AMSC/CMSC 660 Quiz 2 , Fall 2008

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, other electronic devices, communication with others, scratchpaper, etc.

Name _____

1. (10) Let $\boldsymbol{A}$ be an $m \times n$ matrix, and define

$$\|\boldsymbol{A}\|_\infty = \max_i \sum_{j=1}^{n} |a_{ij}| \,.$$

Write an efficient column-oriented algorithm to compute $\|\boldsymbol{A}\|_\infty$. (Don't use any MATLAB function calls except `abs` and `max`.)

2. (10) Your research advisor wants to solve a least squares problem

$$\min_{\boldsymbol{x}} \|\boldsymbol{A}\boldsymbol{x} - \boldsymbol{b}\|.$$

Given $\boldsymbol{b}$ and the results on the attached sheet, explain how to solve the problem. (Make clear exactly what you would compute and why.)

```
>> [Q,R] = qr(A)

Q =

   -0.5765   -0.4958    0.2491    0.2479   -0.5127   -0.1884
   -0.1796   -0.1225   -0.8396   -0.3736   -0.3094    0.1119
   -0.4759    0.0858   -0.2201    0.5221    0.4019    0.5325
   -0.4737    0.3507   -0.1337   -0.0877    0.3476   -0.7115
   -0.2391    0.7489    0.2168   -0.1234   -0.5040    0.2566
   -0.3569   -0.2192    0.3460   -0.7095    0.3242    0.3104

R =

   -1.5911   -0.9448   -0.9956   -0.8336   -0.8998
         0    0.9456    0.5002    0.5695   -0.2729
         0         0   -0.0006   -0.0004    0.0099
         0         0         0   -0.0011   -0.6413
         0         0         0         0   -0.1391
         0         0         0         0         0
>> [Qp,Rp,Pp] = qr(A)

Qp =

   -0.5765   -0.4958   -0.1298    0.2511   -0.5536   -0.1884
   -0.1796   -0.1225    0.4180   -0.8460   -0.2231    0.1119
   -0.4759    0.0858   -0.5987   -0.2111    0.2821    0.5325
   -0.4737    0.3507    0.0100   -0.1339    0.3583   -0.7115
   -0.2391    0.7489    0.2307    0.2133   -0.4663    0.2566
   -0.3569   -0.2192    0.6298    0.3365    0.4672    0.3104

Rp =

   -1.5911   -0.9448   -0.8998   -0.9956   -0.8336
         0    0.9456   -0.2729    0.5002    0.5695
         0         0    0.6563   -0.0000    0.0010
         0         0         0   -0.0006   -0.0004
         0         0         0         0    0.0002
         0         0         0         0         0

Pp =

     1     0     0     0     0
     0     1     0     0     0
     0     0     0     1     0
     0     0     0     0     1
     0     0     1     0     0
```