# Optimization

## Assignment 4

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### Q1

Given

Show that the frequency response can be written as:

Where

and

Proof:

The frequency response:

Which can also be written as:

Where

Q.E.D.

### Q2

Given a type I FIR filter with the response of:

Assume we subsample at

We then get:

With weights

we can write the error at each sampled frequency as:

With our constraint we get:

where

which leads us to

### Q3

For the non-standard form of:

We can convert this to standard form by defining

And a slack variable which leads to

and

Q.E.D.

### Q4

For a LP problem of the standard form:

The auxiliary problem is:

We initialize with

If we get as the solution to problem that then is the basic feasible point of the original problem.

### Q5

Matlab

### Q6

Matlab

### Q7

We will translate the time constraints on the step response

To constraints on the vector **.** To do thiswe will find the linear transform from

Starting from

Going from

So

where

So

Adding this to our previous constraints gives us:

Q.E.D.

### Q9

For the following inequality

Where and can be written as column vectors stacked row wise

,

We will calculate the gradient the following barrier function:

First we shall find the gradient for

For the Hessian first find

We shall define a diagonal matrix

### Q10

The Primal problem is

The Dual problem is:

The Langrangian for the problem is:

In order to prove dual feasibility we need to show that

Fulfills the following conditions:

Proof a:

Assuming

Proof b:

If we try minimize centering problem :

If we substitute (\*\*) into (\*), we get that

Q.E.D.

### Q11

We are asked to prove that

Proof: