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Wikipedia Offline Search Engine

Project outline:

- The main purpose of this project is to write a **Wikipedia Search Engine** program, which is able to take an input from a user (any kind of string representation) and search for matching articles.
- Another goal for this project is to take text wiki dataset files, and parse them into meaningful XML entities. Also a part of the program is to Index that XML and make it searchable by the program.

How it works?

- **Phase 1:** The user choses to enter a query string to search, or to enter and customize some parameters for the program.

- **Phase 2a (Options):** The user can redo dataset pre-processing, re-indexing, or change the number of top retrieved documents.

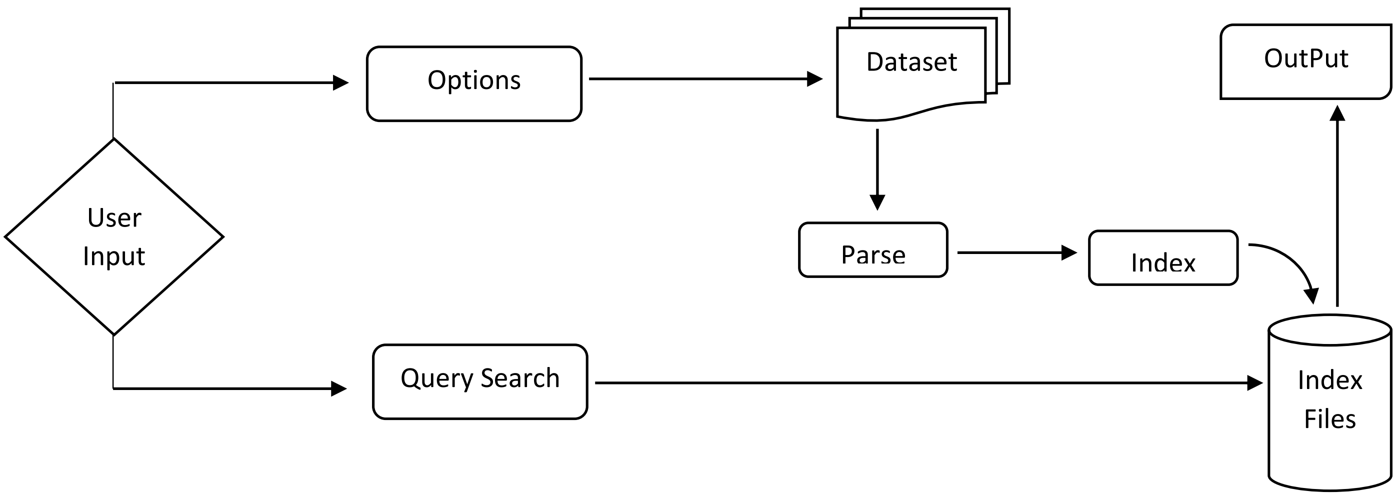
- **Phase 2b (Query):** The user gets the results for the entered query string.

- **Phase 3a (redo pre-processing):** Read provided text files, and create the main XML file with concatenated fields into tags.

- **Phase 3b (redo indexing):** Use the XML file to read article at a time, and index it**.**

- **Phase 3c (Top Documents Retrieved):** Just entering a number would adjust that parameter for the search engine

- **Phase 4:** Search Results.



Data Used (Dataset)

Downloaded from

Total of *3,201,391 Article which are 1.35 GB.*

Full set *are 3,201,391 article*

(Consists of: wiki_labels_all.txt / wiki_links_all.txt / wiki_abstracts_all.txt)

Partial set *are 30,000 article*

(Consists of: wiki_labels_part.txt / wiki_links_part.txt / wiki_abstracts_part.txt)

Constructed as follows:

```
Labels:
<http://dbpedia.org/resource/%21%21> <http://www.w3.org/2000/01/rdf-schema#label> "!!"@en .

Links:
%21%21   http://xmlns.com/foaf/0.1/page    http://en.wikipedia.org/wiki/%21%21        r

Abstracts:
<http://dbpedia.org/resource/%21%21%21> <http://www.w3.org/2000/01/rdf-schema#comment> "Desc"@en .
```

Each line contains a single article information.

Note 1:

Program comes **pre-loaded** and ready to run (Datasets / FULL XML file / FULL index).

Note 2:

Indexing and Searching techniques are done with **java Lucene API**.

Note 3:

For now the program only runs from **command prompt** or any **IDE console**.

Phase 1 – User input *wikisearchengine.Main*

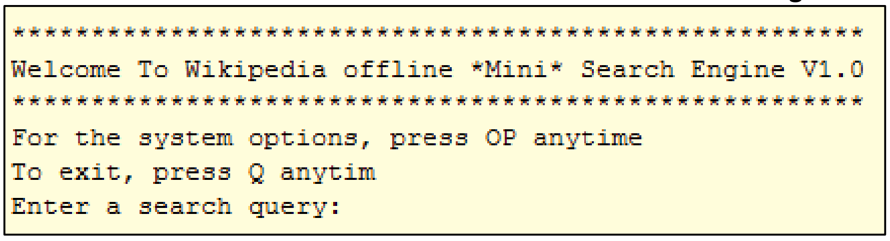
What is it?

The program allows the user to choose what route to be executed. (Figure 1).

User can:

a) Manually insert the query string needed.
b) Press ***"op"*** (non-case-sensitive) to be redirected to adjust the options.
c) Exit the program by pressing ***"Q"*** (non-case-sensitive).

Figure 1



```
***********************************************************
Welcome To Wikipedia offline *Mini* Search Engine V1.0
***********************************************************
For the system options, press OP anytime
To exit, press Q anytim
Enter a search query:
```

How it works?

- **By running "wikisearchengine.main"** the user will be prompted with the options shown in Figure 1.

- Can enter any string right away, to search with it as a query.

- Press "OP" or "op" to get redirected to adjust the parameters (later).

- Can exit anytime by pressing "Q" or "q".

- Functions do as expected by dispatching the input properly…

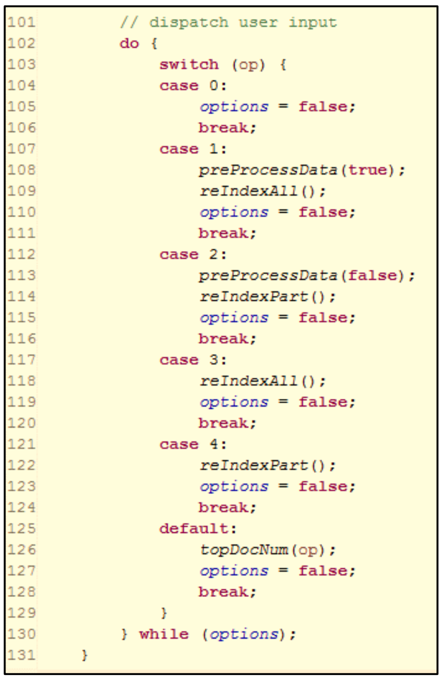
    - Either to enter a query string, and the corresponding function is invoked to evaluate the input and search for a match.

    - Or redirect the user to another screen, with the options available cases.

    - Or exit the program.

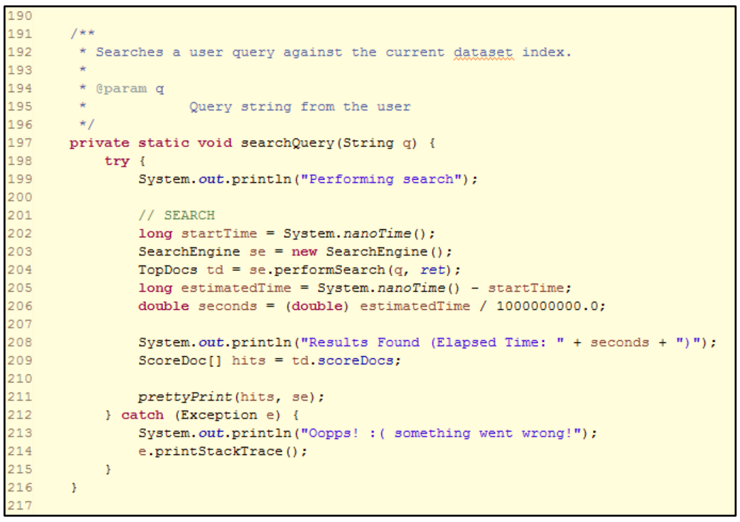
Code snippet:

Figure 2



```
        // dispatch user input
        do {
            switch (op) {
            case 0:
                options = false;
                break;
            case 1:
                preProcessData(true);
                reIndexAll();
                options = false;
                break;
            case 2:
                preProcessData(false);
                reIndexPart();
                options = false;
                break;
            case 3:
                reIndexAll();
                options = false;
                break;
            case 4:
                reIndexPart();
                options = false;
                break;
            default:
                topDocNum(op);
                options = false;
                break;
            }
        } while (options);
    }
```

Figure 3



```

    /**
     * Searches a user query against the current dataset index.
     *
     * @param q
     *            Query string from the user
     */
    private static void searchQuery(String q) {
        try {
            System.out.println("Performing search");

            // SEARCH
            long startTime = System.nanoTime();
            SearchEngine se = new SearchEngine();
            TopDocs td = se.performSearch(q, ret);
            long estimatedTime = System.nanoTime() - startTime;
            double seconds = (double) estimatedTime / 1000000000.0;

            System.out.println("Results Found (Elapsed Time: " + seconds + ")");
            ScoreDoc[] hits = td.scoreDocs;

            prettyPrint(hits, se);
        } catch (Exception e) {
            System.out.println("Oopps! :( something went wrong!");
            e.printStackTrace();
        }
    }

```

Phase 2a – Options *wikisearchengine.Main*

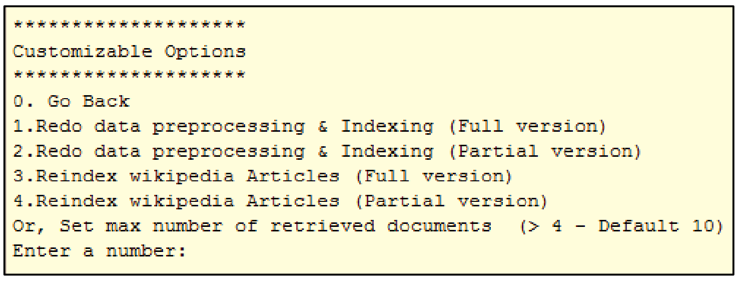
What is it?

The program allows the user to make some adjustments on the system. (Figure 4).

User can:

a) Re-create the main XML file from scratch. (full / partial)
b) Re-create the indexes from scratch. (full / partial)
c) Change the default number for the top documents retrieved.
d) Go back to main screen.

Figure 4



```
********************
Customizable Options
********************
0. Go Back
1.Redo data preprocessing & Indexing (Full version)
2.Redo data preprocessing & Indexing (Partial version)
3.Reindex wikipedia Articles (Full version)
4.Reindex wikipedia Articles (Partial version)
Or, Set max number of retrieved documents  (> 4 - Default 10)
Enter a number:
```

How it works?

- **By running “wikisearchengine.main”** and choosing to get redirected to *Options,* the user will be prompted with the options shown in Figure 4.

- Can redo ***preprocessing*** steps from scratch (full or partial).

- Can redo ***indexing*** steps from scratch (full or partial).

- Can change the value for number of top retrieved documents.

- Can go back to the previous screen

- Functions do as expected by dispatching the input properly…

  - Either to invoke *preProcessData(),* with the correct Boolean value for full or partial.

  - invoke *reIndexAll().*

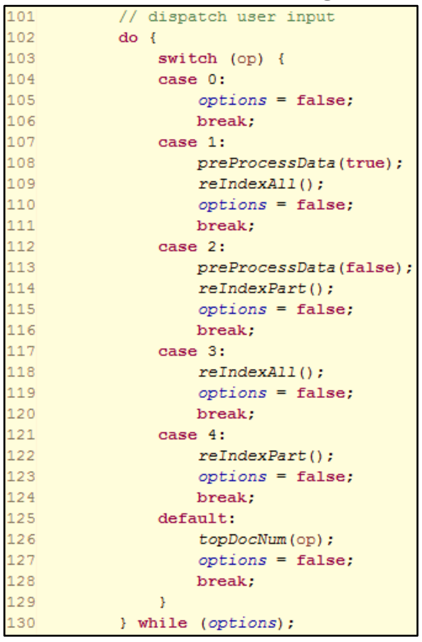
  - invoke *reIndexPart().*

  - invoke topDocNum().

  - Or return to previous screen.

Code snippet:

Figure 5



```
        // dispatch user input
        do {
            switch (op) {
            case 0:
                options = false;
                break;
            case 1:
                preProcessData(true);
                reIndexAll();
                options = false;
                break;
            case 2:
                preProcessData(false);
                reIndexPart();
                options = false;
                break;
            case 3:
                reIndexAll();
                options = false;
                break;
            case 4:
                reIndexPart();
                options = false;
                break;
            default:
                topDocNum(op);
                options = false;
                break;
            }
        } while (options);
```

Phase 2b – Query *wikisearchengine.Main / wikisearchengine.SearchEngine*

What is it?

Taking the input from the user, processing it, and returning the matching documents as a search results (Figure 6).

How it works:

- When the function *searchQuery()* is invoked with the query string,

- It creates a new instance from *SearchEngine class.*

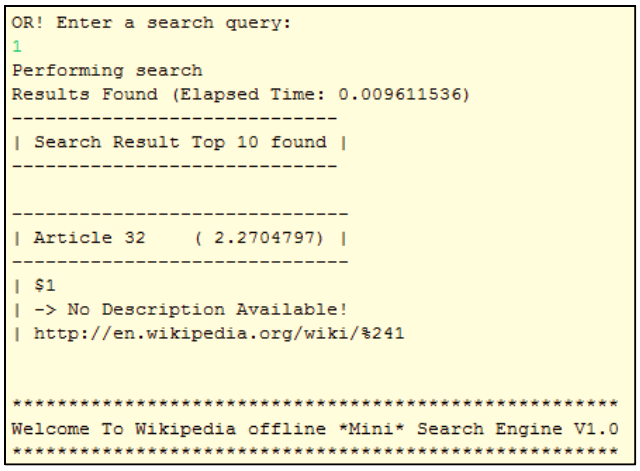
- pass it the query and the number of top documents retrieved.

- get back a list of top documents matching the query, along with its contents.

- pass those documents to *prettyPrint()* function, to be returned to the user as search results.

- present the user with the same initial first screen.

Figure 6



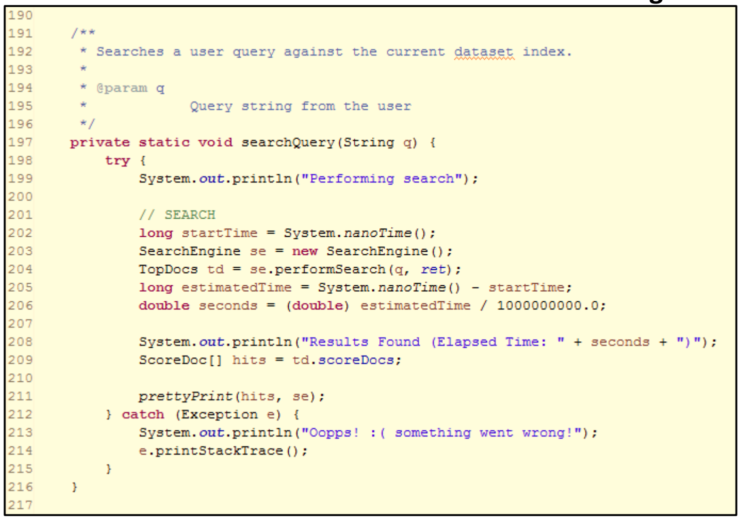
```
OR! Enter a search query:
1
Performing search
Results Found (Elapsed Time: 0.009611536)
-----------------------------
| Search Result Top 10 found |
-----------------------------

------------------------------
| Article 32    ( 2.2704797) |
------------------------------
| $1
| -> No Description Available!
| http://en.wikipedia.org/wiki/%241
|

*******************************************************
Welcome To Wikipedia offline *Mini* Search Engine V1.0
*******************************************************
```

Code snippet:

Figure 7



```java

    /**
     * Searches a user query against the current dataset index.
     *
     * @param q
     *            Query string from the user
     */
    private static void searchQuery(String q) {
        try {
            System.out.println("Performing search");

            // SEARCH
            long startTime = System.nanoTime();
            SearchEngine se = new SearchEngine();
            TopDocs td = se.performSearch(q, ret);
            long estimatedTime = System.nanoTime() - startTime;
            double seconds = (double) estimatedTime / 1000000000.0;

            System.out.println("Results Found (Elapsed Time: " + seconds + ")");
            ScoreDoc[] hits = td.scoreDocs;

            prettyPrint(hits, se);
        } catch (Exception e) {
            System.out.println("Oopps! :( something went wrong!");
            e.printStackTrace();
        }
    }

```

Phase 3a – Redo pre-processing *wikidataset.TextToXmlAll / wikidataset.TextToXmlPart*

What is it?

A text to xml converter class, that reads from each of the three files one line at a time, compare them.

Whenever it finds a match, it starts an <Article> tag and put in the appropriate information.

How it works?

- Opens 3 *buffered readers,* one for each text file (labels / links / abstracts).

- Opens 1 *stream result,* to open one xml file to write the articles with the information associated with it.

- **The case is that every label (title) has a link, but not every instance has a description.**

- Every text line is compared against *java regex,* to be cleaned and info to be extracted properly.

- Finally after all text processing is done, the xml file gets populated with information.

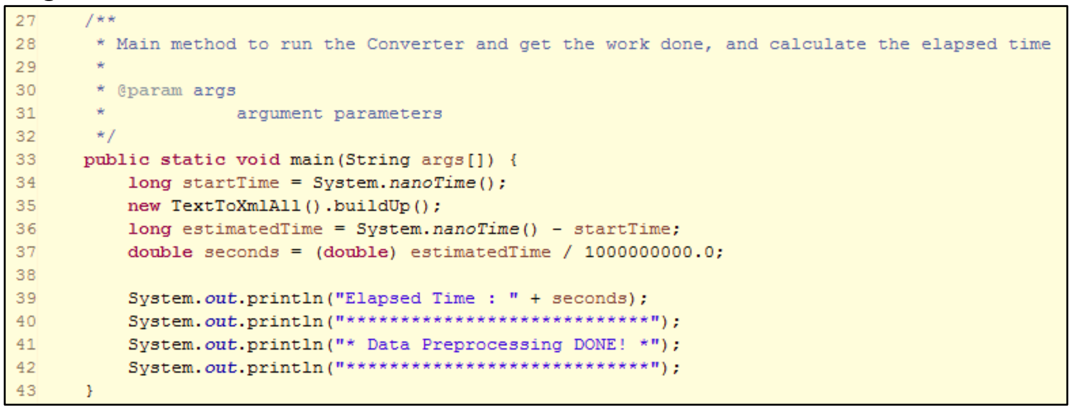
XML structure:

```
<Wiki>
        <Article>
                <ID> ….. </ID>
                <Title> ….. </Title>
                <Link>……</Link>
                <Description>…..</Description>
        </Article>
        <Article> …….. </Article>
        <Article> …….. </Article>
</wiki>
```

Figure 8

Code snippet:

Figure 9



```java
    /**
     * Main method to run the Converter and get the work done, and calculate the elapsed time
     *
     * @param args
     *            argument parameters
     */
    public static void main(String args[]) {
        long startTime = System.nanoTime();
        new TextToXmlAll().buildUp();
        long estimatedTime = System.nanoTime() - startTime;
        double seconds = (double) estimatedTime / 1000000000.0;

        System.out.println("Elapsed Time : " + seconds);
        System.out.println("*****************************");
        System.out.println("* Data Preprocessing DONE! *");
        System.out.println("*****************************");
    }
```

Phase 3b – Redo Indexing *wikiarticle.Article / wikiarticle.ArticleIndexer / wikiarticle.ArticleParser*

What is it?

Invoking the *Indexing class*, which invokes *parsing class* to read the xml file in a stream, and parse each tag and index each independent article as a document in the index. Resulting in one index holding all the documents to search for.

How it works (Using Lucene API)?

- Create an *index reader*, and an index directory.

- pass that index reader to *Parser* class.

