Java 8 Sequential Search

Example (Part 2)

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Learning Objectives in this Part of the Lesson

- Know how to apply sequential streams to the SearchStreamGang program
- Understand the SearchStreamGang printPhrases() method

```java
void printPhrases(List<List<SearchResults>> listOfListOfSearchResults) {
    Map<String, List<SearchResults>> resultsMap =
        listOfListOfSearchResults
            .stream()
            .flatMap(List::stream)
            .collect(groupingBy(SearchResults::getTitle));

    resultsMap.forEach((key, value) -> {
        System.out.println("Title \"" + key + "\" contained");
        value.forEach(SearchResults::print);
    });
}
```

Visualizing printPhrases()
Visualizing printPhrases()

- SearchStreamGang.printPhrases() displays phrases associated with each play...

Title "The Tragedy of Hamlet, Prince of Denmark" contained
"It shall be so. Madness in great ones must not unwatch'd go." at [89594]
"Give every man thine ear, but few thy voice" at [26207]
"There is nothing either good or bad but thinking makes it so" at [62609]
"To be, or not to be- that is the question" at [83061]
"Neither a borrower nor a lender be" at [26556]
"This above all- to thine own self be true, And it must follow, as the night the day, Thou canst not then be false to any man" at [26693]
"Frailty, thy name is woman" at [17233]
"The lady doth protest too much, methinks" at [102267]
"Get thee to a nunnery" at [86071|86953]
"Brevity is the soul of wit" at [54747]

...
Visualizing `printPhrases()`

- `printPhrases()` uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.
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```
List<List<SearchResults>>
```

**Output a stream of lists of search results**

```
Stream<List<SearchResults>>
```

```
stream()
```
printPhrases() uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.

**Input a stream of lists of search results**

```
List<List<SearchResults>>
```

```
Stream<List<List<SearchResults>>>
```

```
stream()
```

```
flatMap(List::stream)
```
Visualizing `printPhrases()`

- `printPhrases()` uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.

Flatten the stream of lists of search results to a stream of search results.
Visualizing `printPhrases()`

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Visualizing `printPhrases()`

- `printPhrases()` uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.

```
List<List<SearchResults>>
```

```
Stream<List<SearchResults>>
```

```
Stream<SearchResults>
```

```
Input a stream of search results
```

```
flatMap(List::stream)
```

```
stream()
```

```
collect(groupingBy(...))
```
printPhrases() uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.

Visualizing printPhrases()

- `printPhrases()` uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.

```
List<List<SearchResults>>
Stream<List<SearchResults>>
Stream<SearchResults>
```

```
stream()
flatMap(List::stream)
collect(groupingBy(…))
```

Trigger intermediate operation processing
Visualizing `printPhrases()`

- `printPhrases()` uses a stream that converts a list of lists of search results into a map that associates phrases with the plays where they were found.

```
List<List<SearchResults>>
```

```
Stream<List<SearchResults>>
```

```
Stream<SearchResults>
```

```
Map<String, List<SearchResults>>
```

Create a map that groups phrases according to the plays where they appear.
Implementing `printPhrases()` as a Sequential Stream
Implementing `printPhrases()` as a Sequential Stream

- `printPhrases()` uses a stream to converts a list of lists of search results to a map that associates phrases found in the input with the plays where they were found.

```java
Stream<List<SearchResults>>
flatMap(List::stream)
collect(groupingBy(...))
```

Diagram:
- List<List<SearchResults>>
- Stream<List<SearchResults>>
- Stream<SearchResults>
- Map<String, List<SearchResults>>
Implementing printPhrases() as a Sequential Stream

- printPhrases() uses a stream to display phrases associated with each play

```java
void printPhrases(List<List<SearchResults>> listOfListOfResults)
{
    Map<String, List<SearchResults>> map = listOfListOfResults
        .stream()
        .flatMap(List::stream)
        .collect(groupingBy(SearchResults::getTitle));

    map.forEach((key, value) -> {
        System.out.println("Title " + key + " contained");
        value.forEach(SearchResults::print);});
}
```

Implementing printPhrases() as a Sequential Stream

- printPhrases() uses a stream to display phrases associated with each play.

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        .stream()
        .flatMap(List::stream)
        .collect(groupingBy(SearchResults::getTitle));

    map.forEach((key, value) -> {
        System.out.println("Title \"");
        + key
        + "\" contained");
        value.forEach(SearchResults::print);
    });
}
```

Converts the list of lists of search results into a stream of lists of search results.
Implementing `printPhrases()` as a Sequential Stream

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    map.forEach((key, value) -> {
        System.out.println("Title \"" + key + "\" contained");
        value.forEach(SearchResults::print);
    });
}
```

*Returns an output stream containing the results of flattening the stream of lists into a stream of search results.*

See [docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html#flatMap](https://docs.oracle.com/javase/8/docs/api/java/util/stream/Stream.html#flatMap)
Implementing `printPhrases()` as a Sequential Stream

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        .stream()
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        .collect(groupingBy(SearchResults::getTitle));

    map.forEach((key, value) -> {
        System.out.println("Title \"
            + key
            + "\" contained");
        value.forEach(SearchResults::print);
    });
}
```

The number of output stream elements may differ from the number of input stream elements.
Implementing `printPhrases()` as a Sequential Stream

- `printPhrases()` uses a stream to display phrases associated with each play.

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    Map<String, List<SearchResults>> map = listOfListOfResults.stream()
        .flatMap(List::stream)
        .collect(groupingBy(SearchResults::getTitle));

    map.forEach((key, value) -> {
        System.out.println("Title "+ key + " contained ";
        value.forEach(SearchResults::print));
    });
}
```

`flatMap()` can also transform its input stream type into a different output stream type.
Implementing `printPhrases()` as a Sequential Stream

- `printPhrases()` uses a stream to display phrases associated with each play.

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    map.forEach((key, value) -> {
        System.out.println("Title " + key + " contained");
        value.forEach(SearchResults::print);
    });
}
```

See [docs.oracle.com/javase/8/docs/api/java/util/stream/Collectors.html#groupingBy](https://docs.oracle.com/javase/8/docs/api/java/util/stream/Collectors.html#groupingBy)
Implementing printPhrases() as a Sequential Stream

- printPhrases() uses a stream to display phrases associated with each play.

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    Map<String, List<SearchResults>> map = listOfListOfResults.stream()
        .flatMap(List::stream)
        .collect(groupingBy(SearchResults::getTitle));

    map.forEach((key, value) -> {
        System.out.println("Title " + key + " contained" + "\" contained");
        value.forEach(SearchResults::print);
    });
}
```

See [docs.oracle.com/javase/8/docs/api/java/util/Map.html](docs.oracle.com/javase/8/docs/api/java/util/Map.html)

Associates phrases found in input with titles where they were found
Implementing printPhrases() as a Sequential Stream

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    map.forEach((key, value) -> {
        System.out.println("Title ")
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        value.forEach(SearchResults::print);
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}
```

See [docs.oracle.com/javase/8/docs/api/java/util/Map.html#forEach](https://docs.oracle.com/javase/8/docs/api/java/util/Map.html#forEach)
End of Java 8 Sequential SearchStreamGang Example (Part 2)