Udom Phay
Assignment 2

Haberman's Survival prediction

1. Using Maximum Likelihood Estimation with gradient ascent to get theta after multiple iterations. I used the theta from testing to predict whether or not the patient would survive after surgery.
    a. With Alpha = .01, and trained for 100 iterations, All the predicted results are 1, and It cannot predict 0s. This is not valid.
        i. Theta = [0.47330177 -0.24403265 0.0662931   0.24772203]
        ii. True Positive = 33
        iii. True Negative = 0
        iv. False Positive = 13
        v. False Negative = 0
        vi. Total = 46
        vii. precision = 0.717391304347826
        viii. recall = 1.0
        ix. F1-Score = 0.8354430379746834
    b. With Alpha = .01, and trained for 200 iterations
        i. Theta = [0.46256371 -0.11598576 0.07936131 0.21376874]
        ii. True Positive = 32
        iii. True Negative = 3
        iv. False Positive = 10
        v. False Negative = 1
        vi. Total = 46
        vii. precision = 0.7619047619047619
        viii. recall = 0.9696969696969697
        ix. F1-Score = 0.8533333333333334
    c. With Alpha = .01, and trained for 1000 iterations
        i. Theta = [0.35313874 -0.01412703 0.00901093 0.23768925]
        ii. True Positive = 17
        iii. True Negative = 10
        iv. False Positive = 3
        v. False Negative = 16
        vi. Total = 46
        vii. precision = 0.85
        viii. recall = 0.5151515151515151
        ix. F1-Score = 0.6415094339622641
2. I normalized the features of my data, and ran the same test. I learned that with the normalized data, theta converged much slower than the un normalized data. I was not

able to get a high F1 score until 1000 training iterations. Normalized data starts converging slowly from 0 to 1000.

a. With Alpha = .01, and trained for 100 iterations
    i. Theta = [0.21957342 0.5221817 0.41226486 0.44105889]
    ii. True Positive = 1
    iii. True Negative = 13
    iv. False Positive = 0
    v. False Negative = 32
    vi. Total = 46
    vii. precision = 1.0
    viii. recall = 0.030303030303030304
    ix. F1-Score = 0.05882352941176471
b. With Alpha = .01, and trained for 200 iterations
    i. Theta = [-0.00557061 0.52612012 0.3383237   0.38747155]
    ii. True Positive = 3
    iii. True Negative = 12
    iv. False Positive = 1
    v. False Negative = 30
    vi. Total = 46
    vii. precision = 0.75
    viii. recall = 0.09090909090909091
    ix. F1-Score = 0.16216216216216214
c. With Alpha = .01, and trained for 1000 iterations
    i. Theta = [-0.76989399 0.37836963 0.08360016 0.21199508]
    ii. True Positive = 30
    iii. True Negative = 6
    iv. False Positive = 7
    v. False Negative = 3
    vi. Total = 46
    vii. precision = 0.8108108108108109
    viii. recall = 0.9090909090909091
    ix. F1-Score = 0.8571428571428571