

Department of Mathematical Sciences  
CARNEGIE MELLON UNIVERSITY

**OPERATIONS RESEARCH II 21-393**

Homework 4: Due Monday October 15.

**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*. Transform 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  $x_1 + x_2 \leq 1, 2x_1 + 3x_2 \leq 2$ .