Algorithmic Operation Research

Homework 2
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1. Find a differentiable function $f : \mathbb{R} \to \mathbb{R}$ such that f does not have an extremum at its critical point.

2. Given a positive integer S, which decompositions

$$a_1 + \cdots + a_n = S$$

with the a_i positive integers have the largest product $a_1 \cdot \cdots \cdot a_n$?

3. Find the optimal solution to the Diet Problem when the cost function is

$$Cost(x_1, x_2) = x_1 + x_2.$$

4. Let $A, B \in \mathbb{R}^{n \times n}$. Show that the traditional way of computing their product AB requires a total of $(2n - 1)n^2$ arithmetic operations.

5. Consider the problem of solving a system of n linear equations in n unknowns. Show that the Gaussian elimination method requires $O(n^3)$ arithmetic operations in order to either compute a solution or to decide that no solution exist.

6. Suppose that we are given a set of vectors in $\mathbb{R}^n$ that form a basis and let y be an arbitrary vector in R^n. We wish to express y as a linear combination of the basis vectors. How can this by accomplished?

7. Study the paper with title: *Do dogs know Calculus?* found in the Readings folder.