Algorithm 1 BISECTION

Input: $f, a, b, tol, Nmax$
Output: $x, iter, err$

$fa \leftarrow f(a)$
$fpm \leftarrow (a+b)/2$
$fpm \leftarrow f(pm)$
$E \leftarrow 1000$
$cont \leftarrow 1$
While $(E > tol)$ & $(cont < Nmax)$ **do**
  if $(fa * fpm < 0)$ **Then**
    $b \leftarrow pm$
  else if
    $a \leftarrow pm$
  End if
  $p0 \leftarrow pm$
  $pm \leftarrow (a+b)/2$
  $fpm \leftarrow f(pm)$
  $E \leftarrow |pm - p0|$
  $cont \leftarrow cont + 1$
End While
$x \leftarrow pm$
$iter \leftarrow cont$
$err \leftarrow E$
Return $x, iter, err$

Algorithm 2 FALSE RULE

Input: f, a, b, tol, nax
Output: $x, iter, err$

$fa \leftarrow f(a)$
$fb \leftarrow f(b)$
$fpm \leftarrow f(pm)$
$E \leftarrow 1000$
$cont \leftarrow 1$
While $(E > tol)$ & $(cont < Nmax)$ **do**
  if $(fa * fmp < 0)$ **Then**
    $b \leftarrow pm$
  else if
    $a \leftarrow pm$
  End if
  $p0 \leftarrow pm$
  $pm \leftarrow (f(b) * a - f(a) * b)/f(b) - f(a))$
  $fpm \leftarrow f(pm)$
  $E \leftarrow |pm - p0|$
  $cont \leftarrow cont + 1$
End While
$x \leftarrow pm$
$iter \leftarrow cont$
$err \leftarrow E$
Return $x, iter, err$

Algorithm 3 FIXED POINT

Input: $g, x0, tol, Nmax$
Output: $x, iter, err$

$xant \leftarrow x0$
$E \leftarrow 1000$
$cont \leftarrow 1$
While $(E > tol)$ & $(cont < Nmax)$ **do**
  $xact \leftarrow g(xant)$
  $E \leftarrow |xact - xant|$
  $cont \leftarrow cont + 1$
  $xant \leftarrow xact$
End While
$x \leftarrow xact$
$iter \leftarrow cont$
$err \leftarrow E$
Return $x, iter, err$

Algorithm 4 NEWTON

Input: $f, df, x0, tol, Nmax$
Output: $x, iter, err$

$xant \leftarrow x0$
$fant \leftarrow f(xant)$
$E \leftarrow 1000$
$cont \leftarrow 0$
While $(E > tol)$ & $(cont < Nmax)$ **do**
  $xact \leftarrow (xant - fant)/(df(xant))$
  $fact \leftarrow f(xact)$
  $E \leftarrow |xact - xant|$
  $cont \leftarrow cont + 1$
  $xant \leftarrow xact$
  $fant \leftarrow fact$
End While
$x \leftarrow xact$
$iter \leftarrow cont$
$err \leftarrow E$
Return $x, iter, err$

Algorithm 5 SEC

Input: $f, x0, x1, tol, Nmax$
Output: $x, iter, err$

$f0 \leftarrow f(x0)$
$f1 \leftarrow f(x1)$
$E \leftarrow 1000$
$cont \leftarrow 1$
While $(E > tol)$ & $(cont < Nmax)$ **do**
  $xact \leftarrow x1 - f1 * (x1 - x0)/(f1 - f0)$
  $fact \leftarrow f(xact)$
  $E \leftarrow |xact - x1|$
  $cont \leftarrow cont + 1$
  $x0 \leftarrow x1$
  $f0 \leftarrow f1$
  $x1 \leftarrow xact$
  $f1 \leftarrow fact$
End While
$x \leftarrow xact$
$iter \leftarrow cont$
$err \leftarrow E$
Return $x, xact, err$

Algorithm 6 MULTIPLE ROOTS

Input: $f, f', f'', x0, tol, Nmax$
Output: $x, iter, err$

$xant \leftarrow x0$
$fant \leftarrow f(act)$
$E \leftarrow 1000$
$cont \leftarrow 0$
While $(E > tol)$ & $(cont < Nmax)$ **do**
  $xact \leftarrow (xant - fant) * f''(xant)/(f'(xant)^2 - fant * f''(xant))$
  $fact \leftarrow f(xact)$
  $E \leftarrow |xact - xant|$
  $cont \leftarrow cont + 1$
  $xant \leftarrow xact$
  $fant \leftarrow fact$
End While
$x \leftarrow xact$
$iter \leftarrow cont$
$err \leftarrow E$
Return $x, iter, err$

Algorithm 7 GAUSSIAN ELIMINATION

Input: A, b
Output: x

$n \leftarrow size(A, 1)$
$M \leftarrow [Ab]$
For $i \leftarrow 0, n - 1$ **do**
  For $j \leftarrow i + 1, n$ **do**
    if $M(j, i) \neq 0$ **Then**
      $M(j, i : n + 1) \leftarrow M(j, i : n + 1) - (M(j, i)/M(i, i)) * M(i, i : n + 1)$
    End if
  End For
End For
$x \leftarrow backsubstitution(M)$
Return x

Algorithm 8 GAUSSIAN ELIMINATION WITH PARCIAL PIVOTING

Input: A, b
Output: x
  $n \leftarrow size(A, 1)$
  $M \leftarrow [Ab]$
  For $i \leftarrow 1, n-1$ **do**
    $[aux0, aux] \leftarrow max|M(i+1:n, 1)|$
    if $aux0 > |M(i,i)|$ **Then**
      $aux2 \leftarrow M(i+aux, i:n+1)$
      $M(aux+i, i:n+1) \leftarrow M(i, i:n+1)$
      $M(i, i:n+1) \leftarrow aux2$
    End if
    For $j \leftarrow i+1, n$ **do**
      if $M(j,i) \neq 0$ **Then**
        $M(j, i:n+1) \leftarrow M(j, i:n+1) - (M(j,i)/M(i,i)) * M(i, i:n+1)$
      End if
    End For
  End For
  $x \leftarrow backsubstitution(M)$
  Return x

Algorithm 9 GAUSSIAN ELIMINATION WITH TOTAL PIVOTING

Input: A, b
Output: x
  $n \leftarrow size(A, 1)$
  $M \leftarrow [Ab]$
  $cambi \leftarrow []$
  For $i \leftarrow 1, n-1$ **do**
    $[a, b] \leftarrow find(|M(i:n, i:n)|) \equiv max(|M(i:n, i:n)|))$ Cambio de columna
    if $b(1) + i - 1 \neq i$ **Then**
      $cambi \leftarrow += [ib(1) + i + 1]$
      $aux2 \leftarrow M(:, b(1) + i + 1)$
      $M(:, b(1) + i - 1) \leftarrow$
      $M(:, i) \leftarrow$
    End if Cambio de fila
    if $a(1) + i \neq i$ **Then**
      $aux2 \leftarrow M(i + a(1) - 1, i:n+1)$
      $M(a(1) + i - 1, i:n+1) \leftarrow M(i, i:n+1)$
      $M(i, i:n+1) \leftarrow aux2$
    End if
    For $j \leftarrow i+1, n$ **do**
      if $M(j,i) \neq 0$ **Then**
        $M(j, i:n+1) \leftarrow M(j, i:n+1) - (M(j,i)/M(i,i)) * M(i, i:n+1)$
      End if
    End For
  End For
  $x \leftarrow backsubstitution(M)$
  Return x