Spring AU ’21 – Java Multithreading – Morning Session

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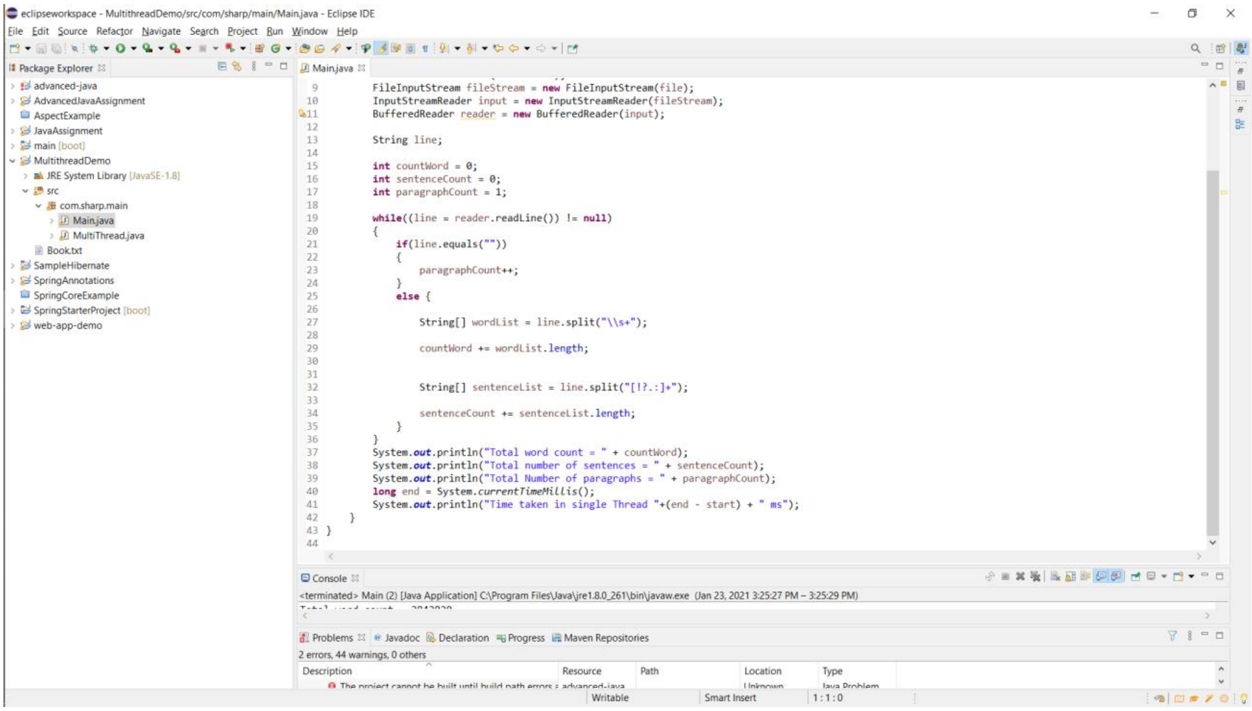
Date: 19/01/2021

Download the attached text document. It's book in plain text format. Analyze the book using a java program and perform a word count operation. You have to find out the count of each word in the book. Along with words, you also need to find out the number of paragraphs and sentences present in the book. Try it using single threading program and repeat the same through multi-threading approach. Make note of the performance improvement.

Program using single thread:



