MIT, 2.098J/6.255J/15.093J
Optimization Methods, Fall 2009
Problem Set #7

Due: Lec #20 (in class)
Note: **Problem 1 is worth significant credit in this HW.**

1. (**TSP - Performance of Different Algorithms**).
BT Exercise 11.17. Submit a hardcopy of your code.

2. (**Dynamic Programming Exercise**).
Consider the matrix multiplication problem we saw in Lecture 16. We want to find an optimal sequence of multiplications for computing $M_1 \cdot M_2 \cdot M_3 \cdot M_4$. Suppose the dimensions of the four matrices are 5×4, 4×6, 6×2 and 2×7. Use the DP recursion in the lecture to compute the optimal sequence of multiplications. Show all the steps.

3. (**Diffraction Law in Optics**).
Let p and q be two points on the plane that lie on opposite sides of a horizontal axis. Assume that the speed of light from p and from q to the horizontal axis is v and w, respectively, and that light reaches a point from other points along paths of minimum travel time. Formulate a non-linear optimization problem to find the path that a ray of light would follow from p to q.

4. (**Characterizing Convex/Concave Functions**).
Which of the following functions is convex, concave, strictly convex, strictly concave or none of the above? Why?

1. $f(x_1) = x_1^2 + e^{x_1^2}$
2. $f(x_1, x_2) = 2x_1^2 + 4x_1x_2 - 10x_1 + 5x_2$
3. $f(x_1, x_2) = x_1 e^{-(x_1+x_2)}$
4. $f(x_1, x_2, x_3) = -x_1^2 - 3x_2^2 - 2x_3^2 + 4x_1x_2 + 2x_1x_3 + 4x_2x_3$

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