# Team 1: Zip Code Group Project

Version 3.0

Generated by Doxygen 1.9.8

# Chapter 1

# Class Index

## 1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

# Chapter 2

# File Index

## 2.1 File List

Here is a list of all files with brief descriptions:

# Chapter 3

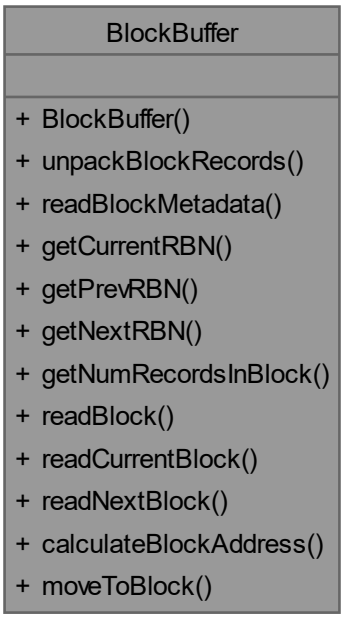
# Class Documentation

## 3.1 BlockBuffer Class Reference

See BlockBuffer.h for full documentation.

```
#include <BlockBuffer.h>
```

Collaboration diagram for BlockBuffer:



**Public Member Functions**

- BlockBuffer (std::ifstream &file, HeaderBuffer headerBuffer)

  *Construct a new Block Buffer object.*
- vector< string > unpackBlockRecords ()

  *Unpacks the length-indicated records from the block into a string vector.*
- void readBlockMetadata ()

  *Reads the block metadata for the current block.*
- int getCurrentRBN () const
- int getPrevRBN () const
- int getNextRBN () const
- int getNumRecordsInBlock () const
- vector< string > readBlock (int relativeBlockNumber)

  *Reads the block at the given Relative Block Number (RBN) and returns it as a vector of records in string form.*
- vector< string > readCurrentBlock ()

  *Reads the current block after the file pointer and returns it as a vector of records in string form.*
- vector< string > readNextBlock ()

  *Moves to and reads the next block and returns it as a vector of records in string form.*
- int calculateBlockAddress (int relativeBlockNumber)

  *Calculates the address of a Relative Block Number (RBN) within the file.*
- void moveToBlock (int relativeBlockNumber)

  *Moves the file pointer to the address of the block at the given Relative Block Number (RBN).*

## 3.1.1 Detailed Description

See BlockBuffer.h for full documentation.

Reads blocks of length-indicated records from a blocked file.

**Author**

Kent Biernath

Andrew Clayton

**Date**

2023-11-14

**Version**

1.0

Definition at line 48 of file BlockBuffer.h.

## 3.1.2 Constructor & Destructor Documentation

### 3.1.2.1 BlockBuffer()

```
BlockBuffer::BlockBuffer (
            std::ifstream & file,
            HeaderBuffer headerBuffer = HeaderBuffer("blocked_postal_codes.txt") )
```

Construct a new Block Buffer object.

**Parameters**

| | |
|---|---|
| *file* | The file to read. |
| *headerBuffer* | A HeaderBuffer object for the file. |

**Precondition**

: The block is a string.

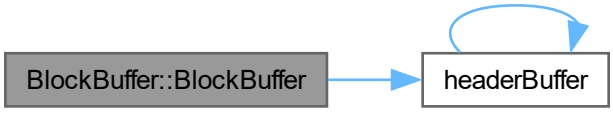
**Postcondition**

: A new Block Buffer object is created.

Definition at line 15 of file BlockBuffer.cpp.

```
00015
      : file(file) { // TODO remove HeaderBuffer filename once it allows generic constructor
00016     headerBuffer.readHeader();
00017     headerSize = headerBuffer.getHeaderSizeBytes();
00018     blockSize = headerBuffer.getBlockSize();
00019     nextRBN = headerBuffer.getRBNS();
00020 }
```

Here is the call graph for this function:




### 3.1.3 Member Function Documentation

#### 3.1.3.1 unpackBlockRecords()

```
vector< string > BlockBuffer::unpackBlockRecords ( )
```

Unpacks the length-indicated records from the block into a string vector.

**Returns**

A vector of strings, the records within a block.

**Precondition**

: The file pointer is at the start of the records within the block after the block metadata was read.

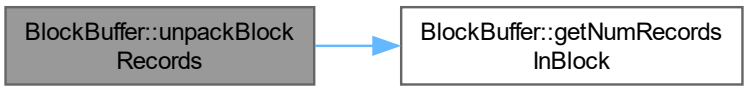
**Postcondition**

: The block is unpacked into individual strings for each record in the block, returned as a vector.

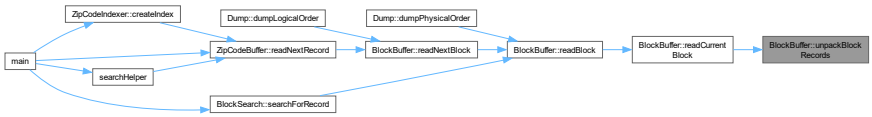
Definition at line 23 of file BlockBuffer.cpp.

```
00023                                                {
00024     // This will convert a block to a vector of records
00025     size_t idx = 0;
00026     vector<string> records;
00027
00028     for (size_t i = 0; i < getNumRecordsInBlock(); i++)
00029     {
00030         // Reads the length and retrieves that many characters for the record
00031         std::string recordString;
00032         int numCharactersToRead = 0;
00033         file » numCharactersToRead;   // Read the length indicator, the first field in each record
00034         file.ignore(1);                // Skip the comma after the length field
00035         recordString.resize(numCharactersToRead);
00036         file.read(&recordString[0], numCharactersToRead);
00037         records.push_back(recordString);
00038     }
00039
00040     return records;
00041 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




### 3.1.3.2 readBlockMetadata()

```
void BlockBuffer::readBlockMetadata ( )
```

Reads the block metadata for the current block.

**Precondition**

The file pointer is at the start of the block before the 5 metadata fields.

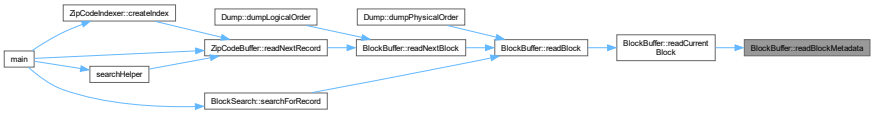
**Postcondition**

The 5 metadata fields have been read into the member variables and the file pointer is after the metadata.

Definition at line 46 of file BlockBuffer.cpp.

```
00046                                    {
00047     int metadataRecordLength = -1;
00048     int newRelativeBlockNumber = -1;
00049     int newNumRecordsInBlock = -1;
00050     int newPrevRBN = -1;
00051     int newNextRBN = -1;
00052
00053     file » metadataRecordLength;
00054     file.ignore(1); // Ignore the commas separating the fields
00055     file » newRelativeBlockNumber;
00056     file.ignore(1);
00057     file » newNumRecordsInBlock;
00058     file.ignore(1);
00059     file » newPrevRBN;
00060     file.ignore(1);
00061     file » newNextRBN;
00062     file.ignore(1); // Skip the comma after the last metadata field
00063
00064     // TODO throw exception if any of these reads failed or the values are invalid
00065
00066     currentRBN = newRelativeBlockNumber;
00067     numRecordsInBlock = newNumRecordsInBlock;
00068     prevRBN = newPrevRBN;
00069     nextRBN = newNextRBN;
00070 }
```

Here is the caller graph for this function:




### 3.1.3.3 getCurrentRBN()

```
int BlockBuffer::getCurrentRBN ( ) const  [inline]
```

Definition at line 87 of file BlockBuffer.h.

```
00087 { return currentRBN; }
```

### 3.1.3.4 getPrevRBN()

```
int BlockBuffer::getPrevRBN ( ) const  [inline]
```

Definition at line 88 of file BlockBuffer.h.

```
00088 { return prevRBN; }
```

Here is the caller graph for this function:

### 3.1.3.5 getNextRBN()

```
int BlockBuffer::getNextRBN ( ) const  [inline]
```

Definition at line 89 of file BlockBuffer.h.

```
00089 { return nextRBN; }
```

Here is the caller graph for this function:

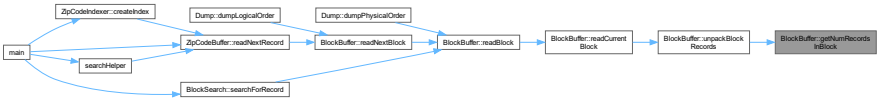

### 3.1.3.6 getNumRecordsInBlock()

```
int BlockBuffer::getNumRecordsInBlock ( ) const  [inline]
```

Definition at line 90 of file BlockBuffer.h.

