

# ProblemAnswers

October 22, 2016

## 0.1 Problem 1

```
In [10]: N = 10
        A = zeros(N,N)
        for i in 1:N, j in 1:N
            abs(i-j)<=1 ? A[i,j]+=1 : nothing
            i==j ? A[i,j]-=3 : nothing
        end
        A
```

```
Out[10]: 10×10 Array{Float64,2}:
 -2.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
  1.0 -2.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
  0.0  1.0 -2.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0
  0.0  0.0  1.0 -2.0  1.0  0.0  0.0  0.0  0.0  0.0
  0.0  0.0  0.0  1.0 -2.0  1.0  0.0  0.0  0.0  0.0
  0.0  0.0  0.0  0.0  1.0 -2.0  1.0  0.0  0.0  0.0
  0.0  0.0  0.0  0.0  0.0  1.0 -2.0  1.0  0.0  0.0
  0.0  0.0  0.0  0.0  0.0  0.0  1.0 -2.0  1.0  0.0
  0.0  0.0  0.0  0.0  0.0  0.0  0.0  1.0 -2.0  1.0
  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  1.0 -2.0
```

```
In [14]: ##### Prepare Data

        X = rand(1000, 3)           # feature matrix
        a0 = rand(3)                # ground truths
        y = X * a0 + 0.1 * randn(1000); # generate response
```

```
Out[14]: 1000-element Array{Float64,1}:
 1.0737
 0.617939
 0.941093
 0.142068
 0.6174
 0.361449
 0.657612
 0.571313
 0.310871
```

```

0.407938
0.330809
0.263355
0.949922
⋮
0.223555
0.41471
0.29676
0.991029
0.395745
0.947528
0.835744
0.669867
0.836518
0.393077
0.543453
0.5212

```

## 0.2 Problem 2

```

In [15]: X2 = hcat(X, ones(1000))
          println(X2\y)

[0.120512, 0.0732871, 0.954649, 0.00897003]

```

## 0.3 Problem 3

```

In [16]: using MultivariateStats
          llsq(X, y)

Out[16]: 4-element Array{Float64,1}:
          0.120512
          0.0732871
          0.954649
          0.00897003

```

## 0.4 Problem 4

```

In [23]: using DataFrames, GLM
          data = DataFrame(X1=X[:,1], X2=X[:,2], X3=X[:,3], Y=y)
          OLS = lm(Y ~ X1 + X2 + X3, data)

Out[23]: DataFrames.DataFrameRegressionModel{GLM.LinearModel{GLM.LmResp{Array{Float64,1}},
          Formula: Y ~ 1 + X1 + X2 + X3

          Coefficients:
              Estimate Std. Error t value Pr(>|t|)

```

(Intercept)	0.00897003	0.00960328	0.934059	0.3505
X1	0.120512	0.0106063	11.3623	<1e-27
X2	0.0732871	0.010627	6.8963	<1e-11
X3	0.954649	0.0106649	89.5128	<1e-99