Practical no. 5

FS19CO042

Aim: Using Stream API implement following programs.

- 5.1 Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).
- 5.2 Write a method which takes a list of words as an argument, groups the words by their lengths and returns the groupings in the form of Map>. (The keys in the map are the lengths and the values are the lists of words of that length.)
- 5.3 Given a List<List> write a program to convert it into a List. (Hint: Use flatMap method in Stream interface)
- 5.4 Given: class Album{ public final String name; public final int yearOfRelease; public final List tracks; }
  class Track{ public final int rating; }
  a) Write a method which takes a list of albums as an argument and returns a list of names of all albums sorted by the year of release.
  b) Write a method which takes a list of albums as an argument and returns a list of names of all albums containing at least one track having rating more than four. The returned list should be sorted by the year of release.

Tool used: Editor (Notepad/Intellij IDE), JDK and JRE

Theory:

Stream In Java

Introduced in Java 8, the Stream API is used to process collections of objects. A stream is a sequence of objects that supports various methods which can be pipelined to produce the desired result.
The features of Java stream are –

- A stream is not a data structure instead it takes input from the Collections, Arrays or I/O channels.
- Streams don't change the original data structure, they only provide the result as per the pipelined methods.
- Each intermediate operation is lazily executed and returns a stream as a result, hence various intermediate operations can be pipelined. Terminal operations mark the end of the stream and return the result.

Different Operations On Streams-

Intermediate Operations:

1. **map:** The map method is used to returns a stream consisting of the results of applying the given function to the elements of this stream.
```
List number = Arrays.asList(2,3,4,5);
List square = number.stream().map(x->x*x).collect(Collectors.toList());
```
2. **filter:** The filter method is used to select elements as per the Predicate passed as argument.
```
List names = Arrays.asList("Reflection","Collection","Stream");
List result = names.stream().filter(s->s.startsWith("S")).collect(Collectors.toList());
```

3. **sorted:** The sorted method is used to sort the stream.

   ```
   List names = Arrays.asList("Reflection","Collection","Stream");
   List result = names.stream().sorted().collect(Collectors.toList());
   ```

Terminal Operations:

1. **collect:** The collect method is used to return the result of the intermediate operations performed on the stream.

   ```
   List number = Arrays.asList(2,3,4,5,3);
   Set square = number.stream().map(x->x*x).collect(Collectors.toSet());
   ```

2. **forEach:** The forEach method is used to iterate through every element of the stream.

   ```
   List number = Arrays.asList(2,3,4,5);
   number.stream().map(x->x*x).forEach(y->System.out.println(y));
   ```

3. **reduce:** The reduce method is used to reduce the elements of a stream to a single value.
   The reduce method takes a BinaryOperator as a parameter.

   ```
   List number = Arrays.asList(2,3,4,5);
   int even = number.stream().filter(x->x%2==0).reduce(0,(ans,i)-> ans+i);
   ```

   Here ans variable is assigned 0 as the initial value and i is added to it .

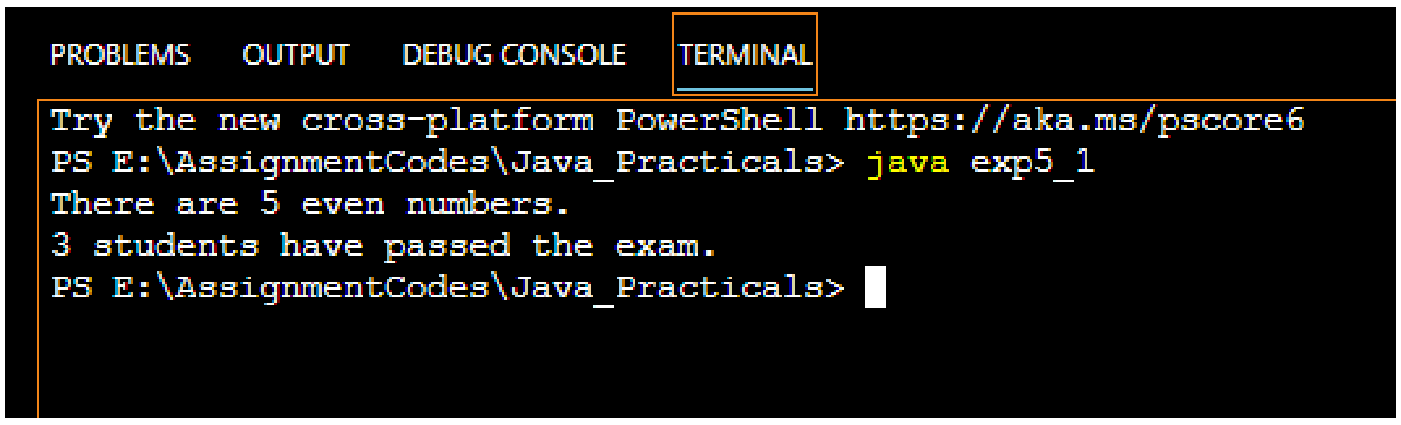
Code:

- **5.1 Write a generic method to count the number of elements in a collection that have a specific property (for example, odd integers, prime numbers, palindromes).**

```
import java.util.Arrays;
import java.util.List;
import java.util.stream.Stream;

public class  exp5_1 {

  static class Student {
    String name = "";
    public int roll = 0;
    public int marks = 0;
    public Student(String name, int roll, int marks) {
      this.name = name;
      this.roll = roll;
      this.marks = marks;
    }
  }

  public static <T extends  Number> long  evenNumbers(List<T> list) {
    Stream<T> stream = list.stream();
    return stream.filter(number -> number.doubleValue() % 2 != 0).count();
```

```
    }

    public static <T extends Student> long  numberOfPassedStudents(List<? extends Student> list) {
      Stream<T> stream = (Stream<T>) list.stream();
      return stream.filter(student -> student.marks >= 35).count();

    }

    public static void main(String[] args) {

      Student s1 = new Student("Roy", 43, 60);
      Student s2 = new Student("Niel", 44, 49);
      Student s3 = new Student("Leo", 30, 75);
      Student s4 = new Student("lisa", 35, 30);
      Student s5 = new Student("Russ", 40, 28);

      List<Integer> list = Arrays.asList(1, 2, 3, 4, 5, 6, 7, 8, 9, 10);
      List<Student> list1 = Arrays.asList(s1, s2, s3, s4, s5);

      long evenNumbers = evenNumbers(list) ;
      long numberOfPassedStudents = numberOfPassedStudents(list1) ;

      System.out.println("There are "+ evenNumbers +" even numbers.");
      System.out.println(numberOfPassedStudents+" students have passed the exam.");
    }
  }
```

Output:



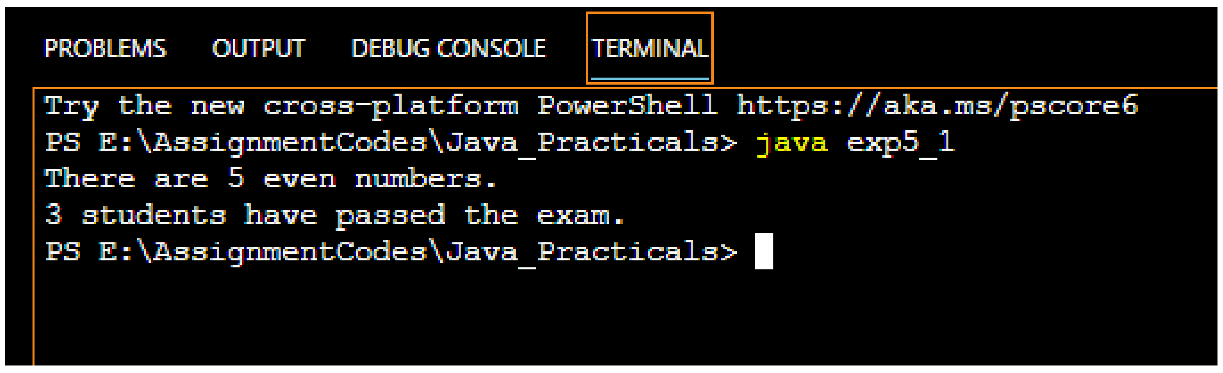
```
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS E:\AssignmentCodes\Java_Practicals> java exp5_1
There are 5 even numbers.
3 students have passed the exam.
PS E:\AssignmentCodes\Java_Practicals>
```