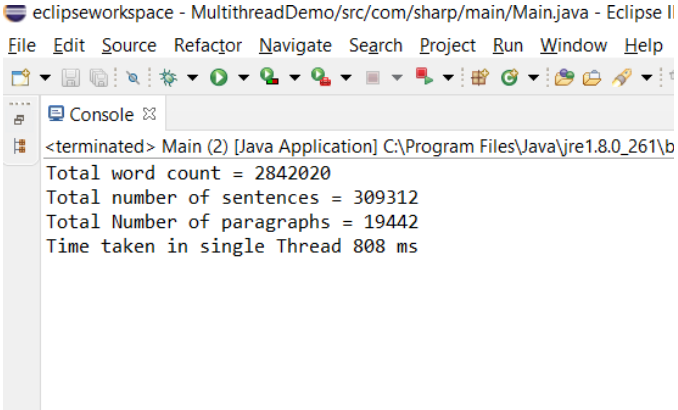
```java
        FileInputStream fileStream = new FileInputStream(file);
        InputStreamReader input = new InputStreamReader(fileStream);
        BufferedReader reader = new BufferedReader(input);

        String line;

        int countWord = 0;
        int sentenceCount = 0;
        int paragraphCount = 1;

        while((line = reader.readLine()) != null)
        {
            if(line.equals(""))
            {
                paragraphCount++;
            }
            else {

                String[] wordList = line.split("\\s+");

                countWord += wordList.length;


                String[] sentenceList = line.split("[!?.:]+");

                sentenceCount += sentenceList.length;
            }
        }
        System.out.println("Total word count = " + countWord);
        System.out.println("Total number of sentences = " + sentenceCount);
        System.out.println("Total Number of paragraphs = " + paragraphCount);
        long end = System.currentTimeMillis();
        System.out.println("Time taken in single Thread "+(end - start) + " ms");
    }
}
```

```
<terminated> Main (2) [Java Application] C:\Program Files\Java\jre1.8.0_261\bin\javaw.exe (Jan 23, 2021 3:25:27 PM – 3:25:29 PM)
```

2 errors, 44 warnings, 0 others

Description	Resource	Path	Location	Type
The project cannot be built until build path errors a	advanced-java		Unknown	Java Problem

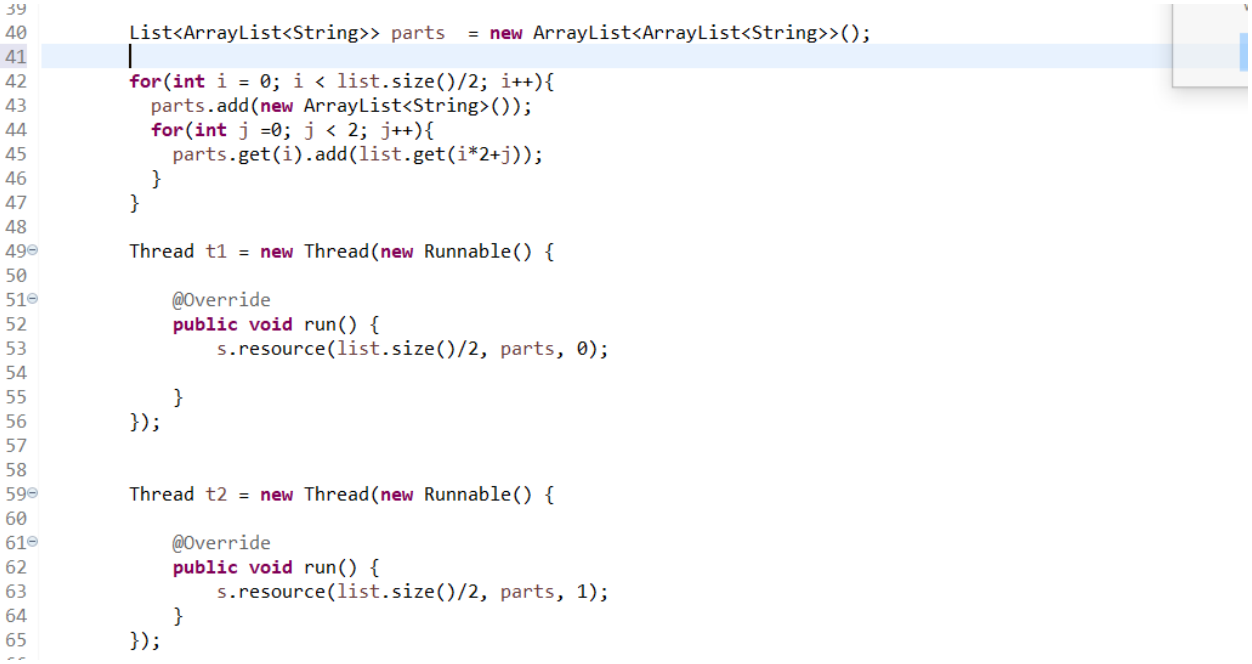
Output: Program executed in 808ms while run in single thread


eclipseworkspace - MultithreadDemo/src/com/sharp/main/Main.java - Eclipse I
File Edit Source Refactor Navigate Search Project Run Window Help
Console

```
<terminated> Main (2) [Java Application] C:\Program Files\Java\jre1.8.0_261\b
Total word count = 2842020
Total number of sentences = 309312
Total Number of paragraphs = 19442
Time taken in single Thread 808 ms
```

