Java Sequential SearchStreamGang Example: Implementing Hook Methods

Douglas C. Schmidt

d.schmidt@vanderbilt.edu

www.dre.vanderbilt.edu/~schmidt

Professor of Computer Science

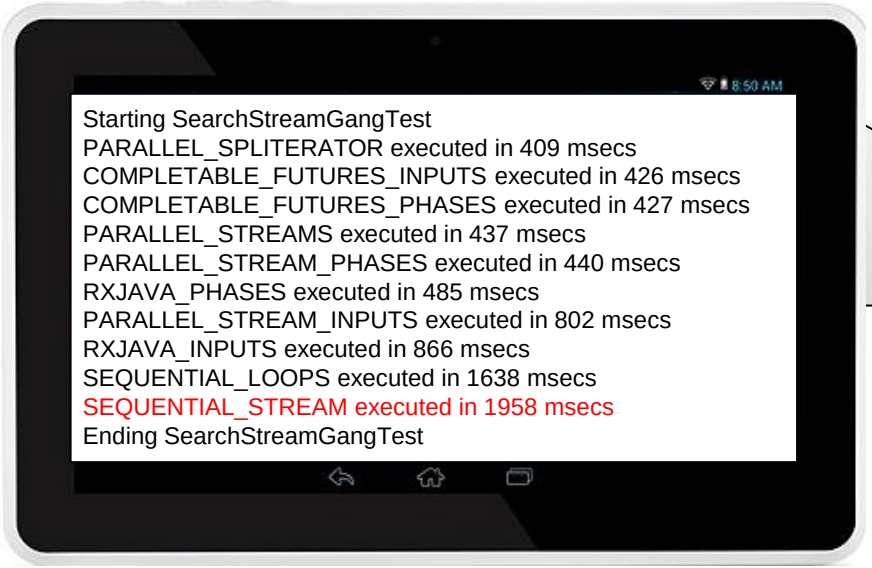
Institute for Software Integrated Systems

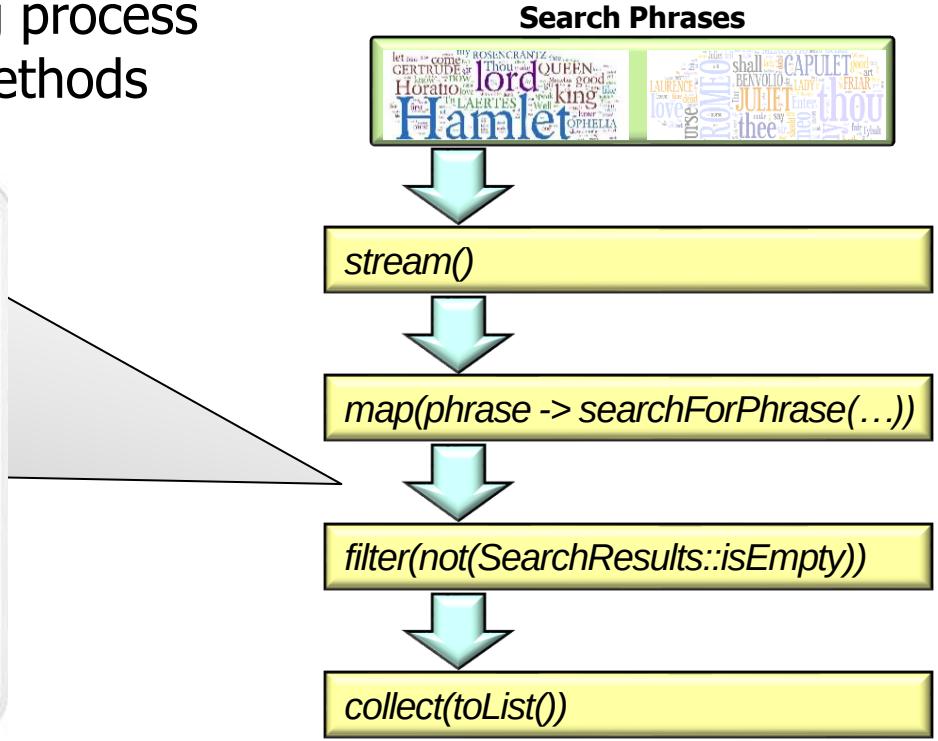
Vanderbilt University

Nashville, Tennessee, USA

Learning Objectives in this Part of the Lesson

- Know how to apply sequential streams to the SearchStreamGang program
  - Understand the SearchStreamGang process Stream() & processInput() hook methods





