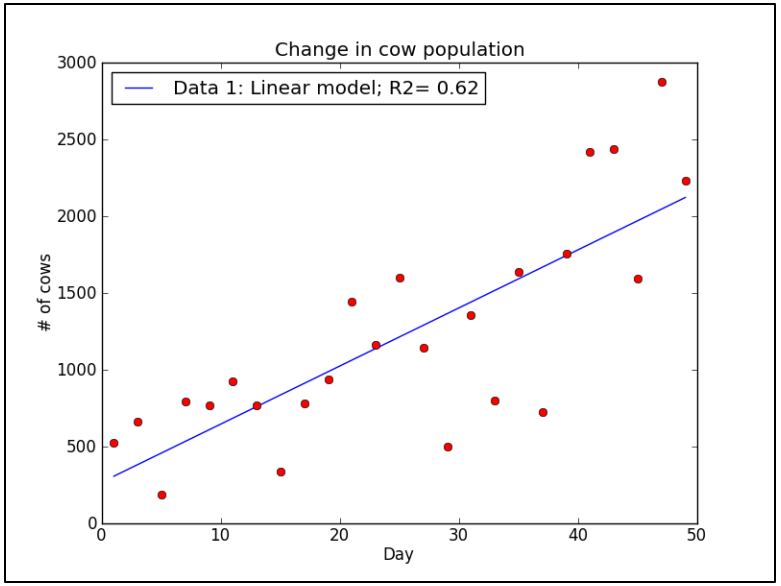
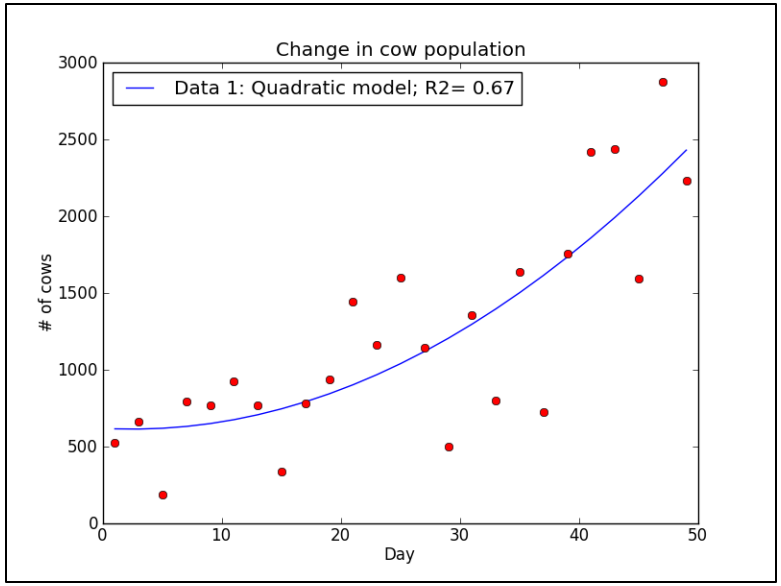
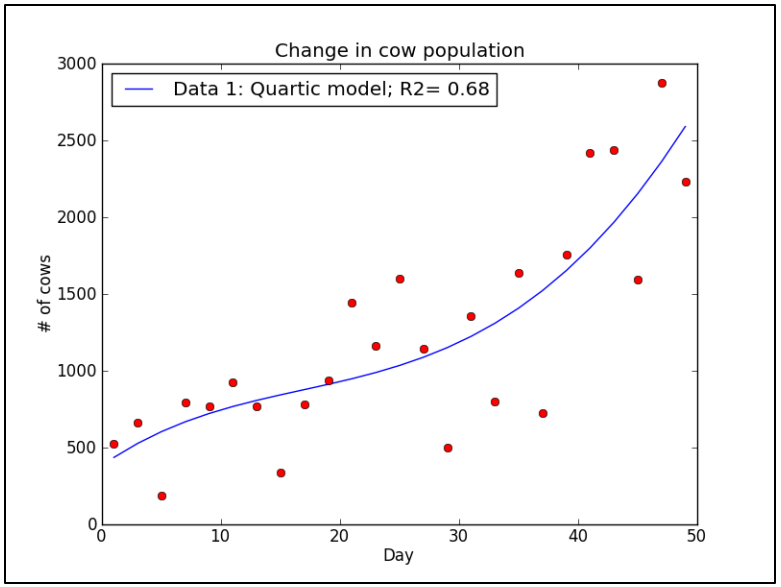
