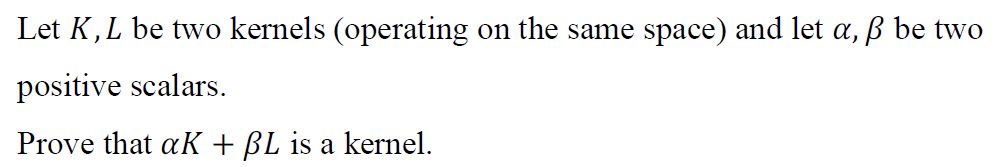
**HW5**

**Question 1**



Proof:

Denote be the kernels.

By kernel definition,

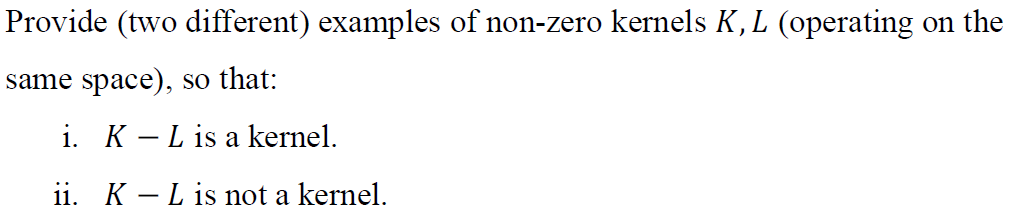
We’ll define the following function as follows:

Explanation:

The value of returns 2N values which calculated as follow – mark the values returned from as and the values returned from as . Multiply all values is S by and all values of by and mount the multiplied values of on top of the multiplied values of .

Now note that:

Which means is a kernel.



1. Let , the 1st degree homogenous polynomial kernel is:

For , it holds that:

and as such,

The function holds:

Thus is a kernel.

1. Let ,

let

For , it holds that:

and as such,

Assume towards contradiction that it is a kernel,

thus, it has a function it holds:

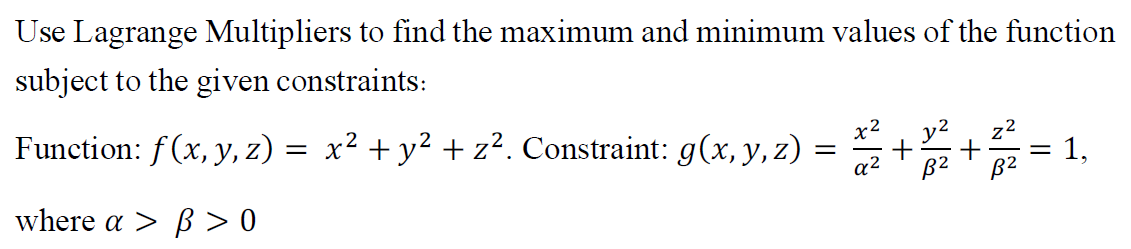
Let :

So, we have:

But an inner product of a vector with itself is always >=0. Contradiction.

Thus is not a kernel.

**Question 2**



Note that:

From the 1st equation, look at two cases:

1st case:

Assume the following –

From we get:

And by plugging the above into the 2nd and 3rd equations, we get:

By plugging the above into the 4th equation, we get:

Thus, the points are extremum points, and:

2nd case:

Now we assume the following –

From the 2nd equation, look at two sub-cases:

Sub1:

Assume , which means can be any numbers that keeps the 4th equation:

And therefore, for any .

Sub2:

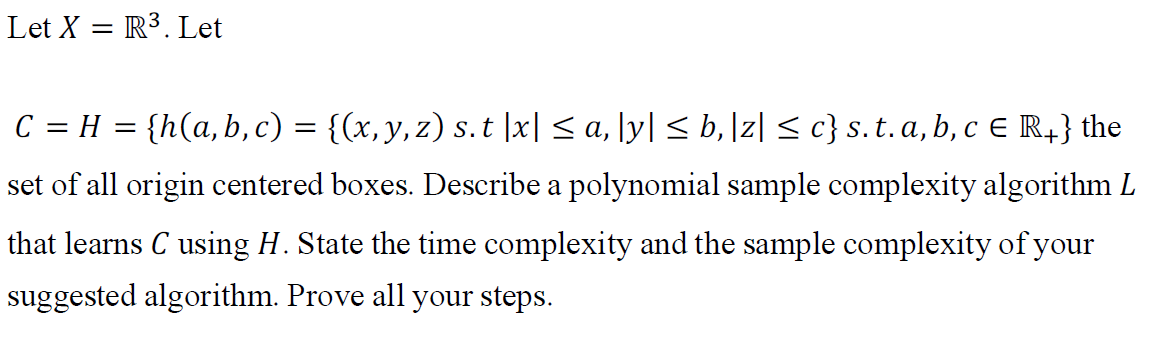
Assume and plug it into the 4th equation and get:

Thus, the points are extremum points, and:

We know that . Thus minimum points are – for example

And the maximums are

**Question 3:**



**Learner:**

Let be a data set and .

Define:

Return

Proof:

Let

If we show that , that is is inside box of .

by the definition of .

Else we show that , that is is outside box of .

**Time Complexity:**