```
00090 { return numRecordsInBlock; }
```

Here is the caller graph for this function:




### 3.1.3.7 readBlock()

```
vector< string > BlockBuffer::readBlock (
            int relativeBlockNumber )
```

Reads the block at the given Relative Block Number (RBN) and returns it as a vector of records in string form.

#### Returns

A vector of strings where each string represents a record within the block.
The length indication field for each record is read but not returned in the string.

#### Precondition

: The file is open and in a blocked length-indicated file format.

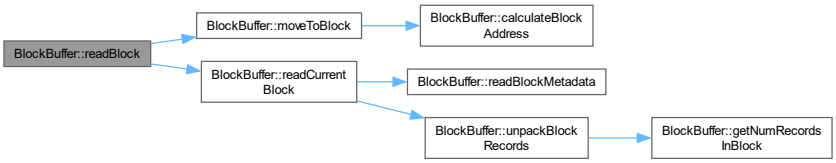
**Postcondition**

: The block is broken down into records and the file pointer is after the records in the block.

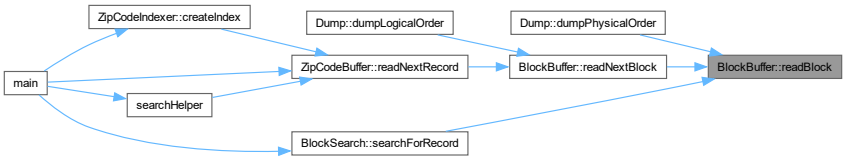
Definition at line 90 of file BlockBuffer.cpp.

```
00090                                                       {
00091     vector<string> recordStrings;
00092     std::string line;
00093
00094     // If the RBN is -1, the end of the chain has been reached.
00095     if (relativeBlockNumber == -1)
00096     {
00097         currentRBN = -1;
00098         return recordStrings;
00099     }
00100
00101     moveToBlock(relativeBlockNumber);               // Move to the next block
00102     return readCurrentBlock();          // Read the metadata and the records
00103 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




### 3.1.3.8 readCurrentBlock()

`vector< string > BlockBuffer::readCurrentBlock ( )`

Reads the current block after the file pointer and returns it as a vector of records in string form.

Reads the current block and returns it as a vector of records in string form.

**Returns**

A vector of strings where each string represents a record within the block.
The length indication field for each record is read but not returned in the string.

**Precondition**

: The file pointer is at the start of the block.

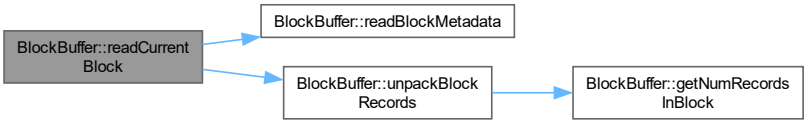
**Postcondition**

: The block is broken down into records and the file pointer is after the records in the block.

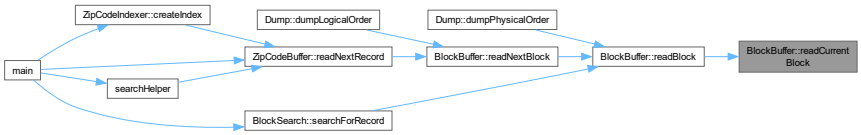
Definition at line 108 of file BlockBuffer.cpp.

```
00108                                           {
00109     readBlockMetadata();                  // Read the metadata for the block
00110     return unpackBlockRecords();          // Read the length-indicated records into strings and return
      them
00111 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




### 3.1.3.9 readNextBlock()

```
vector< string > BlockBuffer::readNextBlock ( )
```

Moves to and reads the next block and returns it as a vector of records in string form.

**Returns**

A vector of strings where each string represents a record within the block.
The length indication field for each record is read but not returned in the string.

**Precondition**

: The file is open and in a blocked length-indicated file format.

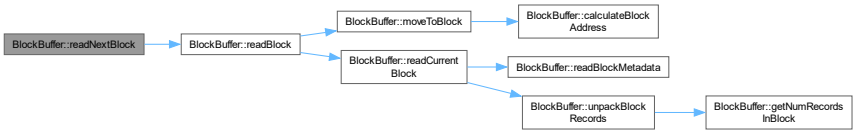
**Postcondition**

: The block is broken down into records and the file pointer is after the records in the block.

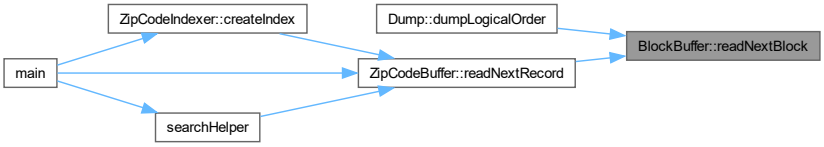
Definition at line 114 of file BlockBuffer.cpp.

```
00114                                       {
00115     return readBlock(nextRBN);
00116 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




### 3.1.3.10 calculateBlockAddress()

```
int BlockBuffer::calculateBlockAddress (
            int relativeBlockNumber )
```

Calculates the address of a Relative Block Number (RBN) within the file.

**Returns**

The address of the RBN.

**Precondition**

The file metadata has been read.

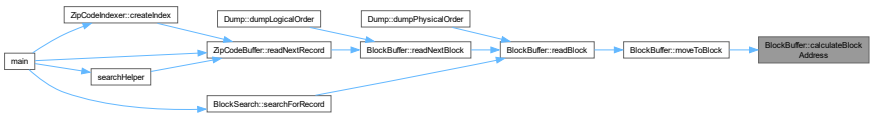
**Postcondition**

The calculation results have been returned.

Definition at line 75 of file BlockBuffer.cpp.

```
00075                                                       {
00076     return headerSize + relativeBlockNumber*blockSize;
00077 }
```

Here is the caller graph for this function:



#### 3.1.3.11 moveToBlock()

```
void BlockBuffer::moveToBlock (
            int relativeBlockNumber )
```

Moves the file pointer to the address of the block at the given Relative Block Number (RBN).

**Precondition**

The file is open.

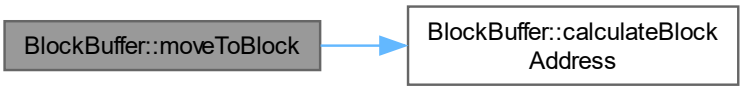
**Postcondition**

The file pointer is moved to the start of the block at the given RBN.

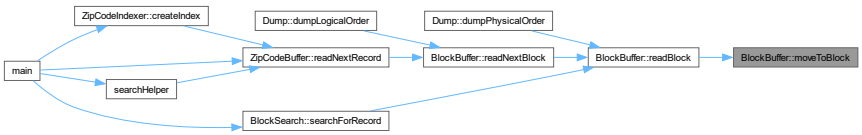
Definition at line 82 of file BlockBuffer.cpp.

```
00082                                                   {
00083     int address = calculateBlockAddress(relativeBlockNumber);
00084     file.seekg(address);
00085 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




The documentation for this class was generated from the following files:

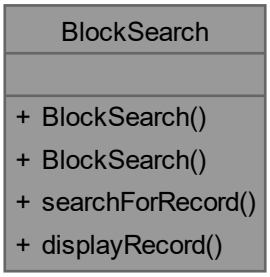
- BlockBuffer.h
- BlockBuffer.cpp

## 3.2 BlockSearch Class Reference

Implementation of the BlockSearch class for searching for records in the blocked index file.

`#include <BlockSearch.h>`

Collaboration diagram for BlockSearch:




### Public Member Functions

- BlockSearch ()

  *Construct a new Block Search object.*
- BlockSearch (string idxFile)

  *Constructor that takes in a blocked index file.*
- string searchForRecord (int target)

  *Searches for a record in the blocked index file by key (zipcode).*
- void displayRecord (string record)

  *Displays the record to the console.*

### 3.2.1 Detailed Description

Implementation of the BlockSearch class for searching for records in the blocked index file.

Uses the blocked index file to be able to search for specific records in the file.

See BlockSearch.h for full documentation.

**Author**

Andrew Clayton

**Date**

2023-11-14

**Version**

1.0

Definition at line 26 of file BlockSearch.h.

## 3.2.2 Constructor & Destructor Documentation

### 3.2.2.1 BlockSearch() [1/2]

```
BlockSearch::BlockSearch ( )  [inline]
```

Construct a new Block Search object.

**Precondition**

: none

**Postcondition**

: A new BlockSearch object is created

Definition at line 39 of file BlockSearch.h.

```
00039 { indexFile = "blocked_Index.txt"; }
```

### 3.2.2.2 BlockSearch() [2/2]

```
BlockSearch::BlockSearch (
            string idxFile )
```

Constructor that takes in a blocked index file.

**Parameters**

| | |
|---|---|
| *indexFile* | The file to open |

**Precondition**

: A blocked index file exists

**Postcondition**

: A new BlockSearch object is created

Definition at line 18 of file BlockSearch.cpp.

```
00018                                       {
00019     indexFile = idxFile;
00020 }
```

## 3.2.3 Member Function Documentation

### 3.2.3.1 searchForRecord()

```
string BlockSearch::searchForRecord (
            int target )
```

Searches for a record in the blocked index file by key (zipcode).

### Parameters

| | |
|---|---|
| *target* | The zipcode to search for |

### Precondition

: A blocked index file exists

### Postcondition

: The record is either found or not found

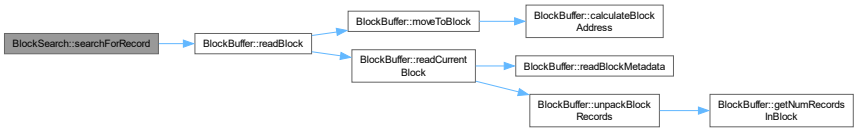
### Returns

: The record if it is found, or a -1 if it is not found

Definition at line 35 of file BlockSearch.cpp.

```
00035                                                {
00036     // Open the index file
00037     ifstream readFile(indexFile);
00038     string line;
00039 
00040     // Read through the file until we find target < greatestKeyInBlock
00041 
00042     // Iterate through each line of the file
00043     while (getline(readFile, line)) {
00044         int commaIdx = line.find(',');
00045         int rbn = 0;
00046         try {
00047             rbn = stoi(line.substr(0, commaIdx));
00048         } catch (invalid_argument& e) {
00049             cerr << "Error parsing RBN: " << e.what() << endl;
00050             // return "-1";
00051         }
00052 
00053         int greatestKeyInBlock;
00054         try {
00055             greatestKeyInBlock = stoi(line.substr(commaIdx+1));
00056         } catch (invalid_argument& e) {
00057             cerr << "Error parsing greatest key in block: " << e.what() << endl;
00058             // return "-1";
00059         }
00060 
00061         if (target < greatestKeyInBlock) {
00062             // We have found the block that contains the record we are looking for
00063             // now we need to actually access the block itself, which we should be able to do with
      BlockBuffer
00064 
00065             ifstream dataFile("us_postal_codes_blocked.txt", std::ios::app);
00066             HeaderBuffer headerBuffer2("us_postal_codes_blocked.txt");
00067             BlockBuffer blockbuffer(dataFile, headerBuffer2);
00068 
00069             // We break down all the block into a vector of records
00070 
00071             vector<string> records = blockbuffer.readBlock(rbn);
00072 
00073             for (string record : records) { // Check if each record is the target record
00074                 int commaIdx = record.find(',');
00075                 int zipcode = stoi(record.substr(0, commaIdx));
00076 
00077                 if (zipcode == target) {
00078                     return record;
00079                 }
00080             }
00081             break; // not  found in this block, and next blocks have greater keys
00082         }
00083     }
00084     // We could not find the block that contains the record we are looking for
00085     return "-1";
00086 }
```

Here is the call graph for this function:




Here is the caller graph for this function:


#### 3.2.3.2 displayRecord()

```
void BlockSearch::displayRecord (
            string record )
```

Displays the record to the console.

**Parameters**

| | |
|---|---|
| *record* | The record to display, in its raw data form |

**Precondition**

: A record exists

**Postcondition**

: The record is displayed to the console

Definition at line 88 of file BlockSearch.cpp.

```
00088                                           {
00089     // The format of a record is: zipcode,town,state,county,latitude,longitude
00090     vector<string> fields;
00091     stringstream ss(record);
00092     string field;
00093 
00094     while (getline(ss, field, ',')) {
00095         fields.push_back(field);
00096     }
00097 
00098     if (fields.size() == 6) { // Ensure there are exactly 6 fields: zipcode, town, state, county,
      latitude, longitude
00099         cout << "Zipcode: " << fields[0] << endl;
```

