Department of Applied Mathematics and Statistics
COLORADO SCHOOL OF MINES
MATH 500: Linear Vector Spaces

Assignment #6: Least Squares & Ranking
Due Thursday, November 11, 2021

For problems which require computational simulation, please print and submit both your code and results (e.g., pictures).

1. (15 points) Consider the following Olympic Gold Medal Winning times (in seconds) for the Men's 100 Meter Dash:

Year	Time	Year	Time
1960	10.32	1988	9.92
1964	10.06	1992	9.96
1968	9.95	1996	9.84
1972	10.14	2000	9.87
1976	10.06	2004	9.85
1980	10.25	2008	9.69
1984	9.99	2012	9.63

(a) Use Least Squares fitting to compute the line $T = \alpha_0 + \alpha_1 x$ and the parabola $T = \beta_0 + \beta_1 x + \beta_2 x^2$ which best fit the data, where T represents the 100 Meter time, y is the true Olympic year, and x represents the scaled Olympic year given by

$$x = \frac{y - 1960}{52}.$$

Include your Matlab code and output for the models.

(b) Graph the data and your first Least Squares curve from part (a) on the same axes, and then do this again with your second Least Squares curve from part (a).

(c) Using each of your resulting models, predict the gold medal time for the 2020 Olympics (now the 2021 Olympics).

2. (15 points) Consider the following match results for five different football teams, denoted by Teams 1 through 5:

Winner	Loser	Difference	Winner	Loser	Difference
1	2	7	3	4	4
3	5	1	2	4	10
1	5	20	3	2	12
2	5	7	3	1	3
4	1	24	5	4	1

(a) Determine the win-loss records of each team and their corresponding winning percentage, and then rank them by winning percentage.

(b) Compute the Massey indices of these teams and their associated rankings.

(c) Change the result in the second portion of the last row from $5-4-1$ to $5-4-20$, and recompute the indices and rankings. Does this elevate Team 5 in the standings? How large must the strength of victory (a positive integer) be for Team 5 in this last game in order to boost them to the top of the rankings?