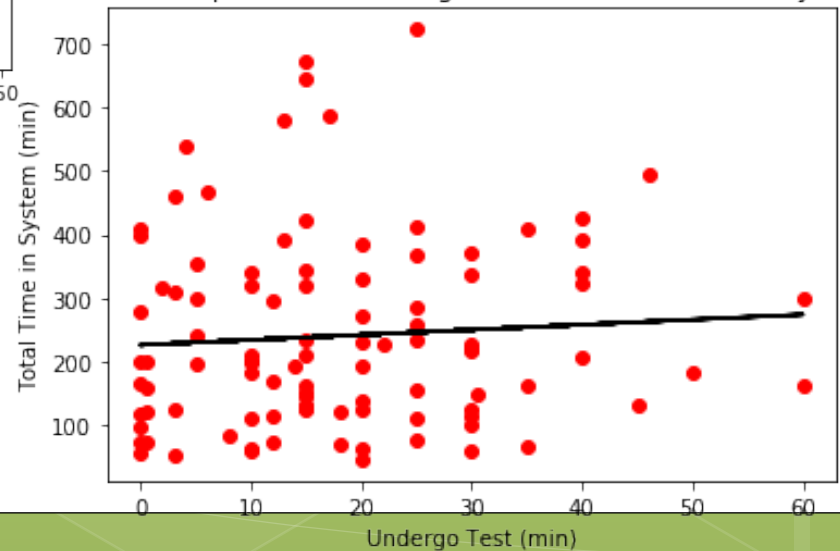
Analysis of Simulated Data

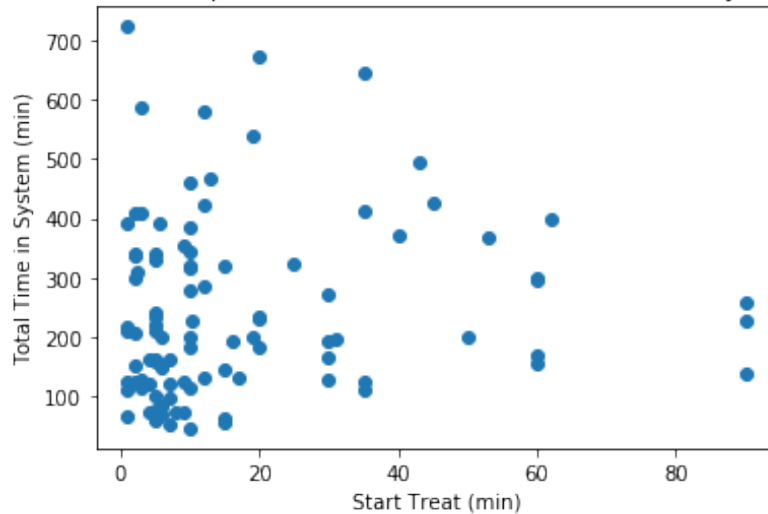Relationship between Undergo Test and Total Time in System
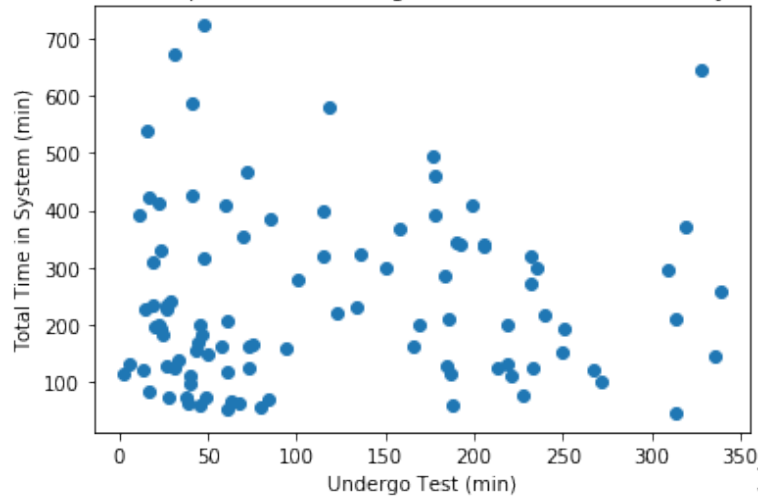
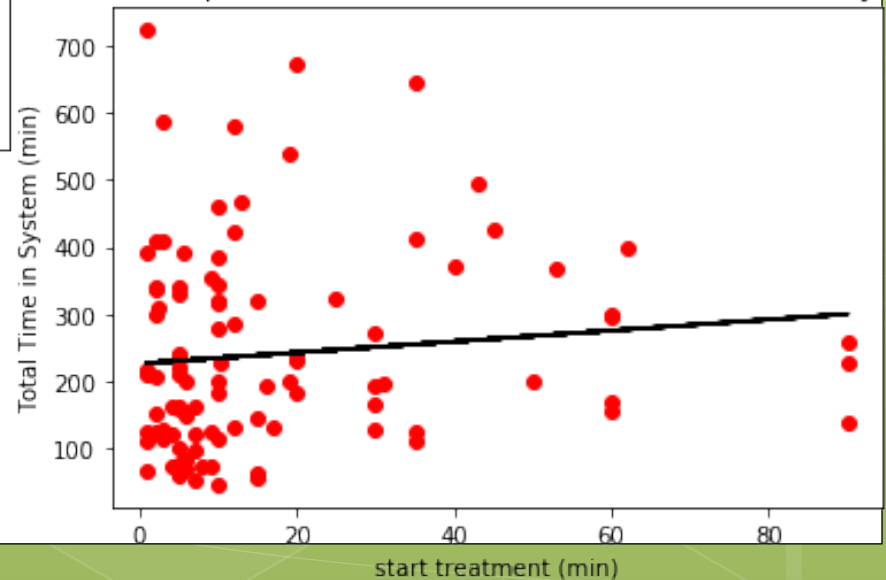Relationship between Undergo Test and Total Time in System