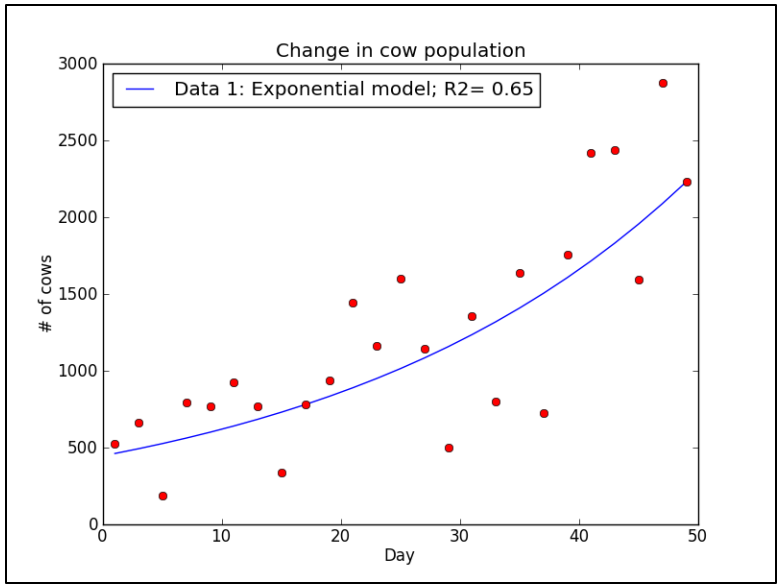
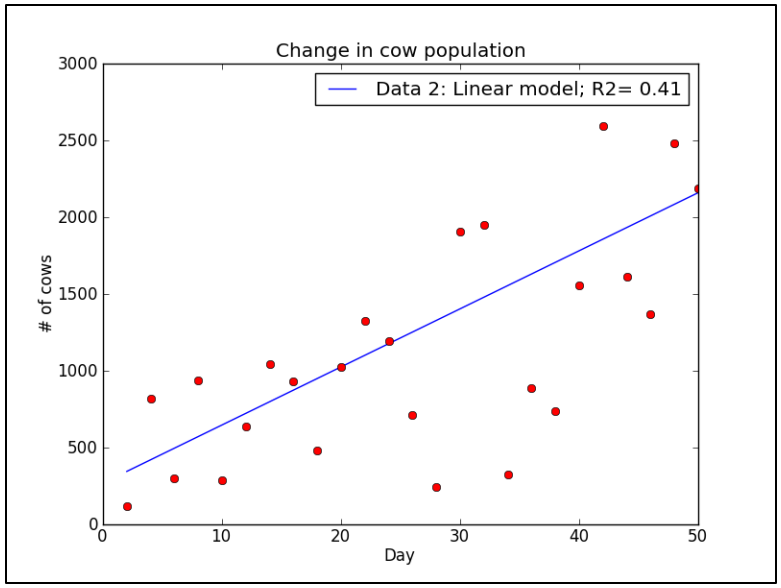
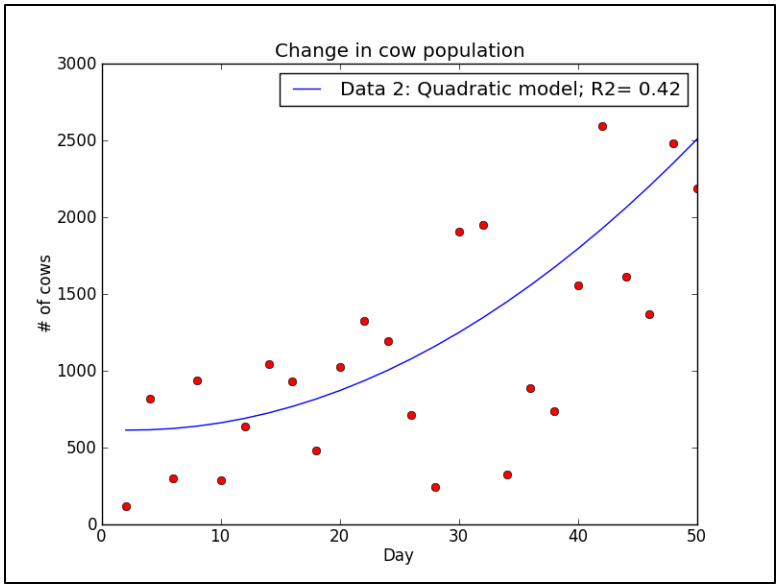