- **5.2 Write a method which takes a list of words as an argument, groups the words by their lengths and returns the groupings in the form of Map>. (The keys in the map are the lengths and the values are the lists of words of that length.)**

```
import java.util.*;
import java.util.stream.Collectors;
import java.util.stream.Stream;

// main class and method
public class exp5_2{

  // main Driver
  private static Stream<String> stream;
```

```
    public static void main(String[] args)
    {

        // create a list

List<String> strings = Arrays.asList("this", "is", "a", "long", "list", "of",
        "strings", "to", "use", "as", "a", "trial");

stream = strings.stream();
Map<Integer, List<String>> lengthMap = stream.collect(Collectors.groupingBy(String::length));

lengthMap.forEach((k,v) -> System.out.printf("%d: %s%n", k, v));
    }
}
```

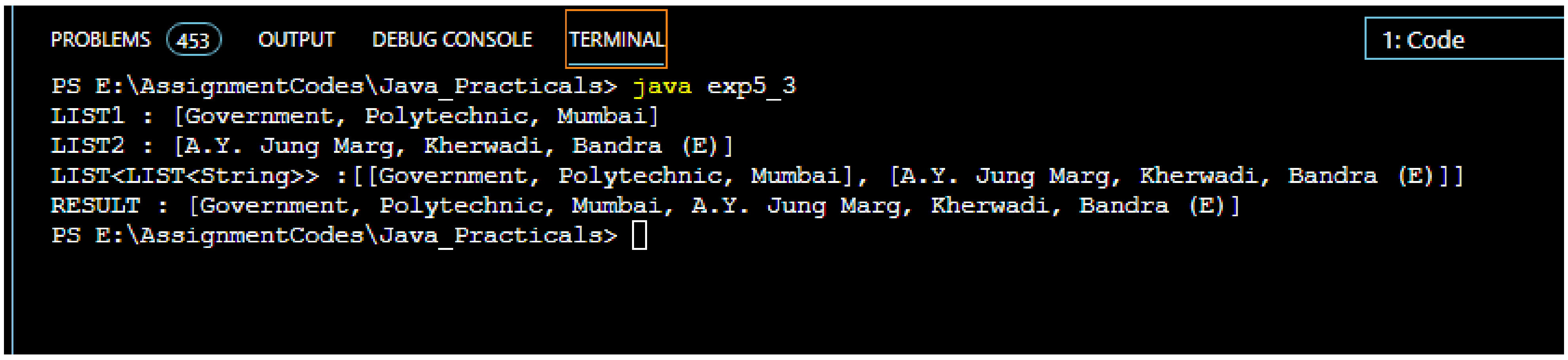
Output:



```
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS E:\AssignmentCodes\Java_Practicals> java exp5_1
There are 5 even numbers.
3 students have passed the exam.
PS E:\AssignmentCodes\Java_Practicals>
```

- **5.3 Given a List<List> write a program to convert it into a List. (Hint: Use flatMap method in Stream interface)**

```
import java.util.*;

import java.util.stream.*;

class exp5_3 {

    public static void main(String[] args) {

        ArrayList<String> list1 = new ArrayList();

        list1.add("Government");

        list1.add("Polytechnic");

        list1.add("Mumbai");


        ArrayList<String> list2 = new ArrayList();

        list2.add("A.Y. Jung Marg");

        list2.add("Kherwadi");

        list2.add("Bandra (E)");


        ArrayList<ArrayList<String>> listOflist = new ArrayList();

        listOflist.add(list1);

        listOflist.add(list2);
        System.out.println("LIST1 : " + list1);
        System.out.println("LIST2 : " + list2);
        System.out.println("LIST<LIST<String>> :" + listOflist);

        ArrayList<String> result = new ArrayList();
        listOflist.forEach(result::addAll);

        System.out.println("RESULT : " + result);
    }
}
```