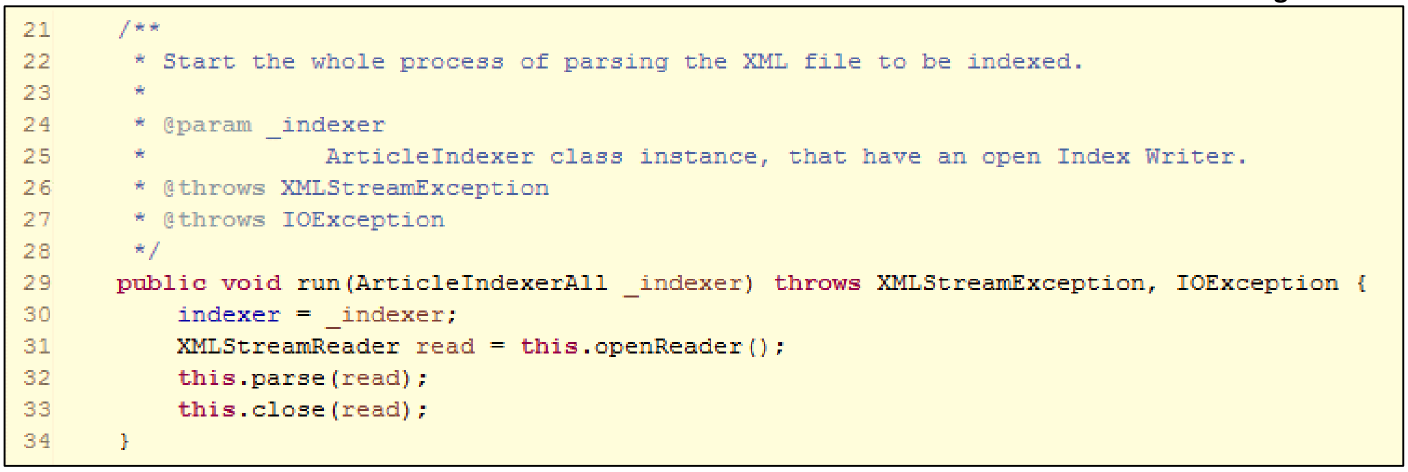
- *Parser class*, opens the xml file and reads it in a stream.

- For each <*Article*> tag, write its information into the index writer as a separate document.

- After finishing the whole xml file, close the index, release the lock, and close the index writer.

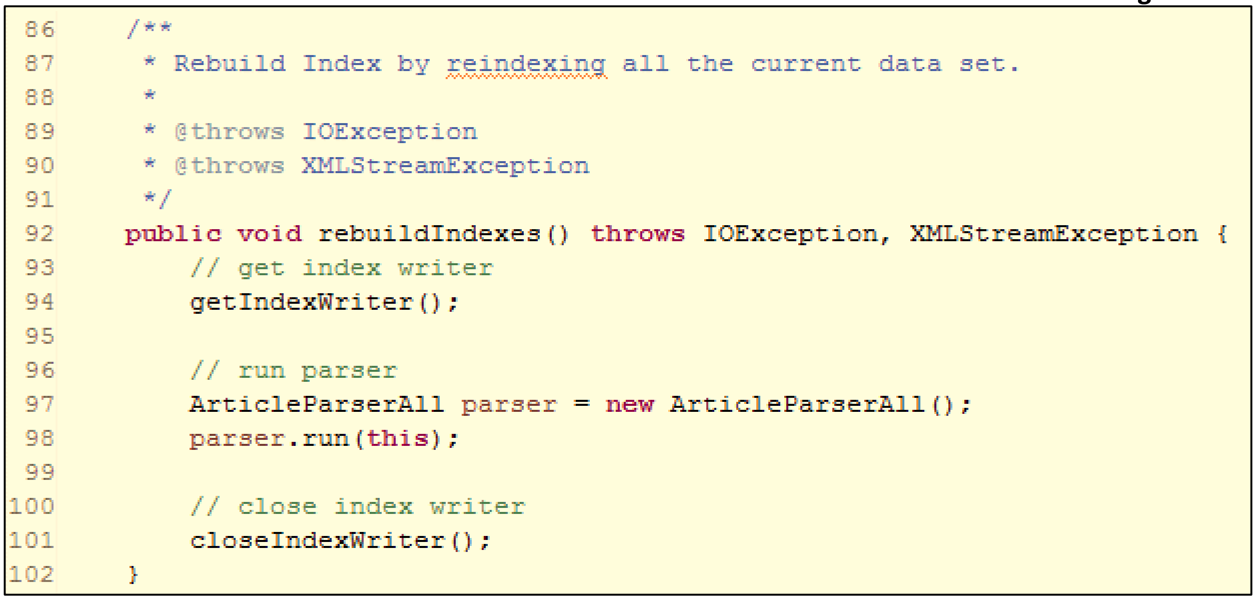
Code snippet:

Figure 10



```
    /**
     * Start the whole process of parsing the XML file to be indexed.
     *
     * @param _indexer
     *            ArticleIndexer class instance, that have an open Index Writer.
     * @throws XMLStreamException
     * @throws IOException
     */
    public void run(ArticleIndexerAll _indexer) throws XMLStreamException, IOException {
        indexer = _indexer;
        XMLStreamReader read = this.openReader();
        this.parse(read);
        this.close(read);
    }
```

Figure 11



```
    /**
     * Rebuild Index by reindexing all the current data set.
     *
     * @throws IOException
     * @throws XMLStreamException
     */
    public void rebuildIndexes() throws IOException, XMLStreamException {
        // get index writer
        getIndexWriter();

        // run parser
        ArticleParserAll parser = new ArticleParserAll();
        parser.run(this);

        // close index writer
        closeIndexWriter();
    }
```

Phase 3c – Top Documents Retrieved *wikisearchengine.Main*

What is it?

This is just about changing one value in the main class (default 10).

How it works?

- User enters any number larger than 4.

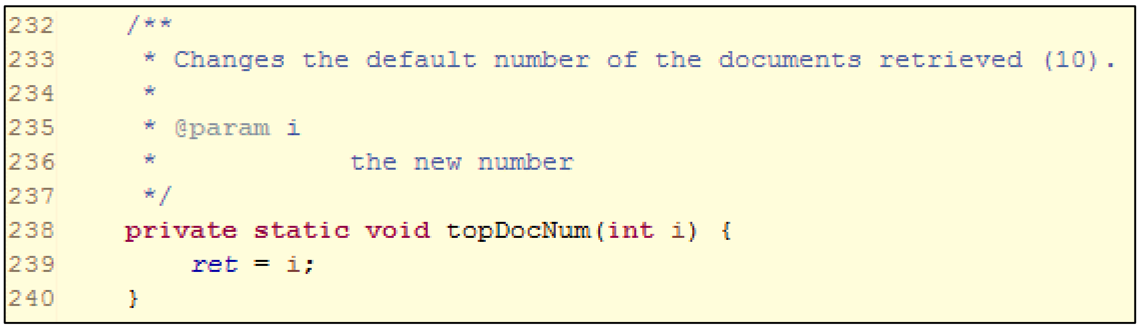
- A method *topDocNum()* is invoked with the entered value.

- The function changes the maximum top number of document retrieved in the search engine (**only for the current search engine instance).**

- Return to the initial first screen.

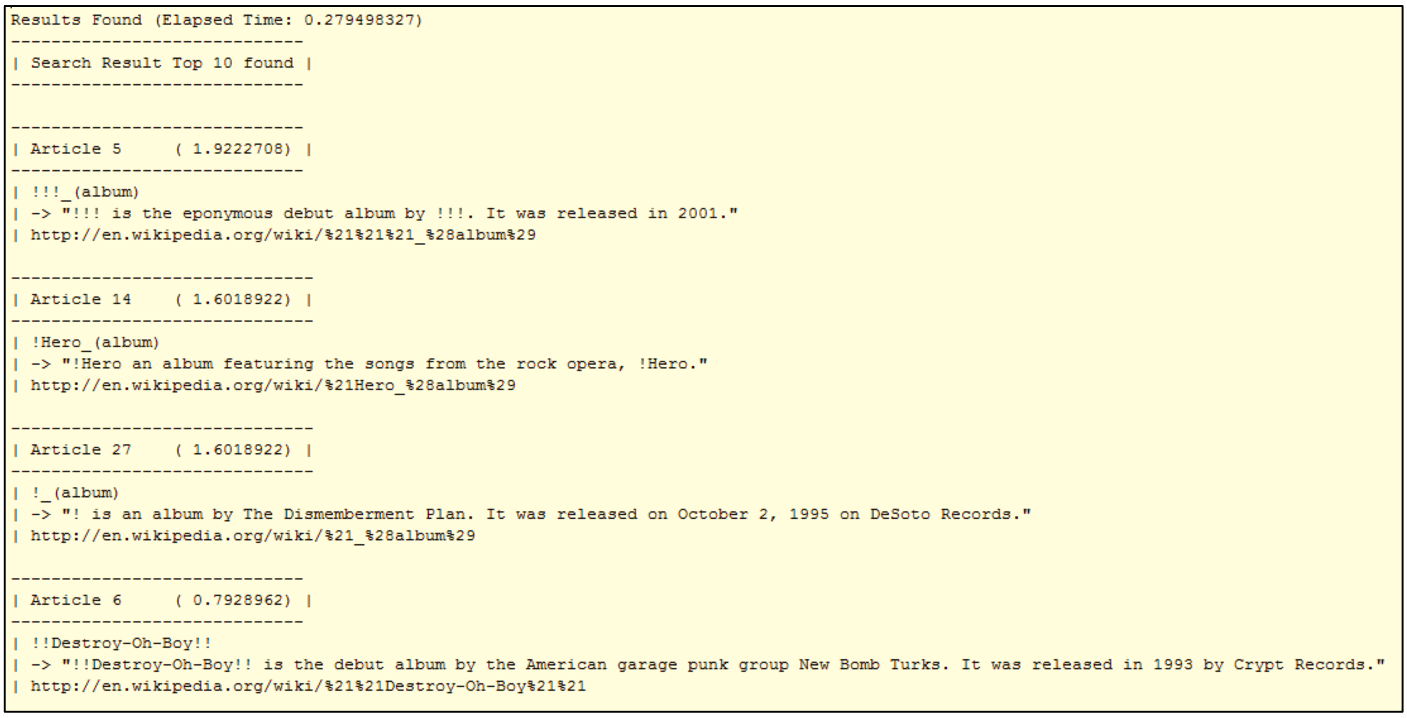
Code snippet:

Figure 12



```java
    /**
     * Changes the default number of the documents retrieved (10).
     *
     * @param i
     *            the new number
     */
    private static void topDocNum(int i) {
        ret = i;
    }
```

Phase 4 – Search Results *wikisearchengine.Main*



```
Results Found (Elapsed Time: 0.279498327)
-----------------------------
| Search Result Top 10 found |
-----------------------------

-----------------------------
| Article 5     ( 1.9222708) |
-----------------------------
| !!!_(album)
| -> "!!! is the eponymous debut album by !!!. It was released in 2001."
| http://en.wikipedia.org/wiki/%21%21%21_%28album%29

------------------------------
| Article 14    ( 1.6018922) |
------------------------------
| !Hero_(album)
| -> "!Hero an album featuring the songs from the rock opera, !Hero."
| http://en.wikipedia.org/wiki/%21Hero_%28album%29

------------------------------
| Article 27    ( 1.6018922) |
------------------------------
| !_(album)
| -> "! is an album by The Dismemberment Plan. It was released on October 2, 1995 on DeSoto Records."
| http://en.wikipedia.org/wiki/%21_%28album%29

-----------------------------
| Article 6     ( 0.7928962) |
-----------------------------
| !!Destroy-Oh-Boy!!
| -> "!!Destroy-Oh-Boy!! is the debut album by the American garage punk group New Bomb Turks. It was released in 1993 by Crypt Records."
| http://en.wikipedia.org/wiki/%21%21Destroy-Oh-Boy%21%21
```

*** Some Stats (i7 Processor – 8GB RAM) ***		
Process	Numbers	Unit
Xml creation for ***3,201,391*** line of text	***281.15964686***	Seconds
Number of complete Articles found (on the above)	***2,959,360***	Seconds
Indexing ***2,959,360*** articles in one ***Lucene*** index	***254.757844039***	Seconds
Searching for ***album***	***0.056861375***	Seconds

Future Improvements:

- Storing the data and the index in a database for easier access.
- Implementing the indexing part myself, for more control over it.
- Building GUI for easier interaction.

Finally:

Submitted Items for the final project:

Documentation Source Code Dataset Search Result test case