Change in cow population
Data 1: Linear model; R2= 0.62
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50

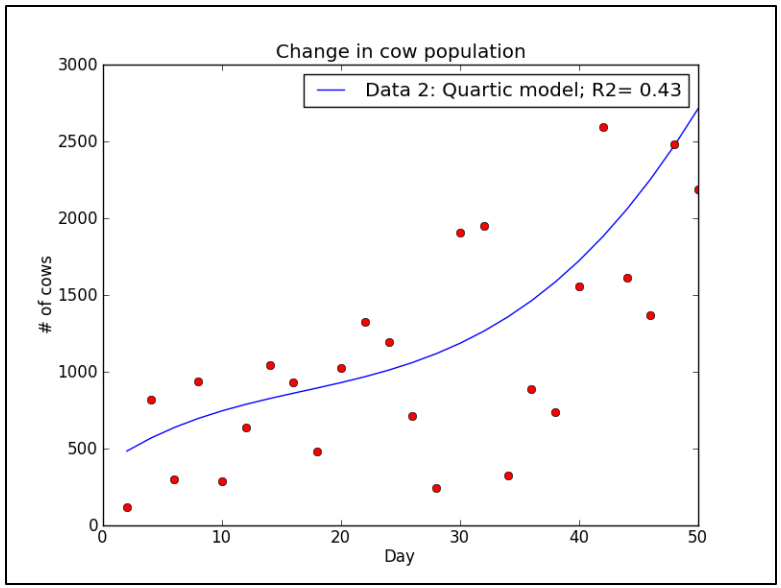

Change in cow population
Data 1: Quadratic model; R2= 0.67
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50

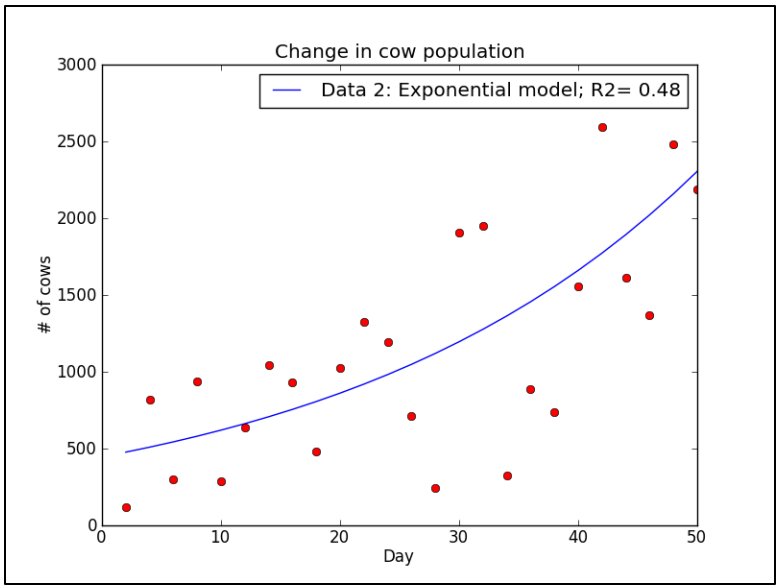

Change in cow population
Data 1: Quartic model; R2= 0.68
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50

