Java 7 fork and join tutorial with a diagram and an example

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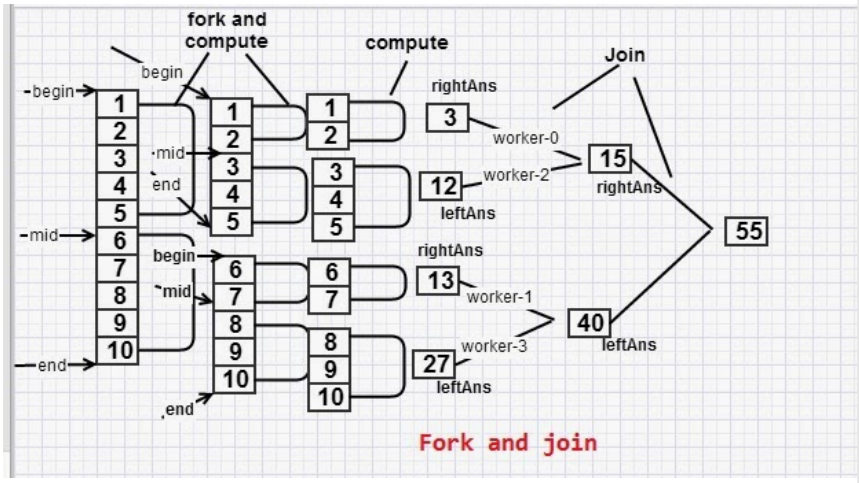
Q. How does java.util.concurrent.***RecursiveTask*** work?
A. It uses a single ForkJoin pool to execute tasks in parallel for both computing sum of numbers recursively and *chunking* (or *breaking*) them into chunks of say 3 or less as per the following example.

Here is an example, where a an array of given numbers are summed in parallel by multiple threads. The batch size is 3. So, each thread processes 3 or less numbers asynchronously (i.e. **fork**) and the **join** to compute the final results.

Example. **numbers** = {1,2,3,4,5,6,7,8,9,10}, **sum** = 55; process them using the **fork and join** feature introduced in Java 7.



Here is the code

```
1  package com.fork.join;
2
3  import java.util.ArrayList;
4  import java.util.Arrays;
5  import java.util.List;
6  import java.util.concurrent.RecursiveTask;
7
8  class SumTask extends RecursiveTask&lt;Integer&g
9
10  static final int CHUNK_SIZE = 3; // execution b
11
12  Integer[] numbers;
13  int begin;
14  int end;
15
16  SumTask(Integer[] numbers, int begin, int end)
17   this.numbers = numbers;
18   this.begin = begin;
19   this.end = end;
20  }
21
22  @Override
23  protected Integer compute() {
24          //sums the given number
25   if (end - begin &lt;= CHUNK_SIZE) {
26    int sum = 0;
27    List&lt;Integer&gt; processedNumbers = new Ar
28    for(int i=begin; i &lt; end; ++i) {
29     processedNumbers.add(numbers[i]);//just to t
30     sum += numbers[i];
31    }
32
33    //tracking thread, numbers processed, and sum
34    System.out.println(Thread.currentThread().get
35       Arrays.asList(processedNumbers) +  ", sum
36    return sum;
37   }
```


16 Technical Key Areas

```
38
39    //create chunks, fork and join
40    else {
41     int mid = begin + (end - begin) / 2; //mid po
42     SumTask left  = new SumTask(numbers, begin, m
43     SumTask right = new SumTask(numbers, mid, end
44     left.fork();            //asynchronously exec
45     int leftAns = right.compute();
46     int rightAns = left.join();  //returns the as
47     System.out.println("leftAns=" + leftAns + " +
48     return leftAns + rightAns;
49    }
50
51   }
52 }
53
```

Here is the test class with the main method

```
1  package com.fork.join;
2
3  import java.util.concurrent.ForkJoinPool;
4
5  public class SumTaskTest {
6
7   public static void main(String[] args) {
8    int numberOfCpuCores = Runtime.getRuntime().av
9    ForkJoinPool forkJoinPool = new ForkJoinPool(n
10
11   Integer[] numbers = { 1, 2, 3, 4, 5, 6, 7, 8,
12   int sum = forkJoinPool.invoke(new SumTask(numb
13
14   System.out.println(sum);
15  }
16
17 }
18
```

The **output**

ForkJoinPool-1-worker-1 proceesing [[6, 7]], sum = 13
ForkJoinPool-1-worker-3 proceesing [[8, 9, 10]], sum = 27
leftAns=27 + rightAns=13
ForkJoinPool-1-worker-2 proceesing [[3, 4, 5]], sum = 12
ForkJoinPool-1-worker-0 proceesing [[1, 2]], sum = 3
leftAns=12 + rightAns=3
leftAns=40 + rightAns=15
55

Q. Where to use fork/join as opposed to using the ***ExecutorService*** framework?

The Fork/Join Framework in Java 7 is designed for work that can be broken down into smaller tasks and the results of those tasks combined to produce the final result. Multicore processors are now widespread across server, desktop, and laptop hardware. They are also making their way into smaller devices, such as smartphones and tablets. Fork/Join offers serious gains for solving problems that involve **recursion**. Because recursion is fundamental to parallel programming on multicore platforms.

The fork/join tasks should operate as “pure” in-memory algorithms in which no I/O operations come into play. Also, communication between tasks through shared state should be avoided as much as possible, because that implies that locking might have to be performed. Ideally, tasks communicate only when one task forks another or when one task joins another.

ExecutorService continues to be a fine solution for many concurrent programming tasks, and in programming scenarios in which recursion is vital to processing power, it makes sense to use Fork/join. This fork and join feature is used in Java 8 parallel stream processing with lambda expressions.

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