Implementing processStream() as a Sequential Stream

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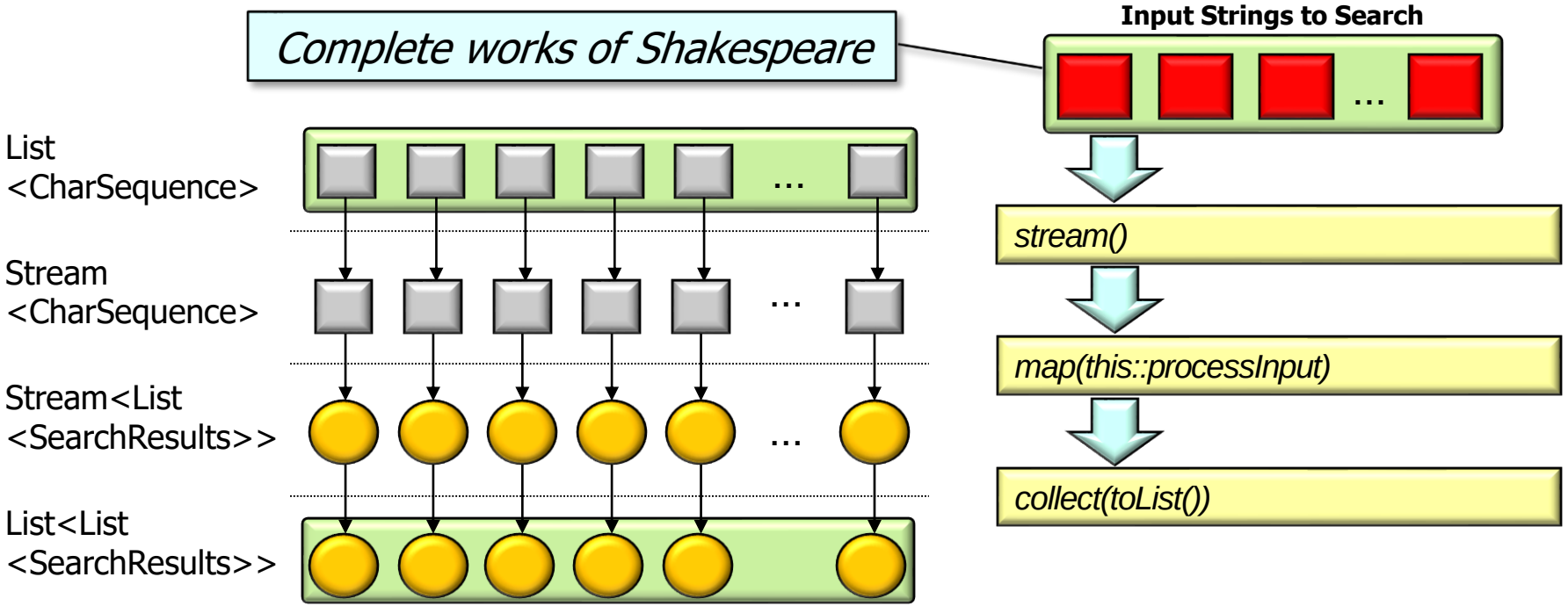
- processStream() sequentially searches for phrases in lists of input "strings"



Implementing processStream() as a Sequential Stream

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```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