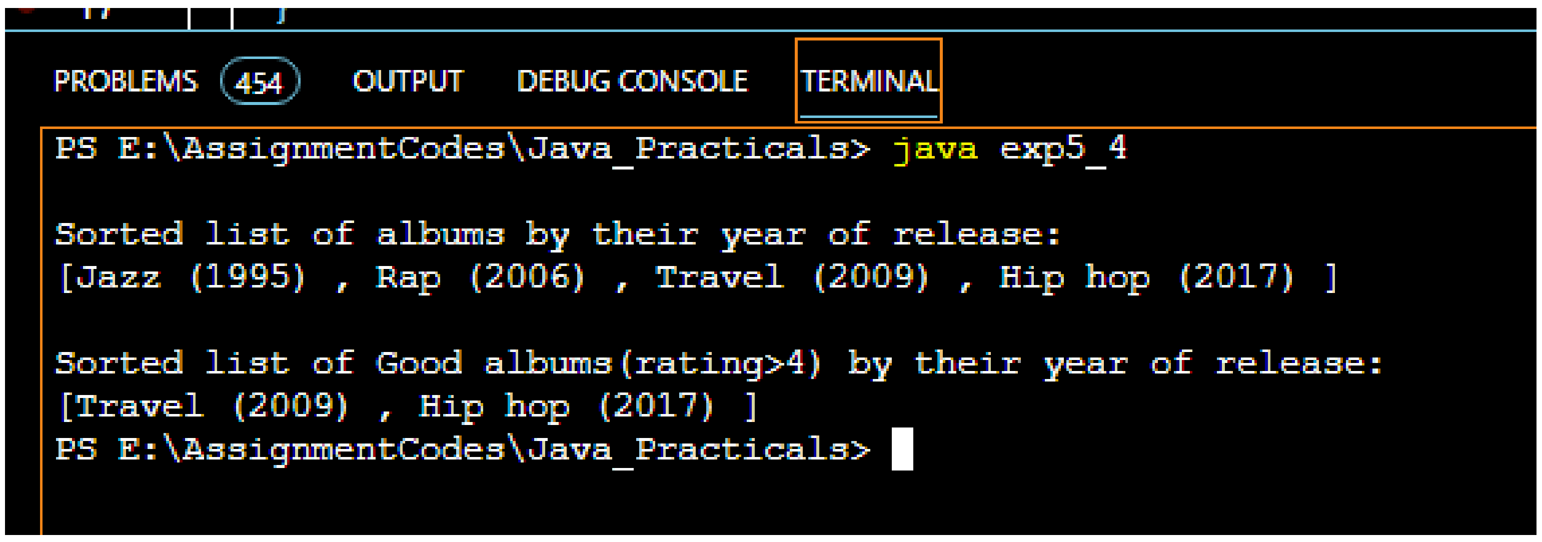
```
PS E:\AssignmentCodes\Java_Practicals> java exp5_3
LIST1 : [Government, Polytechnic, Mumbai]
LIST2 : [A.Y. Jung Marg, Kherwadi, Bandra (E)]
LIST<LIST<String>> :[[Government, Polytechnic, Mumbai], [A.Y. Jung Marg, Kherwadi, Bandra (E)]]
RESULT : [Government, Polytechnic, Mumbai, A.Y. Jung Marg, Kherwadi, Bandra (E)]
PS E:\AssignmentCodes\Java_Practicals> 
```

- **5.4 Given: class Album{ public final String name; public final int yearOfRelease; public final List tracks;**
  class Track{ public final int rating; }
  a) Write a method which takes a list of albums as an argument and returns a list of names of all albums sorted by the year of release.

