

# CPE 212 Algorithm Design (1/63)

## Lab 3: Johnson-Trotter Algorithm

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Due Date: 6/10/2563

จงเขียนโปรแกรมสำหรับการสร้างลิสต์ของ Permutation โดยใช้อัลกอริทึม Johnson-Trotter

### **ALGORITHM** *JohnsonTrotter(n)*

//Implements Johnson-Trotter algorithm for generating permutations

//Input: A positive integer  $n$

//Output: A list of all permutations of  $\{1, \dots, n\}$

initialize the first permutation with  $\overleftarrow{1} \overleftarrow{2} \dots \overleftarrow{n}$

**while** the last permutation has a mobile element **do**

    find its largest mobile element  $k$

    swap  $k$  with the adjacent element  $k$ 's arrow points to

    reverse the direction of all the elements that are larger than  $k$

    add the new permutation to the list

ตัวอย่างผลลัพธ์จากการสร้าง permutation โดยใช้ Johnson-Trotter

1.  $n = 3$

$\{1, 2, 3\}$   $\{1, 3, 2\}$   $\{3, 1, 2\}$

$\{3, 2, 1\}$   $\{2, 3, 1\}$   $\{2, 1, 3\}$

2.  $n = 4$

$\{1, 2, 3, 4\}$	$\{1, 2, 4, 3\}$	$\{1, 4, 2, 3\}$	$\{4, 1, 2, 3\}$
$\{4, 1, 3, 2\}$	$\{1, 4, 3, 2\}$	$\{1, 3, 4, 2\}$	$\{1, 3, 2, 4\}$
$\{3, 1, 2, 4\}$	$\{3, 1, 4, 2\}$	$\{3, 4, 1, 2\}$	$\{4, 3, 1, 2\}$
$\{4, 3, 2, 1\}$	$\{3, 4, 2, 1\}$	$\{3, 2, 4, 1\}$	$\{3, 2, 1, 4\}$
$\{2, 3, 1, 4\}$	$\{2, 3, 4, 1\}$	$\{2, 4, 3, 1\}$	$\{4, 2, 3, 1\}$
$\{4, 2, 1, 3\}$	$\{2, 4, 1, 3\}$	$\{2, 1, 4, 3\}$	$\{2, 1, 3, 4\}$

