Components of Scientific Programming

- Definition of problem
- Physical/mathematical formulation
- Development of computer code (Focus today)
  - Development of logic (e.g., flowchart)
  - Assembly of correct lines of code
  - Testing and troubleshooting
  - Visualization of results
  - Optimization of code
- Analysis of results
- Synthesis

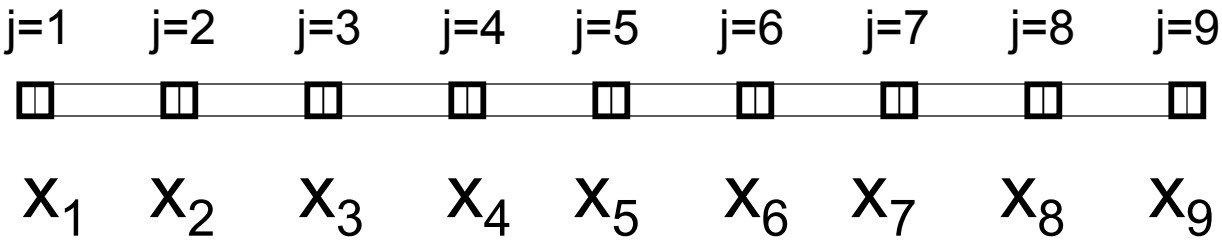
Definition of problem (Sorting a row array)

- Sort through row array A of random numbers, and organize them from left to right by increasing numerical value in array B
- Example
  - A = rand(1,4)
  - A =

    0.7621 0.4565 0.0185 0.8214
  - B =

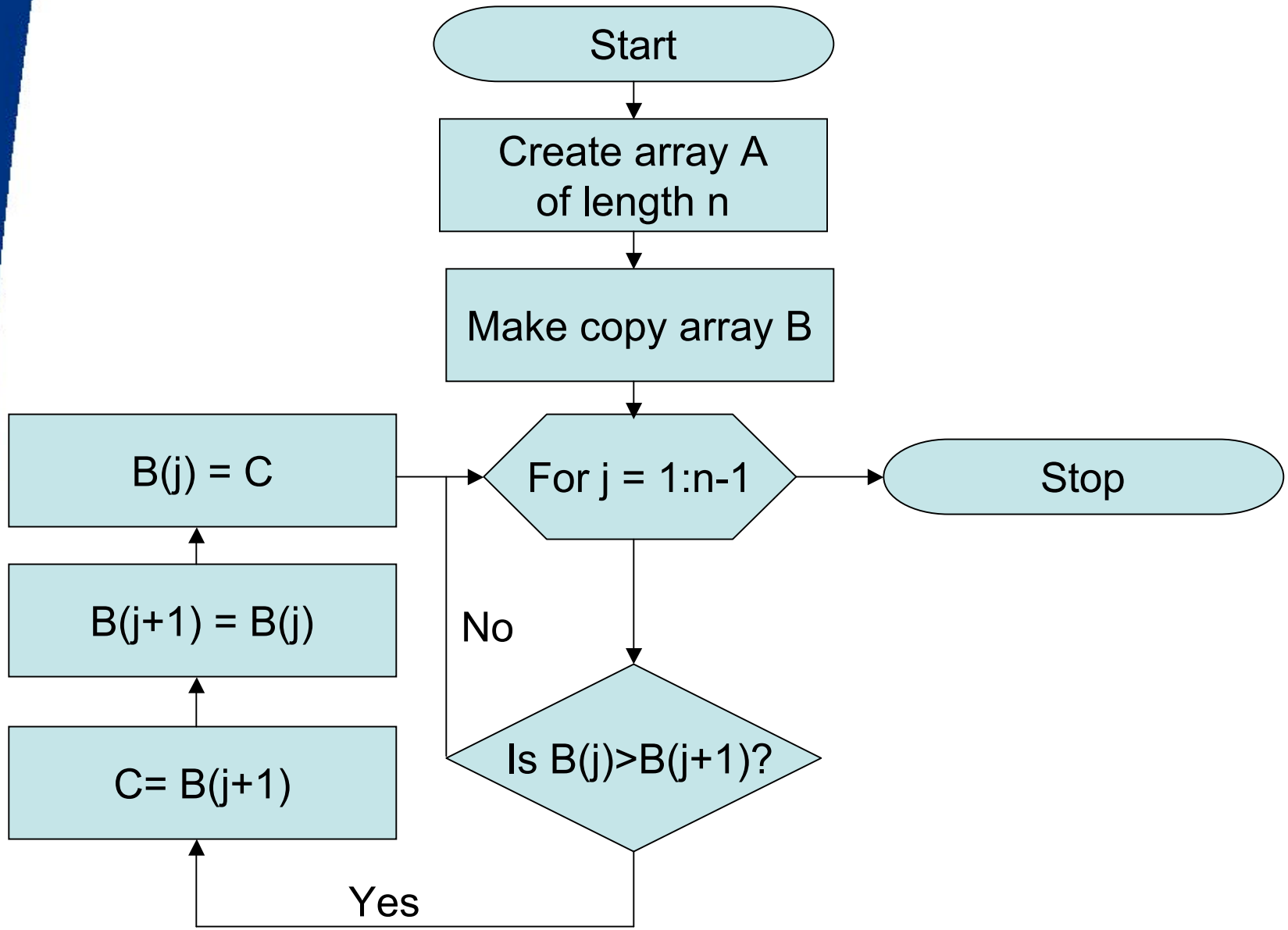
    0.0185 0.4565 0.7621 0.8214

Searching an Array



Here, the column number is “j”