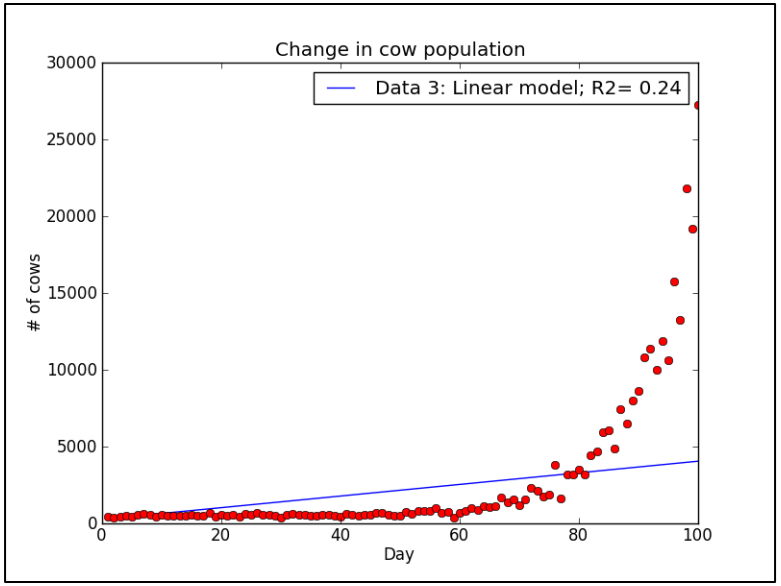

Change in cow population
Data 1: Exponential model; R2= 0.65
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50

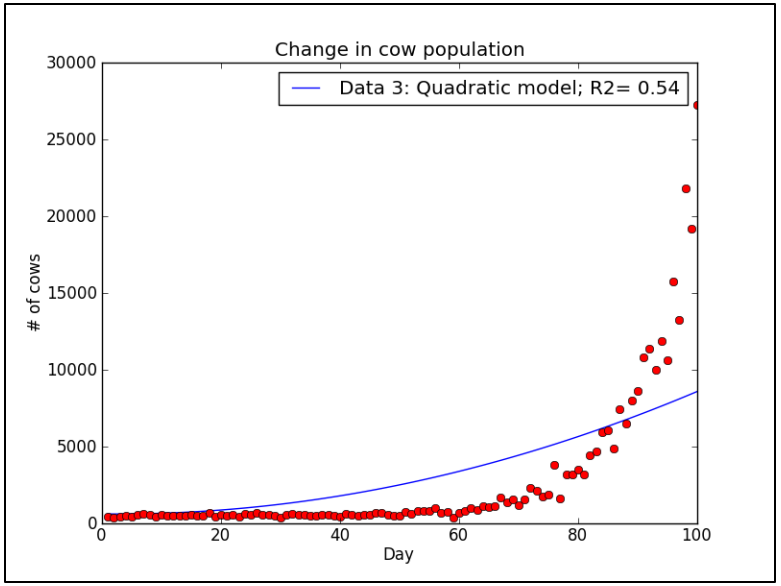

Change in cow population
Data 2: Linear model; R2= 0.41
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50

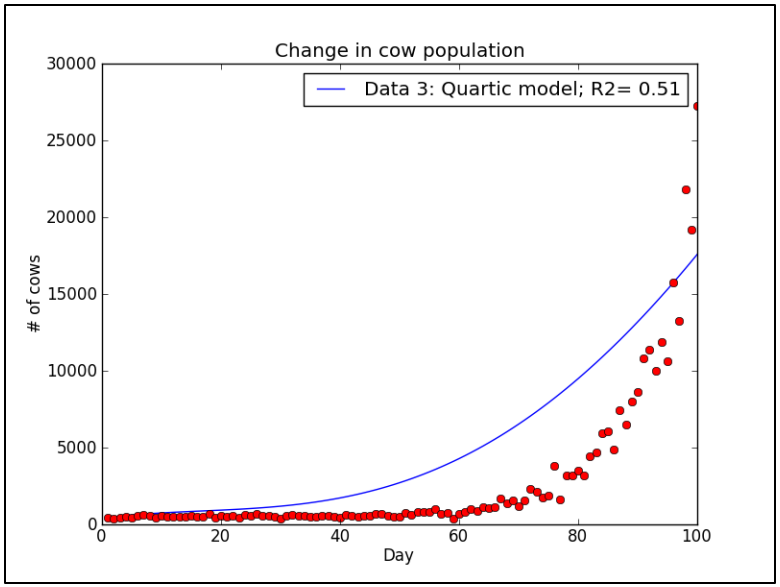

Change in cow population
Data 2: Quadratic model; R2= 0.42
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50

