

Department of Mathematical Sciences
CARNEGIE MELLON UNIVERSITY

OPERATIONS RESEARCH II 21-393

Homework 4: Due Wednesday October 23.

Q1 Show that if $f : \Re^n \rightarrow \Re$ is a convex function then its *epigraph* $\{(\mathbf{x}, t) : t \geq f(\mathbf{x})\}$ is a convex subset of \Re^{n+1} .

Q2 A *monomial* is a function f of the form

$$f(\mathbf{x}) = c \prod_{i=1}^n x_i^{a_i}$$

where $c > 0$.

The sum of monomials is called a *posynomial*. Let $x_i = e^{y_i}$ for $i = 1, 2, \dots, n$. Show that this transforms the *Geometric Programming* problem

Minimise $f_0(\mathbf{x})$ subject to $f_i(\mathbf{x}) \leq 1$, $i = 1, 2, \dots, m$, $x_j > 0$, $j = 1, 2, \dots, n$

where f_0, f_1, \dots, f_m are posynomials, into a convex program.

Q3 Use the KKT conditions to solve

Minimise $(x_1 - 5)^2 + (x_2 - 4)^2$ subject to $x_1 + x_2 \leq 1$, $2x_1 + 3x_2 \leq 2$.