Development of logic (first try)



Assembly of correct lines of code (a)

```
function [A,B] = gg250_lab_06_try(n)
% function [A,B] = gg250_lab_try(n)
% Partially sorts the elements in a vector array
% of n-elements on a single pass through the array.
% Input parameters
% n = input array
% Output parameters
% A = Unsorted array
% B = Partially sorted array
% Example
% [A,B] = gg250_lab_06_try(5)
```

Assembly of correct lines of code (b)

```
% Make copies of the input array
A = rand(n,1);
B = A;
% Find the number of elements in the array
n = length(A)
% Step through the elements one-by-one, switching
% consecutive elements such that the lower element
% comes before the higher element
for j = 1:(n-1)
    if B(j) > B(j+1)
    C = B(j+1);
    B(j+1) = B(j);
    B(j) = C;
    end
end
```

Testing and troubleshooting

Visualization of results

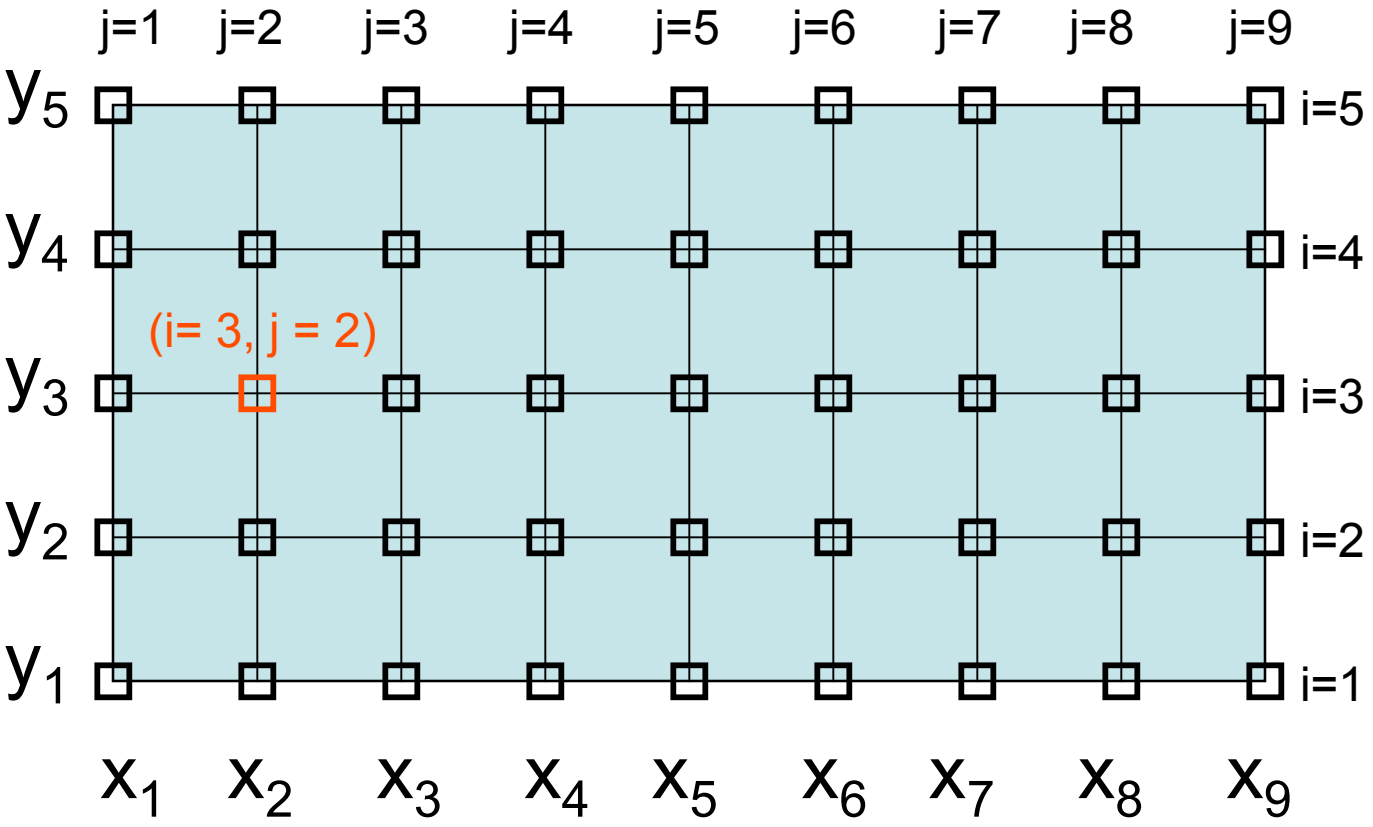
- Can plot the values of the elements vs. their position in the array by including the command

  plot B

Optimization of code

- See Matlab's sort command

Searching a Grid



Here, the row number is “i” and the column number is “j”

Searching a Grid

```
U = rand(5,9);     [n,m] = size(U);
for i = 1:n
   for j = 1:m
      if i==3 & j ==2; U(i,j) = 1;end
   end
end
```

Alternatives

```
U(3,2) = 2;
```

Or search a column vector form of U

```
T = U(:);
T((2-1).*n + 3) = 3;
T = reshape(T,n,m)
```