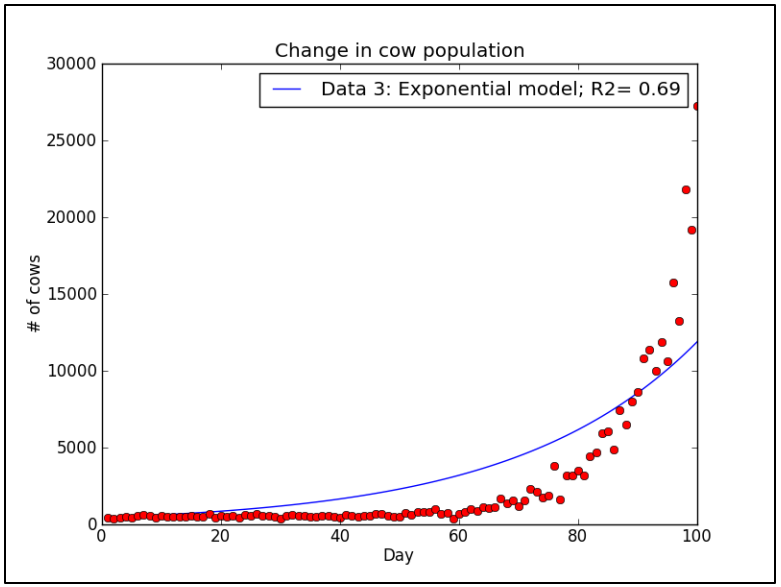

Change in cow population
Data 2: Quartic model; R2= 0.43
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50


Change in cow population
Data 2: Exponential model; R2= 0.48
# of cows
Day
0
500
1000
1500
2000
2500
3000
0
10
20
30
40
50


Change in cow population
Data 3: Linear model; R2= 0.24
# of cows
Day
0
5000
10000
15000
20000
25000
30000
0
20
40
60
80
100


Change in cow population
Data 3: Quadratic model; R2= 0.54
# of cows
Day
0
5000
10000
15000
20000
25000
30000
0
20
40
60
80
100


Change in cow population
Data 3: Quartic model; R2= 0.51
# of cows
Day
0
5000
10000
15000
20000
25000
30000
0
20
40
60
80
100


Change in cow population
Data 3: Exponential model; R2= 0.69
# of cows
Day
0
5000
10000
15000
20000
25000
30000
0
20
40
60
80
100

Problem 4:

1. Which function would you choose to model the Auck's mutant cow breading pattern and why?

   The exponential function. Although the quadratic and quartic functions are slightly better fits for data1 (the dataset to which the functions were fit), R2 doesn't differ much across regressions (btw >0.6 & < 0.7). Importantly, we want to see how the fits generalize to the test data sets (data sets 2 & 3). R2 is typically lower for test data sets although this is not the case for the exponential fit for data3 (for which it is the greatest). Moreover, the exponential regression also explains the greatest amount of variance in the data contained in data2. And, finally, from the data pattern for data3, this appears reasonable.

2. About how many cows will the aliens have after 200 days (given the model chosen)? Does this make sense; if not, choose another model and explain why it's better.

   predicted # cows after 200 days from data1: 316517.01
   predicted # cows after 200 days from data2: 321698.9
   predicted # cows after 200 days from data3: 213353.92

   Yes, from looking at the data points from data3, the number of cows are rising steeply by 100 days.

Problem 8: Comparing the Loading Algorithms

1. How do the results of the greedy and brute force algorithms compare (min # of trips for each)?
2. Which algorithm ran faster?

Number of trips for greedy algorithm: 5
Greedy algorithm runtime: 4.00543212891e-05 seconds (0.04 msec)

Number of trips for brute force algorithm: 4
Brute force algorithm runtime: 2.56682014465 seconds (2566.82 msec)

Using the brute force algorithm, the Aucks can reduce the number of trips by one (5 trips with greedy and 4 trips w/ brute force). This algorithm, however, takes 64,000 times as long as greedy. In this case, using a greedy solution might be a far better idea for the Aucks . While we only tried to find the optimal travel plan for a very small number of cows, the data observed by Joanna, Eric, and me, clearly illustrate that the Aucks are faced with a far more difficult optimization problem (if they intend to take all of their cows) and that the computations required for a brute force solution will only become ever more unwieldy [unless, of course, space travel to their home planet is even more difficult (but then, why are they breeding so many cows on Earth?) or the Aucks are Adric-like ☺]

jjj