Gaussian Elimination Algorithm — No Pivoting

Given the matrix equation $A\mathbf{x} = \mathbf{b}$ where A is an $n \times n$ matrix, the following pseudocode describes an algorithm that will solve for the vector $\mathbf{x}$ assuming that none of the a_{kk} values are zero when used for division.

Note: The entries a_{ik} (which are "eliminated" and become zero) are used to store and save the multipliers.

```
— Gaussian Elimination —
for k = 1 to n − 1 do
    for i = k + 1 to n do
        a_ik = a_ik / a_kk
        for j = k + 1 to n do
            a_ij = a_ij − a_ik a_kj
        endfor
    endfor
endfor

— Forward Elimination —
for k = 1 to n − 1 do
    for i = k + 1 to n do
        b_i = b_i − a_ik b_k
    endfor
endfor

— Backward Solve —
for i = n downto 1 do
    s = b_i
    for j = i + 1 to n do
        s = s − a_ij x_j
    endfor
    x_i = s / a_ii
endfor
```

Gaussian Elimination Algorithm — Scaled Partial Pivoting

— *Gaussian Elimination* —

for $i = 1$ to n do — *this block computes the array of row maximal elements*
    $s_i = 0$
    for $j = 1$ to n do
        $s_i = \max(s_i, |a_{ij}|)$
    endfor
    $p_i = i$ — *initialize row pointers to row numbers*
endfor
for $k = 1$ to $n - 1$ do
    $r_{\max} = 0$ — *this block finds the largest scaled column entry*
    for $i = k$ to n do
        $r = |a_{p_i k}/s_{p_i}|$
        if $r > r_{\max}$ then
            $r_{\max} = r$
            $j = i$ — *row index of largest scaled entry*
        endif
    endfor
    temp $= p_k$ — *exchange row pointers*
    $p_k = p_j$
    $p_j =$ temp
    for $i = k + 1$ to n do — *perform elimination on submatrix*
        $a_{p_i k} = a_{p_i k}/a_{p_k k}$
        for $j = k + 1$ to n do
            $a_{p_i j} = a_{p_i j} - a_{p_i k}\, a_{p_k j}$
        endfor
    endfor
endfor

— *Forward Elimination* —

for $k = 1$ to $n - 1$ do
    for $i = k + 1$ to n do
        $b_{p_i} = b_{p_i} - a_{p_i k}\, b_{p_k}$
    endfor
endfor

— *Backward Solve* —

for $i = n$ downto 1 do
    $s = b_{p_i}$
    for $j = i + 1$ to n do
        $s = s - a_{p_i j}\, x_j$
    endfor
    $x_i = s/a_{p_i i}$
endfor