Java Parallel Streams Internals: Order of Results for Collections

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Learning Objectives in this Part of the Lesson

- Understand parallel stream internals, e.g.
  - Know what can change & what can’t
    - Splitting, combining, & pooling mechanisms
    - Order of processing
    - Order of results
      - Overview
      - Collections that affect results order
Learning Objectives in this Part of the Lesson

- Understand parallel stream internals, e.g.
- Know what can change & what can’t
  - Splitting, combining, & pooling mechanisms
- Order of processing
- Order of results
- Overview
- How collections affect results order

Multiple examples are analyzed in detail

```java
List<Integer> list = Arrays.asList(1, 2, ...);

Integer[] doubledList = list
    .parallelStream()
    .filter(x -> x % 2 == 0)
    .map(x -> x * 2)
    .toArray(Integer[]::new);
```

See [github.com/douglasraigschmidt/LiveLessons/tree/master/Java8/ex21](https://github.com/douglasraigschmidt/LiveLessons/tree/master/Java8/ex21)
Collections that Affect Results Order
Collections that Affect Results Order

- Encounter order is maintained by
  - Ordered spliterators
  - Ordered collections
  - Static stream factory methods

List<Integer> list = Arrays.asList(2, 3, 1, 4, 2);

Integer[] doubledList = list
  .parallelStream()
  .filter(x -> x % 2 == 0)
  .map(x -> x * 2)
  .toArray(Integer[]::new);

Encounter order is maintained by
- Ordered spliterators
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Collections that Affect Results Order

```java
List<Integer> list = Arrays.asList(2, 3, 1, 4, 2);

The encounter order is [2, 3, 1, 4, 2] since list is ordered & non-unique

Integer[] doubledList = list
    .parallelStream()
    .filter(x -> x % 2 == 0)
    .map(x -> x * 2)
    .toArray(Integer[]::new);
```

Recall that “ordered” isn’t the same as “sorted”!
Collections that Affect Results Order

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```java
List<Integer> list = Arrays.asList(2, 3, 1, 4, 2);

Integer[] doubledList = list
    .parallelStream()
    .filter(x -> x % 2 == 0)
    .map(x -> x * 2)
    .toArray(Integer[]::new);
```

Only even values continue thru stream
Collections that Affect Results Order

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List<Integer> list = Arrays.asList(2, 3, 1, 4, 2);

Integer[] doubledList = list
  .parallelStream()
  .filter(x -> x % 2 == 0)
  .map(x -> x * 2)
  .toArray(Integer[]::new);

Multiply each even number by 2
Collections that Affect Results Order

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```java
List<Integer> list = Arrays.asList(2, 3, 1, 4, 2);
Integer[] doubledList = list
        .parallelStream()
        .filter(x -> x % 2 == 0)
        .map(x -> x * 2)
        .toArray(Integer[]::new);
```

Convert stream into an array of integers
Encounter order is maintained by
- Ordered spliterators
- Ordered collections
- Static stream factory methods

Collections that Affect Results Order

List<Integer> list = Arrays.asList(2, 3, 1, 4, 2);

Integer[] doubledList = list.parallelStream()
.filter(x -> x % 2 == 0)
.map(x -> x * 2)
.toArray(Integer[]::new);

Result must be ordered as [4, 8, 4] since the list is an ordered collection
Unordered collections don’t need to respect encounter order

```java
Set<Integer> set = new HashSet<>(Arrays.asList(2, 3, 1, 4, 2))
Integer[] doubledSet = set
    .parallelStream()
    .filter(x -> x % 2 == 0)
    .map(x -> x * 2)
    .toArray(Integer[]::new);
```
Unordered collections don’t need to respect encounter order

Set<Integer> set = new
    HashSet<>(Arrays.asList
        (2, 3, 1, 4, 2));

Integer[] doubledSet = set
    .parallelStream()
    .filter(x -> x % 2 == 0)
    .map(x -> x * 2)
    .toArray(Integer[]::new);

A HashSet is unordered & unique
• Unordered collections don’t need to respect encounter order

Set<Integer> set = new
HashSet<>(Arrays.asList(2, 3, 1, 4, 2));

This code may run faster since encounter order need not be maintained in the end results, which could be [8, 4] or [4, 8]

Integer[] doubledSet = set
.parallelStream()
.filter(x -> x % 2 == 0)
.map(x -> x * 2)
.toArray(Integer[]::new);
End of Java Parallel Streams Internals: Order of Results for Collections