```
Logger.getLogger(WordCount.class.getName()).log(Level.SEVERE, null, ex);
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          URI file = WordCount.class.getResource("given/MarkTwain.utf8.txt").toURI();
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   .collect(groupingBy(w -> w, counting())) // terminal operation
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   .entrySet().stream().sorted((e1, e2) -> (int) (e2.getValue()
                                      ^2 ^{\ast} To change this license header, choose License Headers in Project Properties. ^3 ^{\ast} To change this template file, choose Tools | Templates
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      lines.flatMap(line -> Arrays.stream(line.replaceAll("[^a-zA-Z ]",
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          .forEach(System.out::println); // terminal operation
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     public static void main(String[] args) throws URISyntaxException {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   try (Stream<String> lines = Files.lines(path)) {
                                                                                                                                                                                                                                                                                                   static java.util.stream.Collectors.groupingBy
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 // .peek(System.out::println)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              .filter(w -> !w.isEmpty())
                                                                          * and open the template in the editor
                                                                                                                                                                                           java.net.URISyntaxException;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               catch (IOException ex) {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         ").toLowerCase().split("\\s+")))
                                                                                                                                                                                                                                                                                         java.util.logging.Level;
                                                                                                                                                                                                                                                   java.nio.file.Paths;
                                                                                                                                                     8 import java.io.IOException;
9 import java.net.URI;
                                                                                                                                                                                                               java.nio.file.Files;
                                                                                                                                                                                                                                  java.nio.file.Path;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      e1.getValue())).limit(10)
                                                                                                                                                                                                                                                                     java.util.Arrays;
                                                                                                                 6 package lab11.solution;
7
2021/12/10 上午3:08
                                                                                                                                                                                                           11 import
12 import
13 import
14 import
15 import
                                                                                                                                                                                             import
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localhost:4649/?mode=clike 7 localhost:4649/?mode=clike

```
.sorted(Map.Entry.comparingByKey()).forEach(System.out::println);
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      Logger.getLogger(WordGroupCount.class.getName()).log(Level.SEVERE, null,
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         URI file = WordCount.class.getResource("given/MarkTwain.utf8.txt").toURI();
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 .parallel().filter(w -> !w.isEmpty()).map(w -> w.charAt(0))
* To change this license header, choose License Headers in Project Properties.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        lines.flatMap(line -> Arrays.stream(line.replaceAll("[^a-zA-Z ]",
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              public static void main(String[] args) throws URISyntaxException {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         .collect(Collectors.toMap(w -> w, w -> 1,
                    * To change this template file, choose Tools | Templates
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             try (Stream<String> lines = Files.lines(path))
                                           * and open the template in the editor.
                                                                                                                                                                                             11 import java.nio.file.Files;
12 import java.nio.file.Path;
13 import java.nio.file.Paths;
14 import java.util.Arays;
15 import java.util.Map;
16 import java.util.logging.Level;
17 import java.util.logging.Logger;
18 import java.util.stream.Collectors;
19 import java.util.stream.Stream;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Path path = Paths.get(file);
                                                                                                                                                                               java.net.URISyntaxException;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 catch (IOException ex) {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Integer::sum)).entrySet().stream()
                                                                                                                                                                                                                                                                                                                                                                                                                      ").toLowerCase().split("\\s+")))
                                                                                                                                 8 import java.io.IOException;
9 import java.net.URI;
                                                                                      6 package lab11.solution;
7
                                                                                                                                                                              10 import
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              ex);
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               44 }
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     35
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```

WordGroupCount.java

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```
Using such a "hack" will induce side effect to the program and is not
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               URI file = WordCount.class.getResource("given/MarkTwain.utf8.txt").toURI();
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             The variable prev serves as a holder object and is effectively final
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 * stream. For a parallel stream, the result will become unpredictable
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  PrintWriter writer = new PrintWriter(new File("paircount.txt"))) {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              * Note that a lambda can only access free variables (the variables in
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               practice in general. Pure functional program has no side effect at
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ^st object reference does not change after initialization (effectively
2 * To change this license header, choose License Headers in Project Properties.
3 * To change this template file, choose Tools | Templates
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        The attempt here does not cause problem because the stream is a
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         public static void main(String[] args) throws URISyntaxException {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      * enclosing context) that are final or effectively final
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            try (Stream<String> lines = Files.lines(path);
                                                                                                                                                                                                                                                                                                                                                                                                                                 static java.util.stream.Collectors.groupingBy
                                                                                                                                                                                                                                                                                                                                                                                                               static java.util.stream.Collectors.counting;
                                       * and open the template in the editor
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              * the object is mutable.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      Path path = Paths.get(file)
                                                                                                                                                                                                                                                                                                                                                    java.util.function.Function;
                                                                                                                                                                                                         java.net.URISyntaxException;
                                                                                                                                                                                                                                                                                                                                                                                             java.util.logging.Logger
                                                                                                                                                                                                                                                                                                                                                                          java.util.logging.Level;
                                                                                                                                                                                                                                                                                   java.util.stream.Stream;
                                                                                                                                                                                                                                                                       java.nio.file.Paths;
                                                                                                                                           java.io.IOException;
                                                                                                                                                                 java.io.PrintWriter;
                                                                                                                                                                                                                             java.nio.file.Files;
                                                                                                                                                                                                                                               java.nio.file.Path;
                                                                               6 package lab11.solution;
7
                                                                                                                        8 import java.io.File;
9 import java.io.IOExc
                                                                                                                                                                                        java.net.URI;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        final) but
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                sequential
                                                                                                                                                                                  11 import
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      due to
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                all.
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localhost:4649/?mode=clike 1/2 localhost:4649/?mode=clike

```
.sorted(Map.Entry.comparingByValue(Comparator.reverseOrder())).limit(10).peek(System
                                                                                                                                                                                                                                                                                                                                                                                                                         Logger.getLogger(WordPairCount.class.getName()).log(Level.SEVERE, null,
                                                                                                                                                                                                                                                                                                                                           -> writer.printf("%s %s=%d\n", e.getKey().getKey(),
                                                                                                                                                           Map.Entry<String, String> pair = Map.entry(prev[0], w);
                                                                                                 lines.flatMap(line -> Arrays.stream(line.replaceAll("[^a-zA-Z ]",
                                                                                                                                                                                                    return pair;
}).collect(groupingBy(Function.identity(),
WordPairCount.java
                                                                                                                                      .filter(w -> !w.isEmpty()).map(w ->
                    * the concurrent access to prev.
                                                                                                                                                                                                                                                                                                                                                                e.getKey().getValue(), e.getValue()));
                                                                                                                                                                                 prev[0] = w;
                                                         String[] prev = { "" };
                                                                                                                                                                                                                                                                                                                                                                                                    } catch (IOException ex) {
                                                                                                                   ").toLowerCase().split("\\s+")))
                                                                                                                                                                                                                                          counting())).entrySet().stream()
                                                                                                                                                                                                                                                                                                     out::println)
 2021/12/10 上午3:09
                                                                                                                                                                                                                                                                                                                                                                                                                                                ex);
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```

WordPairCount.java

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