Program using MultiThreading: Lets see the difference

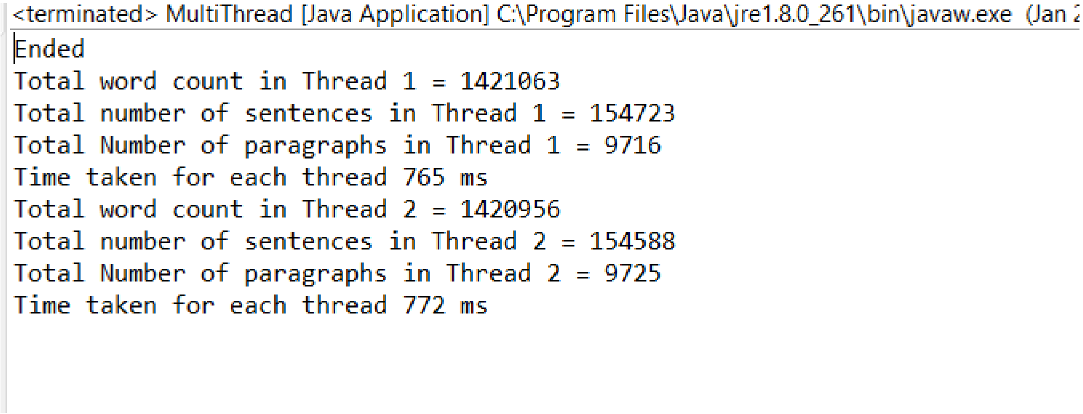
Split the file content into two parts and run each part in each thread;



```
List<ArrayList<String>> parts  = new ArrayList<ArrayList<String>>();

for(int i = 0; i < list.size()/2; i++){
  parts.add(new ArrayList<String>());
  for(int j =0; j < 2; j++){
    parts.get(i).add(list.get(i*2+j));
  }
}

Thread t1 = new Thread(new Runnable() {

    @Override
    public void run() {
        s.resource(list.size()/2, parts, 0);

    }
});


Thread t2 = new Thread(new Runnable() {

    @Override
    public void run() {
        s.resource(list.size()/2, parts, 1);
    }
});
```

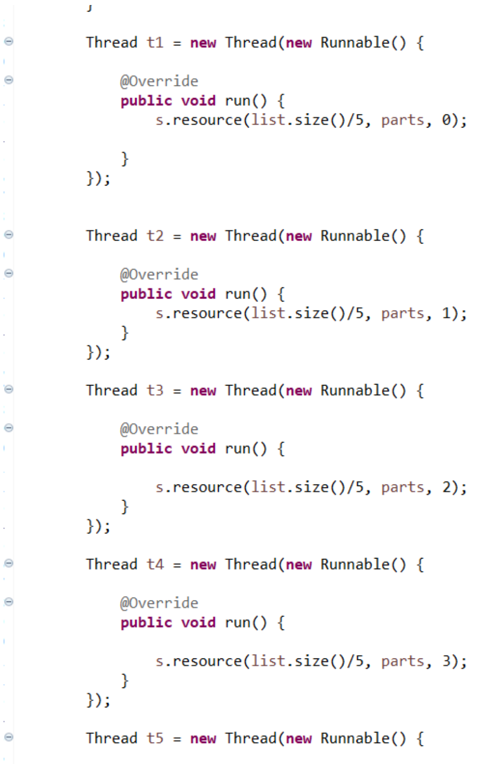
I call the same counting method that is user defined method, I attached the code as separate folder

Output: For execution using 2 threads both thread runs take maximum of 772 ms



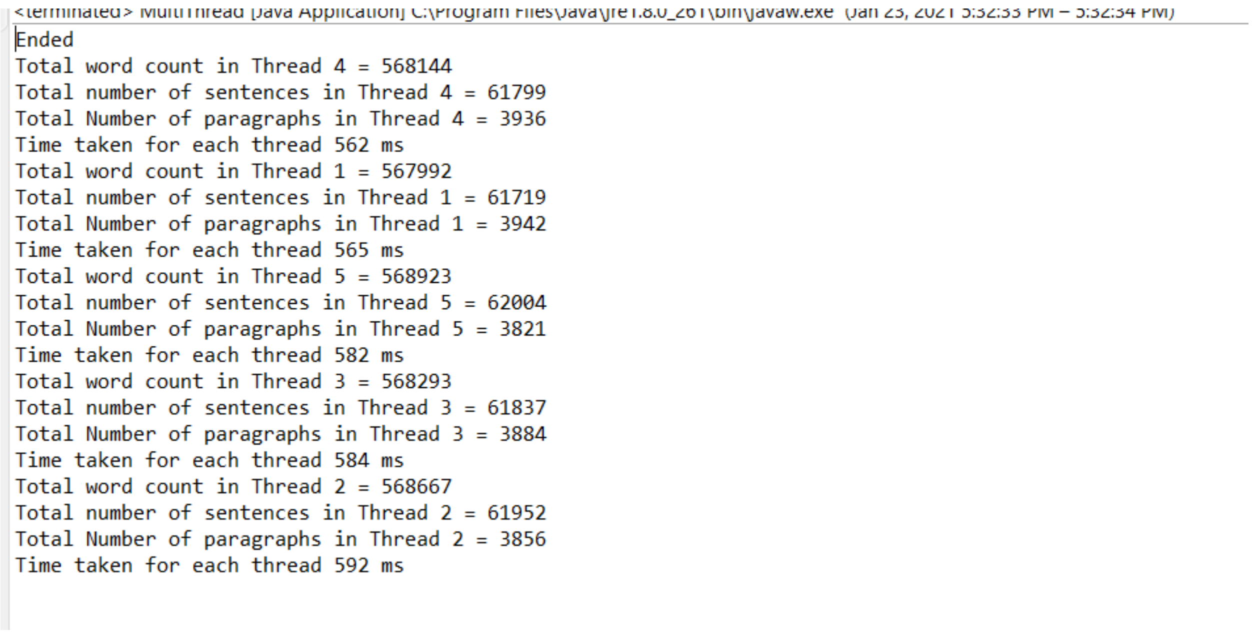
```
<terminated> MultiThread [Java Application] C:\Program Files\Java\jre1.8.0_261\bin\javaw.exe  (Jan 2
Ended
Total word count in Thread 1 = 1421063
Total number of sentences in Thread 1 = 154723
Total Number of paragraphs in Thread 1 = 9716
Time taken for each thread 765 ms
Total word count in Thread 2 = 1420956
Total number of sentences in Thread 2 = 154588
Total Number of paragraphs in Thread 2 = 9725
Time taken for each thread 772 ms
```

Split the file content into 5 parts and run each part in each thread;



```
        }

        Thread t1 = new Thread(new Runnable() {

            @Override
            public void run() {
                s.resource(list.size()/5, parts, 0);

            }
        });


        Thread t2 = new Thread(new Runnable() {

            @Override
            public void run() {
                s.resource(list.size()/5, parts, 1);
            }
        });

        Thread t3 = new Thread(new Runnable() {

            @Override
            public void run() {

                s.resource(list.size()/5, parts, 2);
            }
        });

        Thread t4 = new Thread(new Runnable() {

            @Override
            public void run() {

                s.resource(list.size()/5, parts, 3);
            }
        });

        Thread t5 = new Thread(new Runnable() {
```