3.  $n = 5$

$\{1, 2, 3, 4, 5\}$	$\{1, 2, 3, 5, 4\}$	$\{1, 2, 5, 3, 4\}$	$\{1, 5, 2, 3, 4\}$	$\{5, 1, 2, 3, 4\}$
$\{5, 1, 2, 4, 3\}$	$\{1, 5, 2, 4, 3\}$	$\{1, 2, 5, 4, 3\}$	$\{1, 2, 4, 5, 3\}$	$\{1, 2, 4, 3, 5\}$
$\{1, 4, 2, 3, 5\}$	$\{1, 4, 2, 5, 3\}$	$\{1, 4, 5, 2, 3\}$	$\{1, 5, 4, 2, 3\}$	$\{5, 1, 4, 2, 3\}$
$\{5, 4, 1, 2, 3\}$	$\{4, 5, 1, 2, 3\}$	$\{4, 1, 5, 2, 3\}$	$\{4, 1, 2, 5, 3\}$	$\{4, 1, 2, 3, 5\}$
$\{4, 1, 3, 2, 5\}$	$\{4, 1, 3, 5, 2\}$	$\{4, 1, 5, 3, 2\}$	$\{4, 5, 1, 3, 2\}$	$\{5, 4, 1, 3, 2\}$
$\{5, 1, 4, 3, 2\}$	$\{1, 5, 4, 3, 2\}$	$\{1, 4, 5, 3, 2\}$	$\{1, 4, 3, 5, 2\}$	$\{1, 4, 3, 2, 5\}$
$\{1, 3, 4, 2, 5\}$	$\{1, 3, 4, 5, 2\}$	$\{1, 3, 5, 4, 2\}$	$\{1, 5, 3, 4, 2\}$	$\{5, 1, 3, 4, 2\}$
$\{5, 1, 3, 2, 4\}$	$\{1, 5, 3, 2, 4\}$	$\{1, 3, 5, 2, 4\}$	$\{1, 3, 2, 5, 4\}$	$\{1, 3, 2, 4, 5\}$
$\{3, 1, 2, 4, 5\}$	$\{3, 1, 2, 5, 4\}$	$\{3, 1, 5, 2, 4\}$	$\{3, 5, 1, 2, 4\}$	$\{5, 3, 1, 2, 4\}$
$\{5, 3, 1, 4, 2\}$	$\{3, 5, 1, 4, 2\}$	$\{3, 1, 5, 4, 2\}$	$\{3, 1, 4, 5, 2\}$	$\{3, 1, 4, 2, 5\}$
$\{3, 4, 1, 2, 5\}$	$\{3, 4, 1, 5, 2\}$	$\{3, 4, 5, 1, 2\}$	$\{3, 5, 4, 1, 2\}$	$\{5, 3, 4, 1, 2\}$
$\{5, 4, 3, 1, 2\}$	$\{4, 5, 3, 1, 2\}$	$\{4, 3, 5, 1, 2\}$	$\{4, 3, 1, 5, 2\}$	$\{4, 3, 1, 2, 5\}$
$\{4, 3, 2, 1, 5\}$	$\{4, 3, 2, 5, 1\}$	$\{4, 3, 5, 2, 1\}$	$\{4, 5, 3, 2, 1\}$	$\{5, 4, 3, 2, 1\}$
$\{5, 3, 4, 2, 1\}$	$\{3, 5, 4, 2, 1\}$	$\{3, 4, 5, 2, 1\}$	$\{3, 4, 2, 5, 1\}$	$\{3, 4, 2, 1, 5\}$
$\{3, 2, 4, 1, 5\}$	$\{3, 2, 4, 5, 1\}$	$\{3, 2, 5, 4, 1\}$	$\{3, 5, 2, 4, 1\}$	$\{5, 3, 2, 4, 1\}$
$\{5, 3, 2, 1, 4\}$	$\{3, 5, 2, 1, 4\}$	$\{3, 2, 5, 1, 4\}$	$\{3, 2, 1, 5, 4\}$	$\{3, 2, 1, 4, 5\}$
$\{2, 3, 1, 4, 5\}$	$\{2, 3, 1, 5, 4\}$	$\{2, 3, 5, 1, 4\}$	$\{2, 5, 3, 1, 4\}$	$\{5, 2, 3, 1, 4\}$
$\{5, 2, 3, 4, 1\}$	$\{2, 5, 3, 4, 1\}$	$\{2, 3, 5, 4, 1\}$	$\{2, 3, 4, 5, 1\}$	$\{2, 3, 4, 1, 5\}$
$\{2, 4, 3, 1, 5\}$	$\{2, 4, 3, 5, 1\}$	$\{2, 4, 5, 3, 1\}$	$\{2, 5, 4, 3, 1\}$	$\{5, 2, 4, 3, 1\}$
$\{5, 4, 2, 3, 1\}$	$\{4, 5, 2, 3, 1\}$	$\{4, 2, 5, 3, 1\}$	$\{4, 2, 3, 5, 1\}$	$\{4, 2, 3, 1, 5\}$
$\{4, 2, 1, 3, 5\}$	$\{4, 2, 1, 5, 3\}$	$\{4, 2, 5, 1, 3\}$	$\{4, 5, 2, 1, 3\}$	$\{5, 4, 2, 1, 3\}$
$\{5, 2, 4, 1, 3\}$	$\{2, 5, 4, 1, 3\}$	$\{2, 4, 5, 1, 3\}$	$\{2, 4, 1, 5, 3\}$	$\{2, 4, 1, 3, 5\}$
$\{2, 1, 4, 3, 5\}$	$\{2, 1, 4, 5, 3\}$	$\{2, 1, 5, 4, 3\}$	$\{2, 5, 1, 4, 3\}$	$\{5, 2, 1, 4, 3\}$
$\{5, 2, 1, 3, 4\}$	$\{2, 5, 1, 3, 4\}$	$\{2, 1, 5, 3, 4\}$	$\{2, 1, 3, 5, 4\}$	$\{2, 1, 3, 4, 5\}$