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```

Get list of strings containing all works of Shakespeare

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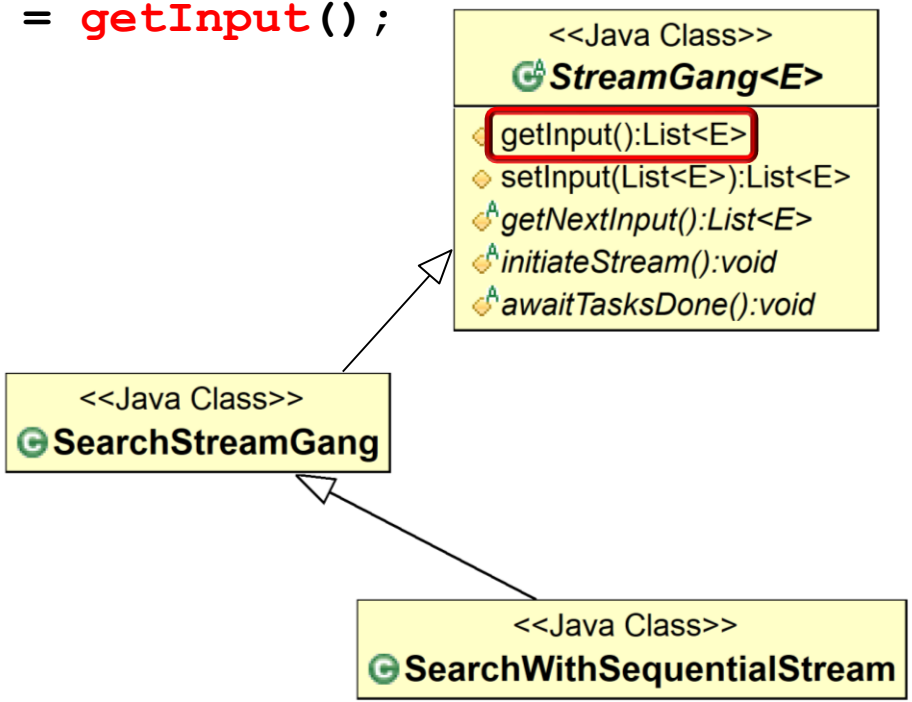

The `getInput()` method is defined in the StreamGang framework

Implementing processStream() as a Sequential Stream

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}
```

CharSequence optimizes subSequence() to avoid memory copies (cf. String substring())

See www.javaspecialists.eu/archive/Issue230.html

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}
```

Returns a list of lists of search results denoting how many times a search phrase appeared in each input string

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```
protected List<List<SearchResults>> processStream() {
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  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

We'll later show how flatMap() "flattens" List<List<SearchResults>> into a stream of SearchResults

See "*Java 8 Sequential SearchStreamGang Example: Implementing printPhrases()*"

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

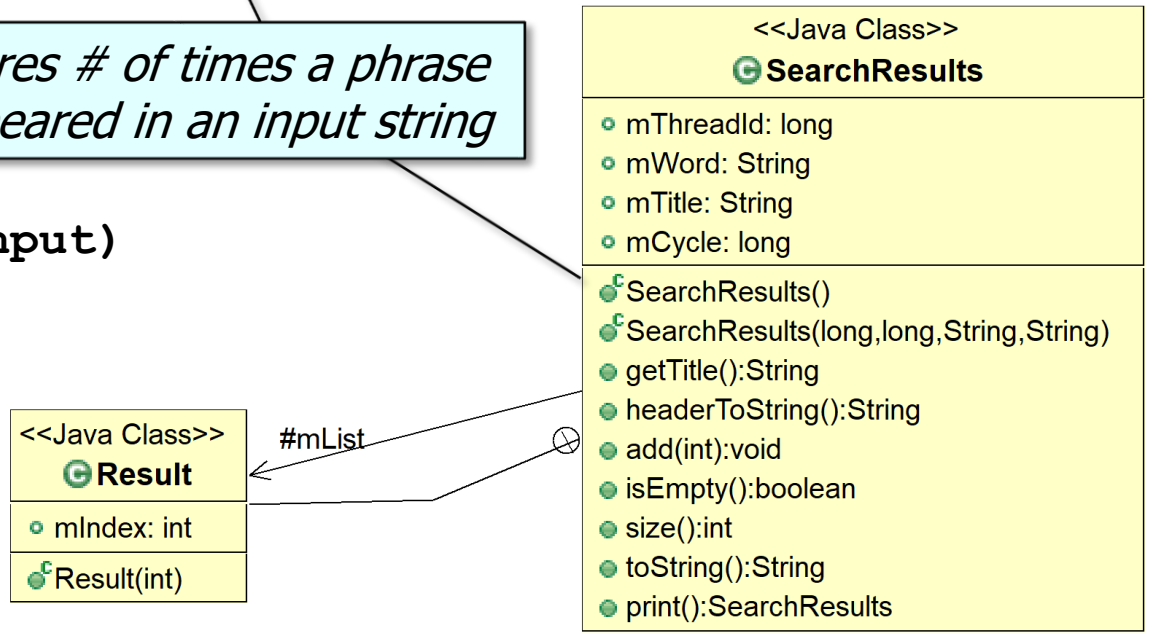
```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

Stores # of times a phrase appeared in an input string



See livelessons/utils/SearchResults.java

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
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  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

processStream() is implemented via a sequential stream pipeline

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

This factory method converts the input list into a stream

`stream()` uses `StreamSupport.stream(spliterator(),false)`

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

The processInput() method reference is applied to each input in the stream

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

processInput() returns a list of SearchResults—one list for each input string

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

    .map(this::processInput)

    .collect(toList());
}
```

This terminal operation triggers intermediate operation processing

collect() allocates memory for results, which is less error-prone than OO version!

