Problem_12_2

November 1, 2021

1 12_2

Defining the size for m *and* n

[ ]:
```
m = 10000
n = 100
```

[ ]:
```
100
```

Creating a random matrix A with $m \times n$ elements

[ ]:
```
A = rand(m, n)
```

[ ]:
```
10000×100 Matrix{Float64}:
 0.350914   0.291264  0.793007   …  0.409472   0.335045   0.138749
 0.506565   0.646634  0.883223      0.592182   0.347379   0.893967
 0.70613    0.694892  0.197484      0.883613   0.226852   0.738609
 0.0981344  0.580862  0.286531      0.337073   0.186437   0.982177
 0.50781    0.283216  0.74042       0.407769   0.129778   0.0526961
 0.403762   0.55565   0.534391   …  0.659364   0.236941   0.248257
 0.584593   0.134353  0.045256      0.854662   0.593271   0.827693
 0.719005   0.813489  0.17541       0.439235   0.0193162  0.00958755
 0.664656   0.970123  0.699786      0.272338   0.241461   0.183084
 0.41569    0.109807  0.401037      0.0266385  0.3471     0.546031
 0.491598   0.846121  0.879301   …  0.329851   0.881514   0.200132
 0.485656   0.43394   0.263759      0.347221   0.617046   0.125806
 0.115229   0.223861  0.311872      0.9489     0.77819    0.774911

 0.93802    0.621834  0.836076      0.904572   0.935503   0.569493
 0.649424   0.878504  0.0215925     0.0181362  0.652419   0.0624965
 0.872815   0.791316  0.732441   …  0.909484   0.188527   0.929795
 0.427682   0.852668  0.961298      0.627304   0.865443   0.801943
 0.526613   0.527859  0.113405      0.283252   0.656142   0.776011
 0.615523   0.482255  0.581557      0.081989   0.858301   0.839047
 0.348905   0.46761   0.0591574     0.699858   0.866566   0.172404
 0.32034    0.412592  0.856696   …  0.964393   0.58961    0.512687
 0.294465   0.552793  0.626824      0.370658   0.533958   0.425059
 0.299729   0.554464  0.645085      0.492179   0.560235   0.185051
 0.170518   0.126295  0.701795      0.441857   0.11875    0.758983
```

```
0.558662    0.30956    0.998766       0.327539    0.74809     0.87765
```

Creating a random vector b with m elements

[ ]:
```
b = rand(m)
```

[ ]:
```
10000-element Vector{Float64}:
 0.2438774235951513
 0.4989067116855921
 0.6357258085066875
 0.20480182528790758
 0.7028436711452
 0.30865510504942306
 0.4631320796114975
 0.9014110725581601
 0.20880369901449858
 0.12024800027914884
 0.19102993191387663
 0.39601770003675907
 0.20096246247570537

 0.5315769963426544
 0.8602536106813634
 0.696348650974534
 0.5253791019477312
 0.7186434399652666
 0.8939419335710104
 0.09926142784832614
 0.49530878868692807
 0.7090491872692779
 0.014824483165897018
 0.949873287167442
 0.1664590653972957
```

Finding the time of $A\backslash b$ operation (Solving least squares)

[ ]:
```
total_time = 0
@show A\b
for i in 1:100
    total_time = total_time + @elapsed A\b
end
```

```
A \ b = [-0.011276757976618784, 0.008567474603968363, 0.010532265174310475,
0.02784040561258568, 0.00437991598572958, 0.012137063428498393,
0.008438409896763819, -0.0005886706811520292, 0.015371228493999661,
0.006638220653259561, 0.02116361497150542, 0.003547185928185108,
0.004103983652469386, 0.005848701380689505, 0.017987237131749077,
0.019897774456989373, 0.019086645402806024, -0.004252930512769166,
0.013040912971170646, -0.002110883511147445, 0.008748862436348852,
```

```
-0.001260236115175669, 0.013843782694413881, -0.0022296428057354606,
0.019760955611952666, 0.0009764001259639438, 0.0017638909715387255,
0.010616706780033847, 0.004261382346968938, 0.005328054651747394,
0.013804580281978592, 0.02022876357110606, 0.008829111973477938,
0.008182027068262099, 0.01900491332366998, 0.002326178998266574,
0.005749134406908925, 0.00884790560754159, 0.013081633153114686,
0.011882762963128806, 0.006571241023149974, 0.011240072734349392,
0.01898138858761484, 0.009980811618005564, 0.010474568048500435,
0.01131322981474523, 0.0007597689770437598, 0.003692801066765982,
0.01774987269497869, 0.0056836071458204246, -0.0013927655026284304,
-0.007334509168774397, 0.014014371650790359, 0.0008115169930671328,
0.00939201256469646, 0.008452490602163956, 0.0024144713438397224,
0.010588588856275798, 0.007069245014881149, 0.012036907329994897,
0.02886731372417174, 0.017594367550370422, 0.0039620047830579985,
0.01958225479210266, 0.008632123441708108, 0.019694988252528443,
0.010094834681223441, 0.011962270542691496, -0.0009248144952373577,
-0.0011128195856501617, 0.01477156882444499, 0.0021557414087779304,
0.0004065841647966384, 0.003349095905127731, 0.01794021340858506,
0.032117158993129634, 0.012166943061822127, 0.004410274136538009,
0.04582612748286704, 0.006866334716346941, 0.004162608856141576,
0.01882185190558138, -0.012348289493274031, 0.0001471351456992046,
0.0036399466514822716, 0.01087588043255286, 0.01686167991180039,
0.013318371427521207, 0.02030191003434853, 0.02789250089165596,
0.020225085328207725, 0.019917863577490383, -0.008516003516569486,
0.02851698834862675, 0.021099929194467522, -0.0010302306510280878,
0.01925220116948008, 0.010771769168118336, 0.006027471671621019,
0.00775579776629778]
```

[ ]:
```
@show total_time
@show average_time = total_time / 100
```

```
total_time = 4.076270699999999
average_time = total_time / 100 = 0.040762706999999995
```

[ ]:
```
0.040762706999999995
```