Analysis of Simulated Data

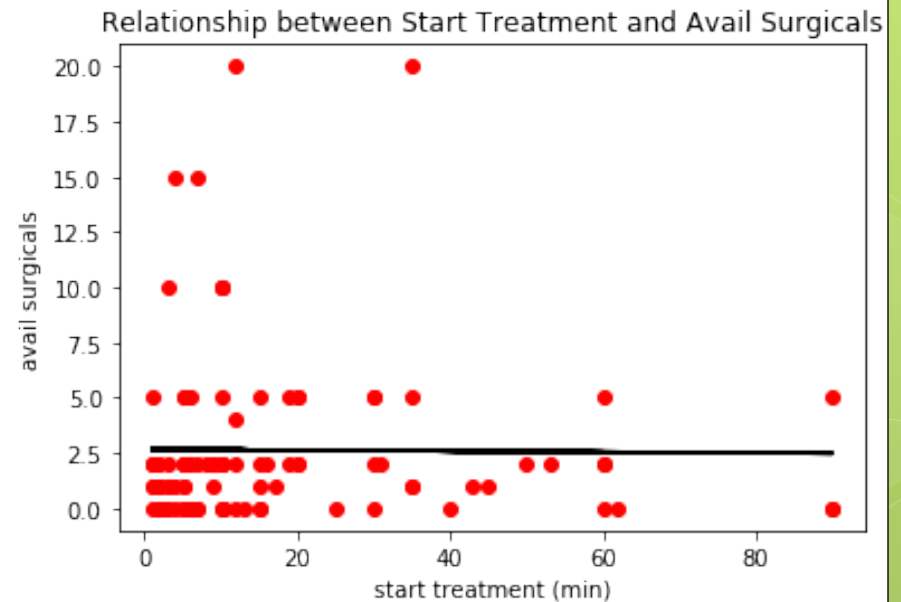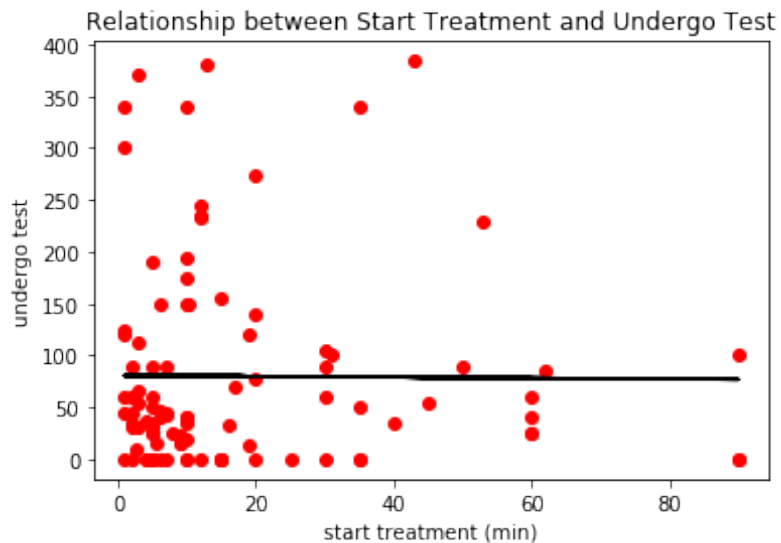Relationship between Start Treat and Total Time in System

Relationship between Start Treatment and Total Time in System

Conclusions

- Need better data!
- Node-Node

Relationship between Start Treatment and Avail Surgicals

Relationship between Start Treatment and Undergo Test

Further Exploration

- Relationship between nodes?
- Try more simulation techniques
- More trials for simulation