Output: For using 5 threads it takes maximum 592 ms for execution



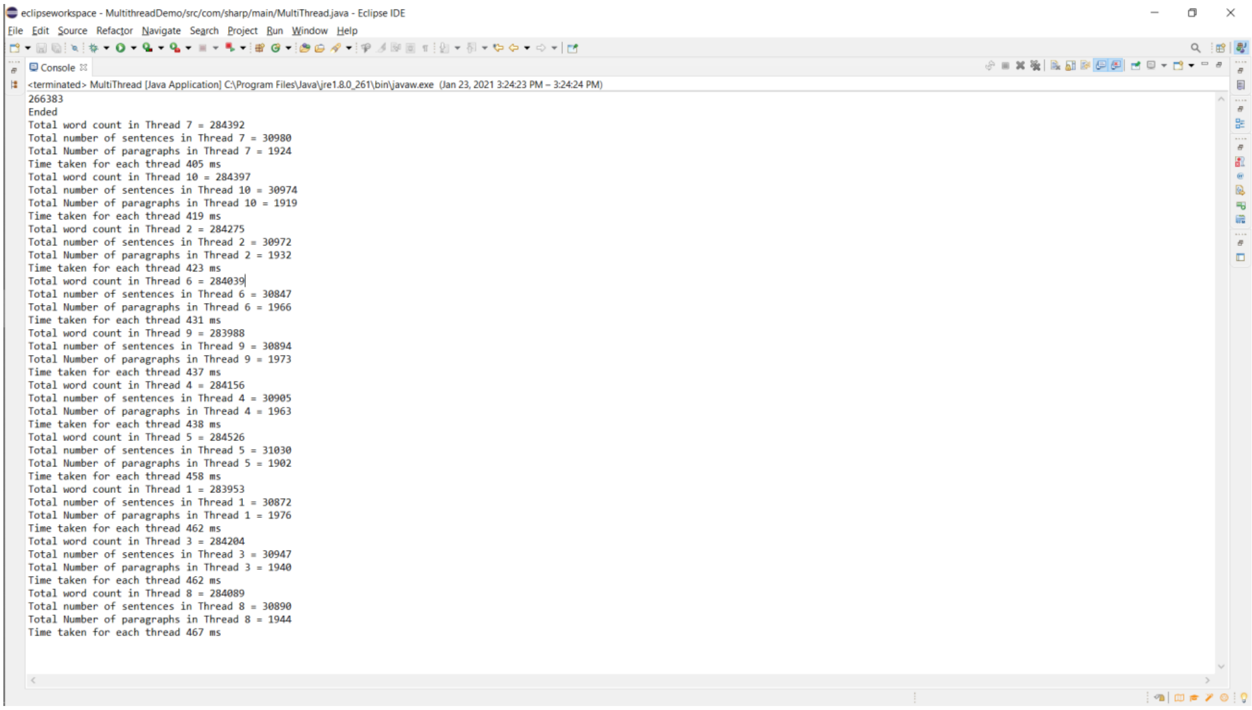
```
<terminated> MultiThread [Java Application] C:\Program Files\Java\jre1.8.0_261\bin\javaw.exe (Jan 23, 2021 5:32:33 PM – 5:32:34 PM)
Ended
Total word count in Thread 4 = 568144
Total number of sentences in Thread 4 = 61799
Total Number of paragraphs in Thread 4 = 3936
Time taken for each thread 562 ms
Total word count in Thread 1 = 567992
Total number of sentences in Thread 1 = 61719
Total Number of paragraphs in Thread 1 = 3942
Time taken for each thread 565 ms
Total word count in Thread 5 = 568923
Total number of sentences in Thread 5 = 62004
Total Number of paragraphs in Thread 5 = 3821
Time taken for each thread 582 ms
Total word count in Thread 3 = 568293
Total number of sentences in Thread 3 = 61837
Total Number of paragraphs in Thread 3 = 3884
Time taken for each thread 584 ms
Total word count in Thread 2 = 568667
Total number of sentences in Thread 2 = 61952
Total Number of paragraphs in Thread 2 = 3856
Time taken for each thread 592 ms
```

Finally split the file into 10 parts and run each parts in each thread

It is the final code I uploaded in Git

Output: It takes maximum of 467 ms

Sometimes this time of execution varies because of my system performance


eclipseworkspace - MultithreadDemo/src/com/sharp/main/MultiThread.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Console

```
<terminated> MultiThread [Java Application] C:\Program Files\Java\jre1.8.0_261\bin\javaw.exe (Jan 23, 2021 3:24:23 PM – 3:24:24 PM)
266383
Ended
Total word count in Thread 7 = 284392
Total number of sentences in Thread 7 = 30980
Total Number of paragraphs in Thread 7 = 1924
Time taken for each thread 405 ms
Total word count in Thread 10 = 284397
Total number of sentences in Thread 10 = 30974
Total Number of paragraphs in Thread 10 = 1919
Time taken for each thread 419 ms
Total word count in Thread 2 = 284275
Total number of sentences in Thread 2 = 30972
Total Number of paragraphs in Thread 2 = 1932
Time taken for each thread 423 ms
Total word count in Thread 6 = 284039
Total number of sentences in Thread 6 = 30847
Total Number of paragraphs in Thread 6 = 1966
Time taken for each thread 431 ms
Total word count in Thread 9 = 283988
Total number of sentences in Thread 9 = 30894
Total Number of paragraphs in Thread 9 = 1973
Time taken for each thread 437 ms
Total word count in Thread 4 = 284156
Total number of sentences in Thread 4 = 30905
Total Number of paragraphs in Thread 4 = 1963
Time taken for each thread 438 ms
Total word count in Thread 5 = 284526
Total number of sentences in Thread 5 = 31030
Total Number of paragraphs in Thread 5 = 1902
Time taken for each thread 458 ms
Total word count in Thread 1 = 283953
Total number of sentences in Thread 1 = 30872
Total Number of paragraphs in Thread 1 = 1976
Time taken for each thread 462 ms
Total word count in Thread 3 = 284204
Total number of sentences in Thread 3 = 30947
Total Number of paragraphs in Thread 3 = 1940
Time taken for each thread 462 ms
Total word count in Thread 8 = 284089
Total number of sentences in Thread 8 = 30890
Total Number of paragraphs in Thread 8 = 1944
Time taken for each thread 467 ms
```

Dynamically run threads:

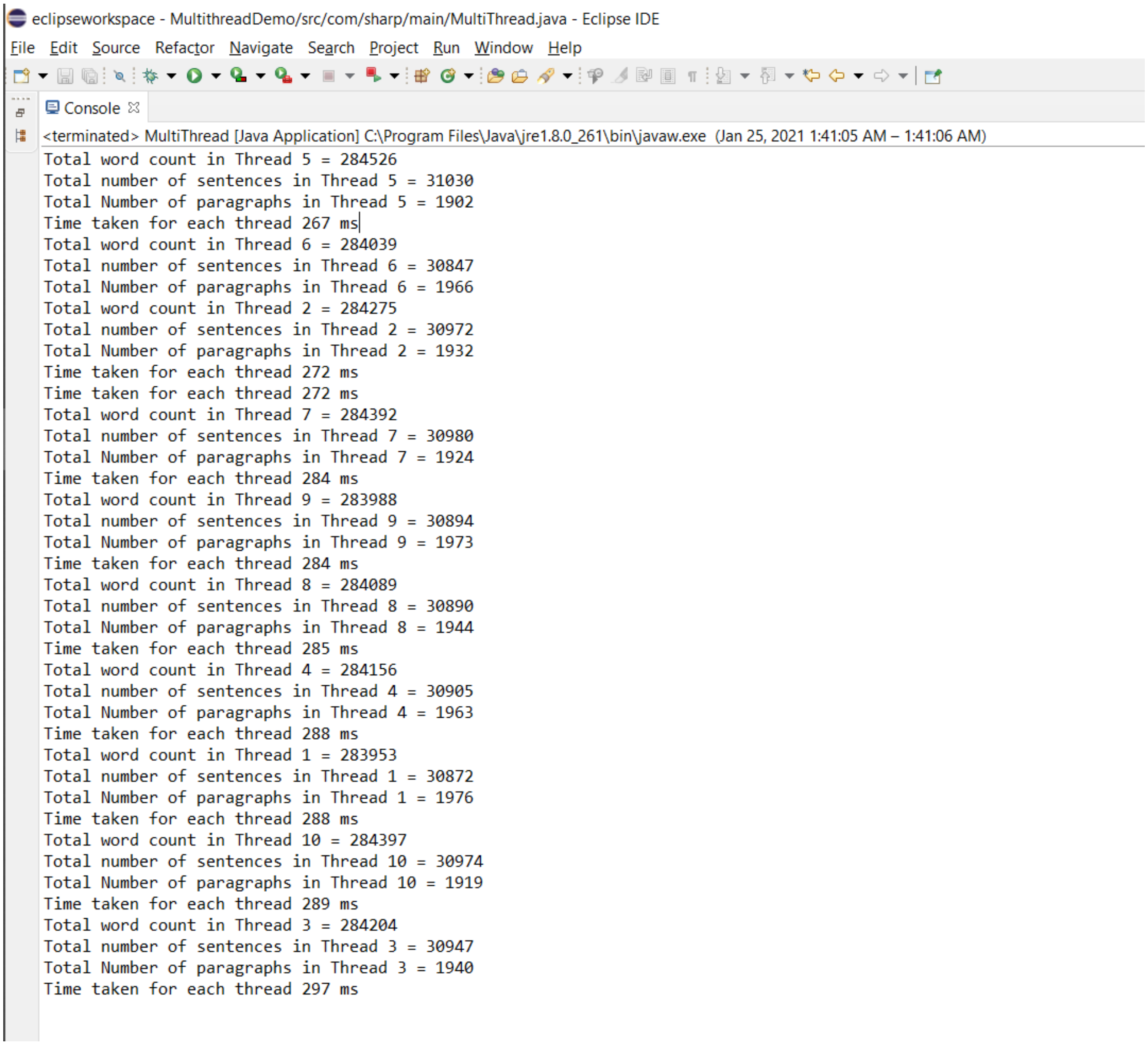
```
Thread t[] = new Thread[10];
int i;
for(i=0;i<10;i++) {
    t[i] = new CountThread(list.size()/10, parts, i);
    t[i].start();
}
```

