Prelim2013

January 11, 2015

Q1. Optimization

Use the Augmented Lagrangian method to solve the equality constrained problem

In [104]:
```
import numpy as np
import matplotlib.pyplot as plt
from scipy.optimize import fmin
```

In [105]:
```
def f(x):
    return 6*x[0]*x[0]+4*x[0]*x[1]+3*x[1]*x[1]

def h(x):
    return x[0]+x[1]-5

def L(x,lamda,rk):
    return f(x)-lamda*h(x)+rk*h(x)**2

def update(x,lamda,rk):
    return (lamda-2*rk*h(x), 2*rk)

lamda = 0
rk = 1
x0 = [1,1]
```

In [106]:
```
x = x0
while np.abs(h(x)) > 0.01:
    x = fmin(lambda x: L(x,lamda,rk), x0)
    (lamda,rk) = update(x,lamda,rk)
    #print "x = ", x
    #print "lamda = ", lamda
    #print "h(x) = ", h(x)
```

```
Optimization terminated successfully.
         Current function value: 18.421053
         Iterations: 31
         Function evaluations: 62
Optimization terminated successfully.
         Current function value: 47.829828
         Iterations: 38
         Function evaluations: 72
Optimization terminated successfully.
         Current function value: 64.674717
         Iterations: 43
```

```
         Function evaluations: 84
Optimization terminated successfully.
         Current function value: 69.431560
         Iterations: 46
         Function evaluations: 90
Optimization terminated successfully.
         Current function value: 69.978025
         Iterations: 46
         Function evaluations: 90
Optimization terminated successfully.
         Current function value: 69.999738
         Iterations: 57
         Function evaluations: 110
```

Q2. Fourier Analysis

In []: