

ECE 608 - Signal Theory, Spring 2006

Homework #4

Due 5/17/06

1. Find the function $x(t)$, $0 \leq t \leq 1$, that minimizes:

$$\int_0^1 \left\{ [x(t) - \cos(2\pi t)]^2 + \frac{1}{2} \left[\frac{dx(t)}{dt} \right]^2 \right\} dt$$

under the conditions that $x(0) = x(1) = 1$.

2. Apply Lagrange multipliers to attempt to maximize:

$$2x_1x_2 + x_2x_3 + x_1x_3$$

subject to:

$$x_1 + x_2 + x_3 = 3.$$

Is your solution a maximum, minimum, or neither?

3. Find the $\underline{x} \in \mathcal{R}^5$ that minimizes $H(\underline{x}) = \sum_{i=1}^5 x_i \ln(x_i)$ under the constraints that $\sum_{i=1}^5 x_i = 1$ and $\sum_{i=1}^5 ix_i = 2$.

4. Find the signal $s(t)$, $0 \leq t \leq 1$, that maximizes $\int_0^1 s(t) \cos(2\pi t) dt$ under the constraints that $\int_0^1 s^2(t) dt = 1$ and $\int_0^1 s(t) dt \geq \frac{1}{2}$.