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
protected List<List<SearchResults>> processStream() {
  List<CharSequence> inputList = getInput();

  return inputList
    .stream()

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    .collect(toList());
}
```

Yields a list (of lists) of search results

Implementing processStream() as a Sequential Stream

- processStream() sequentially searches for phrases in lists of input "strings"

```
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  List<CharSequence> inputList = getInput();

  return inputList
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}
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Returns a list of lists of search results denoting how many times a search phrase appeared in each input string

Implementing processInput() as a Sequential Stream

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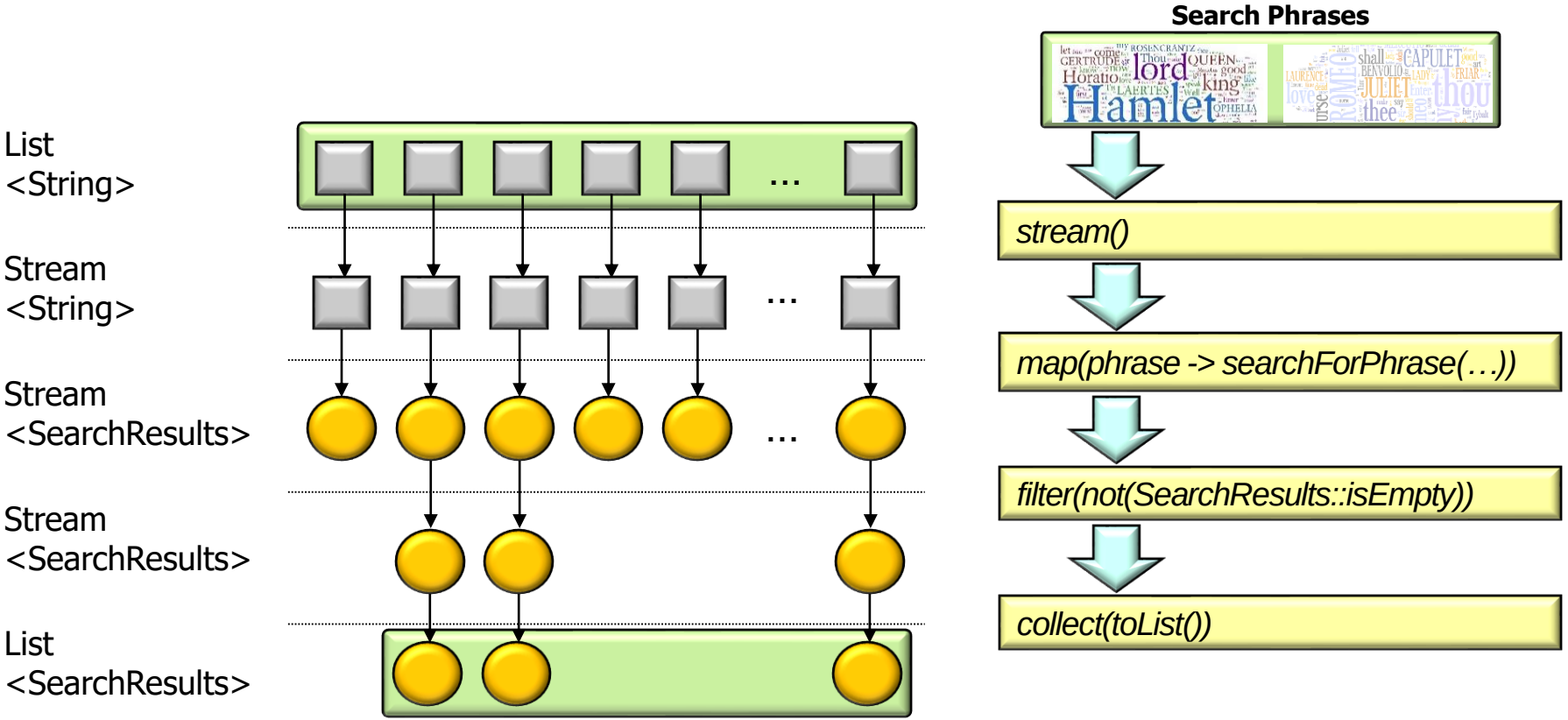
- processInput() searches an input string for all occurrences of phrases to find



