ESC 407
Computational Methods in Engineering Science
Homework 7 Supplement
Pseudocode for Gaussian Elimination With Partial Pivoting

Here is the a version of the algorithm I gave you in class for Gaussian elimination with partial pivoting.

Input: the $n \times n$ matrix $[A]$ and the $n \times m$ matrix $[B]$
Output: the solution array $[X]$ and the determinant of $[A]$

```
for i = 1 to n − 1 do {begin the forward elimination}
    p = i {set p equal to the current row}
    for k = i + 1 to n do {loop on all rows below i to find the max element}
        if |a(k, i)| > |a(k − 1, i)| then
            p = k {if a larger pivot element is found below row i; or use MATLAB's max
            function}
        end if
    end for
    if a(p, i) = 0 then {no solution if the largest element is zero}
        print No unique solution exists.
        STOP
    end if
    if  p ≠ i then {only swap rows if the row with the largest pivot element is not the
    current one i}
        swap row(i) and row(p)
    end if
    for j = i + 1 to n do {do the elimination below element (i, i)}
        m(j, i) = a(j, i)/a(i, i) {multiplier for rows below row i}
        row(j) − m(j, i) · row(i) → row(j) {zero the rows below row i}
    end for
end for
if a(n, n) = 0 then
    print No unique solution exists.
    STOP
end if
for k = 1 to m do {loop to solve with all columns of [B]}
    x(n, k) = a(n, n + k)/a(n, n) {start the backsubstitution}
    for i = n − 1 to 1 do {loop to do the rest of the backsubstitution}
```

$$x(i,k) = \frac{a(i,n+k) - \sum_{j=i+1}^{n} a(i,j)x(j,k)}{a(i,i)}$$

```
    end for
end for
```

Output: solution array $[X]$ and $\det[A]$
STOP