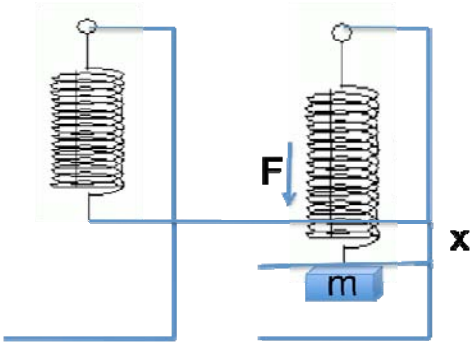
6.00 Handout, Lecture 17
(Not intended to make sense outside of lecture)

```
def getData(fileName):
    dataFile = open(fileName, 'r')
    distances = []
    masses = []
    discardHeader = dataFile.readline()
    for line in dataFile:
        d, m = line.split()
        distances.append(float(d))
        masses.append(float(m))
    dataFile.close()
    return (masses, distances)
```




```
def plotData(fileName):
    xVals, yVals = getData(fileName)
    xVals = pylab.array(xVals)
    yVals = pylab.array(yVals)
    xVals = xVals*9.81  #acc. due to gravity
    pylab.plot(xVals, yVals, 'bo', label = 'Measured displacements')
    pylab.title('Measured Displacement of Spring')
    pylab.xlabel('|Force| (Newtons)')
    pylab.ylabel('Distance (meters)')

def fitData(fileName):
    xVals, yVals = getData(fileName)
    xVals = pylab.array(xVals)
    yVals = pylab.array(yVals)
    xVals = xVals*9.81
    pylab.plot(xVals, yVals, 'bo', label = 'Measured displacements')
    pylab.title('Measured Displacement of Spring')
    pylab.xlabel('|Force| (Newtons)')
    pylab.ylabel('Distance (meters)')
    a,b = pylab.polyfit(xVals, yVals, 1)
    estYVals = a*pylab.array(xVals) + b
    k = 1/a
    pylab.plot(xVals, estYVals, label = 'Linear fit, k = '
               + str(round(k, 5)))
    pylab.legend(loc = 'best')
```

```
def tryFits(fName):
    distances, heights = getTrajectoryData(fName)
    distances = pylab.array(distances)*36
    totHeights = pylab.array([0]*len(distances))
    for h in heights:
        totHeights = totHeights + pylab.array(h)
    pylab.title('Trajectory of Projectile (Mean of 4 Trials)')
    pylab.xlabel('Inches from Launch Point')
    pylab.ylabel('Inches Above Launch Point')
    meanHeights = totHeights/float(len(heights))
    pylab.plot(distances, meanHeights, 'bo')
    a,b = pylab.polyfit(distances, meanHeights, 1)
    altitudes = a*distances + b
    pylab.plot(distances, altitudes, 'r',
               label = 'Linear Fit')
    a,b,c = pylab.polyfit(distances, meanHeights, 2)
    altitudes = a*(distances**2) + b*distances + c
    pylab.plot(distances, altitudes, 'g',
               label = 'Quadratic Fit')
    pylab.legend()

def rSquare(measured, estimated):
    """measured: one dimensional array of measured values
       estimate: one dimensional array of predicted values"""
    EE = ((estimated - measured)**2).sum()
    mMean = measured.sum()/float(len(measured))
    MV = ((mMean - measured)**2).sum()
    return 1 - EE/MV

def tryFits1(fName):
...
    pylab.plot(distances, altitudes, 'r',
               label = 'Linear Fit' + ', R2 = '
               + str(round(rSquare(meanHeights, altitudes), 4)))
    a,b,c = pylab.polyfit(distances, meanHeights, 2)
    altitudes = a*(distances**2) + b*distances + c
    pylab.plot(distances, altitudes, 'g',
               label = 'Quadratic Fit' + ', R2 = '
               + str(round(rSquare(meanHeights, altitudes), 4)))
    pylab.legend()
```

6.00SC Introduction to Computer Science and Programming
Spring 2011

When scientist uses simulation to derive something, they always do some experiment about the real problems to see whether their derived results is correct or not.

- physical reality(means that the real world problems, and we usually use theoretical model to describe such physical reality.However when the complexity of some physical reality is high we alternatively choose the computational models.)

- theoretical model

- computational model

-Fit data get curves and use the objective function to assess how much the curve fits the data

-least squares fit:
it is an objective function to measure how well of any curve fitting in a set of data points.(In least squares fit we need to minimize the value of such objective function, smaller values of results mean fits well.)

-预测曲线的步骤：1.通过预测函数预测曲线 2.通过fit函数（如least square fit）对曲线和训练样本进行拟合（各种拟合基于的理论会不同，例如 least square fit就是用函数计算预测误差，并抛弃误差大于阈值的预测点 最后得到一条拟合曲线使得误差值最小。）
--至于为什么大多数写好的拟合函数都只需要观测值作为输入，那是因为在函数内部，已经为拟合预测好了相应的曲线，然后直接在内部进行拟合 而不需要你去分别输入 预测曲线 和 观测值 然后再做拟合

-coefficient of determination