BasicProblemAnswers

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0.1 Strang Matrix Problem

```
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
             i==j && A[i,j]-=3
         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
```

0.2 Linear Regression Problem

```
In [1]: #### Prepare Data

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

        X2 = hcat(X,ones(1000))
        println(X2\y)

        using MultivariateStats
        println(llsq(X,y))

        using DataFrames, GLM
        data = DataFrame(X1=X[:,1], X2=X[:,2], X3=X[:,3],Y=y)
```

```
OLS = lm(@formula(Y ~ X1 + X2 + X3), data)


X = rand(100);
y = 2X  + 0.1 * randn(100);

using Plots
b = X\y
println(b)
gr()
scatter(X,y)
Plots.abline!(b[1],0.0, lw=3) # Slope,Intercept
```

```
[0.160686,0.303242,0.881393,-0.00799982]
[0.160686,0.303242,0.881393,-0.00799982]
[2.00413]
```

```
WARNING: Method definition describe(AbstractArray) in module StatsBase at /home/cra
```

0.3 Logistic Equation Problem

```
In [9]: r = 2.9:.001:4; numAttract = 100
        steady = ones(length(r),1)*.25
        for i=1:400 ## Get to steady state
          steady .= r.*steady.*(1-steady)
        end
        x = zeros(length(steady),numAttract)
        x[:,1] = steady
        @inbounds for i=2:numAttract ## Grab values at the attractor
          x[:,i] = r.*x[:,i-1].*(1-x[:,i-1])
        end
        using Plots; gr()
        plot(collect(r),x,seriestype=:scatter,markersize=.002,legend=false,color=:b
```