Implementing processInput() as a Sequential Stream

- processInput() searches an input string for all occurrences of phrases to find

```
List<SearchResults> processInput(CharSequence inputSeq) {
  String title = getTitle(inputSeq);
  CharSequence input = inputSeq.subSequence(...);


  List<SearchResults> results = mPhrasesToFind
    .stream()
    .map(phrase
         -> searchForPhrase(phrase, input, title, false))
    .filter(not(SearchResults::isEmpty))

    .collect(toList());
  return results;
}
```

Implementing processInput() as a Sequential Stream

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     .collect(toList());
  return results;
}
```

The input is a section of a text file managed by the test driver program

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    .map(phrase
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    .filter(not(SearchResults::isEmpty))

    .collect(toList());
  return results;
}
```

The input string is split into two parts

Implementing processInput() as a Sequential Stream

- processInput() searches an input string for all occurrences of phrases to find

```
List<SearchResults> processInput(CharSequence inputSeq) {
  String title = getTitle(inputSeq);
  CharSequence input = inputSeq.subSequence(...);
```

subSequence() is used to avoid memory copying overhead for substrings

```
  List<SearchResults> results = mPhrasesToFind
    .stream()
    .map(phrase
         -> searchForPhrase(phrase, input, title, false))
    .filter(not(SearchResults::isEmpty))

    .collect(toList());
  return results;
}
```

See SearchStreamGang/src/main/java/livelessons/utils/SharedString.java

Implementing processInput() as a Sequential Stream

- processInput() searches an input string for all occurrences of phrases to find

```
List<SearchResults> processInput(CharSequence inputSeq) {
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     .stream()
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     .filter(not(SearchResults::isEmpty))

     .collect(toList());
  return results;
}
```

Convert a list of phrases into a stream

Implementing processInput() as a Sequential Stream

- processInput() searches an input string for all occurrences of phrases to find

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     .stream()
     .map(phrase
          -> searchForPhrase(phrase, input, title, false))
     .filter(not(SearchResults::isEmpty))

     .collect(toList());
  return results;
}
```

Apply this function lambda to all phrases in input stream & return an output stream of SearchResults

See upcoming lesson on "*Java Sequential SearchStreamGang Example: Applying Spliterator*"

Implementing processInput() as a Sequential Stream

- processInput() searches an input string for all occurrences of phrases to find

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     .filter(not(SearchResults::isEmpty))

     .collect(toList());
  return results;
}
```

Returns output stream containing non-empty SearchResults from input stream

Implementing processInput() as a Sequential Stream

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     .filter(not(SearchResults::isEmpty))

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}
```

This approach uses a method reference along with a negator predicate lambda

See SearchStreamGang/src/main/java/livelessons/utils/StreamsUtils.java

Implementing processInput() as a Sequential Stream

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  List<SearchResults> results = mPhrasesToFind
     .stream()
     .map(phrase
          -> searchForPhrase(phrase, input, title, false))
     .filter(((Predicate<String>) SearchResults::isEmpty))
             .negate())
     .collect(toList());
  return results;
}
```

Another approach uses a composed predicate

See docs.oracle.com/javase/8/docs/api/java/util/function/Predicate.html#negate

Implementing processInput() as a Sequential Stream

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    .stream()
    .map(phrase
         -> searchForPhrase(phrase, input, title, false))
    .filter(result -> result.size() > 0)

    .collect(toList());
  return results;
}
```

Yet another approach uses a lambda expression

Implementing processInput() as a Sequential Stream

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  return results;
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```

These are both intermediate operations

There are no control constructs in this code, which makes it easier to read!

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This terminal operation triggers intermediate operation processing & yields a list result

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The list result is returned back to the map() operation in processStream()

End of Java Sequential SearchStreamGang Example: Implementing Hook Methods