  b) Write a method which takes a list of albums as an argument and returns a list of names of all albums containing at least one track having rating more than four. The returned list should be sorted by the year of release.

```
import java.util.*;
import java.util.stream.*;
public class exp5_4{
    static class Track{
        public final String name;
        public final int rating;
        public Track(String name, int rating){
            this.name = name;
            this.rating = rating;
        }
        public String toString(){
            return this.name + " (" + this.rating + ") ";
        }
    }
    static class Album{
        public final String name;
        private final List<Track> tracks;
        private int yearOfRelease;
        public int getYear(){
            return yearOfRelease;
        }
        public List<Track> getTracks(){
            return tracks;
        }
        public int maxRating(){
            Track maxTrack = tracks.stream().reduce(new Track("temp",0), (maxTrackYet, currTrack) -> {
                if(maxTrackYet.rating < currTrack.rating)
                    return currTrack;
                return maxTrackYet;
            });
            return maxTrack.rating;
        }
        public Album(String name, List<Track> trackList, int yearOfRelease){
            this.name = name;
            this.yearOfRelease = yearOfRelease;
            this.tracks = trackList;
        }
        public String toString(){
            return this.name+" ("+this.yearOfRelease+") ";
        }
    }
    static List<String>  sortAlbumsByYear(List<Album> albums){
        Stream albumStream = albums.stream();
        Object sorted[] = albumStream.sorted(Comparator.comparingInt(Album::getYear)).toArray();
        List<String> sortedList = new ArrayList<>();
        for(Object obj : sorted)
            sortedList.add(String.valueOf(obj));
        return sortedList;
    }

    static public List<String> filterGoodAlbums(List<Album> albums){
        List<String> goodAlbums = new ArrayList<>();
        albums.stream().forEach(album -> {
            if(album.maxRating() >4)
                goodAlbums.add(album.toString());
        });
         return goodAlbums;
    }

    public  static void main(String[] args) {
        System.out.println();
        // Preparing albums and tracks
        String[] travelNames = {"Ve maahi", "Duniya", "Bolna", "Kabira", "Vaaste"};
        int[] travelRatings= {5,6,4,8,5};
        List<Track> travelSongs = new  ArrayList<>();
        for(int i=0; i<travelNames.length; i++)
            travelSongs.add(new Track(travelNames[i], travelRatings[i]));
        Album travelAlbum = new Album("Travel",travelSongs, 2009);

        String[] rapNames = {"Mirchi", "ChalBombay", "Kohinoor"};
        int[] rapRatings = {1, 3,2};
        List<Track> rapSongs = new  ArrayList<>();
        for(int i=0; i<rapNames.length; i++)
                rapSongs.add(new Track(rapNames[i], rapRatings[i]));
        Album rapAlbum = new Album("Rap",rapSongs, 2006);

        String[] hipHopNames = {"Ve maahi", "Duniya", "Bolna", "Kabira", "Vaaste"};
        int[] hiphopRatings = {5,9,9,4,7};
        List<Track> hipHopSongs = new  ArrayList<>();
```

```
        for(int i=0; i<hipHopNames.length; i++)
            hipHopSongs.add(new Track(hipHopNames[i], hiphopRatings[i]));
        Album hipHopAlbum = new Album("Hip hop",hipHopSongs, 2017);

        String[] jazzNames = {"Sham", "Masakali","Lovely"};
        int[] jazzRatings = {3,1,2};
        List<Track> jazzSongs = new  ArrayList<>();
        for(int i=0; i<jazzNames.length; i++)
          jazzSongs.add(new Track(jazzNames[i], jazzRatings[i]));
        Album jazzAlbum = new Album("Jazz",jazzSongs, 1995);

        List<String> sortedAlbums =  sortAlbumsByYear(Arrays.asList(travelAlbum, jazzAlbum,
    hipHopAlbum, rapAlbum));
        System.out.println("Sorted list of albums by their year of release: \n"+sortedAlbums+"\n");

        List<String> goodAlbums =  filterGoodAlbums(Arrays.asList(travelAlbum, jazzAlbum,
    hipHopAlbum, rapAlbum));
        System.out.println("Sorted list of Good albums(rating>4) by their year of release:
    \n"+goodAlbums);

      }
    }
```



```
PS E:\AssignmentCodes\Java_Practicals> java exp5_4

Sorted list of albums by their year of release:
[Jazz (1995) , Rap (2006) , Travel (2009) , Hip hop (2017) ]

Sorted list of Good albums(rating>4) by their year of release:
[Travel (2009) , Hip hop (2017) ]
PS E:\AssignmentCodes\Java_Practicals>
```

Conclusion: In this experiment, we used various methods of Java Stream API and performed various programs.