I create one CountThread class extends Thread class

Output screen in next page and code uploaded

Output:

Here maximum takes 290 ms for counting


eclipseworkspace - MultithreadDemo/src/com/sharp/main/MultiThread.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Console

```
<terminated> MultiThread [Java Application] C:\Program Files\Java\jre1.8.0_261\bin\javaw.exe  (Jan 25, 2021 1:41:05 AM – 1:41:06 AM)
Total word count in Thread 5 = 284526
Total number of sentences in Thread 5 = 31030
Total Number of paragraphs in Thread 5 = 1902
Time taken for each thread 267 ms
Total word count in Thread 6 = 284039
Total number of sentences in Thread 6 = 30847
Total Number of paragraphs in Thread 6 = 1966
Total word count in Thread 2 = 284275
Total number of sentences in Thread 2 = 30972
Total Number of paragraphs in Thread 2 = 1932
Time taken for each thread 272 ms
Time taken for each thread 272 ms
Total word count in Thread 7 = 284392
Total number of sentences in Thread 7 = 30980
Total Number of paragraphs in Thread 7 = 1924
Time taken for each thread 284 ms
Total word count in Thread 9 = 283988
Total number of sentences in Thread 9 = 30894
Total Number of paragraphs in Thread 9 = 1973
Time taken for each thread 284 ms
Total word count in Thread 8 = 284089
Total number of sentences in Thread 8 = 30890
Total Number of paragraphs in Thread 8 = 1944
Time taken for each thread 285 ms
Total word count in Thread 4 = 284156
Total number of sentences in Thread 4 = 30905
Total Number of paragraphs in Thread 4 = 1963
Time taken for each thread 288 ms
Total word count in Thread 1 = 283953
Total number of sentences in Thread 1 = 30872
Total Number of paragraphs in Thread 1 = 1976
Time taken for each thread 288 ms
Total word count in Thread 10 = 284397
Total number of sentences in Thread 10 = 30974
Total Number of paragraphs in Thread 10 = 1919
Time taken for each thread 289 ms
Total word count in Thread 3 = 284204
Total number of sentences in Thread 3 = 30947
Total Number of paragraphs in Thread 3 = 1940
Time taken for each thread 297 ms
```