```
00100         cout « "Town: " « fields[1] « endl;
00101         cout « "State: " « fields[2] « endl;
00102         cout « "County: " « fields[3] « endl;
00103         cout « "Latitude: " « fields[4] « endl;
00104         cout « "Longitude: " « fields[5] « "\n\n";
00105     } else {
00106         cerr « "Zipcode not found." « endl;
00107     }
00108
00109 }
```

Here is the caller graph for this function:


The documentation for this class was generated from the following files:

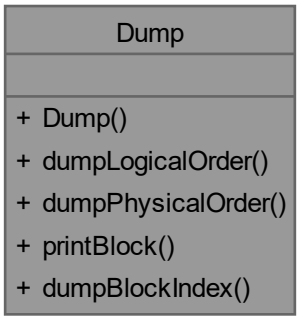
- BlockSearch.h
- BlockSearch.cpp

## 3.3 Dump Class Reference

Class for dumping and printing block records in logical and physical order and for dumping the simple index for the blocks.

`#include <Dump.h>`

Collaboration diagram for Dump:



**Public Member Functions**

- Dump (ZipCodeBuffer &recordBuffer)
- void dumpLogicalOrder ()

  *Dump records in logical order.*
- void dumpPhysicalOrder ()

  *Dump records in physical order.*
- void printBlock (std::vector< std::string > records)

  *Print a block of records.*
- void dumpBlockIndex (const std::string &filename)

  *Dump the block index from a file.*

### 3.3.1 Detailed Description

Class for dumping and printing block records in logical and physical order and for dumping the simple index for the blocks.

The Dump class provides methods to dump and print records in logical and physical order. It takes a `ZipCodeBuffer` object during initialization and uses it to access and process ZIP code records.

The constructor takes a reference to a `ZipCodeBuffer` object, initializing the `BlockBuffer` and `HeaderBuffer` for further use. It also reads the header information from the file.

The class includes methods for dumping records in logical order (`dumpLogicalOrder`), dumping records in physical order (`dumpPhysicalOrder`), and printing a block index from a specified file (`dumpBlockIndex`).

The logical order dump iterates through the records in a file using the `readNextBlock` method of `BlockBuffer`.

The physical order dump iterates through the blocks in a file using the `readBlock` method of `BlockBuffer`.

The `printBlock` method is used internally to print the records within a block.

The class assumes that the ZIP code records are stored in a file and follow a specific format. It also assumes that the file has header information and contains a specific structure of blocks.

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**Date**

2023-11-19

**Version**

1.0

Definition at line 56 of file Dump.h.

## 3.3.2 Constructor & Destructor Documentation

### 3.3.2.1 Dump()

```
Dump::Dump (
            ZipCodeBuffer & recordBuffer )
```

Definition at line 18 of file Dump.cpp.

```
00018                                   : recordBuffer(recordBuffer),
      blockBuffer(recordBuffer.blockBuffer), headerBuffer(recordBuffer.headerBuffer) {
00019     // The constructor takes an ifstream and HeaderBuffer, initializing the BlockBuffer
00020     // with the provided file and headerBuffer.
00021     headerBuffer.readHeader();
00022 }
```

Here is the call graph for this function:


## 3.3.3 Member Function Documentation

### 3.3.3.1 dumpLogicalOrder()

```
void Dump::dumpLogicalOrder ( )
```

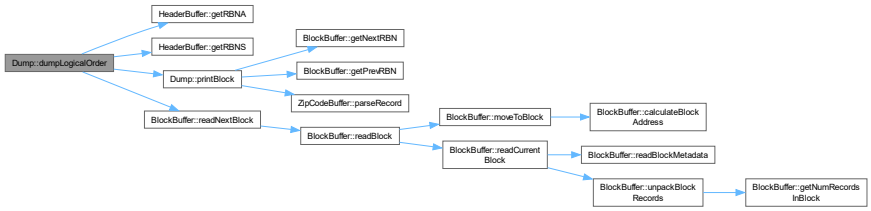
Dump records in logical order.

Prints the List Head and Avail Head Relative Block Numbers (RBNS and RBNA) and iterates through each block in logical order, printing its contents.

Definition at line 27 of file Dump.cpp.

```
00027                                {
00028     // Display the list head Relative Block Numbers
00029     std::cout « "List Head RBN: " « headerBuffer.getRBNS() « std::endl;
00030     std::cout « "Avail Head RBN: " « headerBuffer.getRBNA() « std::endl;
00031
00032     while (true)
00033     {
00034         std::vector<std::string> records = blockBuffer.readNextBlock();
00035         if (records.size() == 0) // TODO could change to when it reads -1 as next RBN to skip a step
00036         {
00037             // When it receives an empty vector, end the loop
00038             break;
00039         }
00040
00041         printBlock(records);
00042     }
00043 }
```

Here is the call graph for this function:



#### 3.3.3.2 dumpPhysicalOrder()

```
void Dump::dumpPhysicalOrder ( )
```

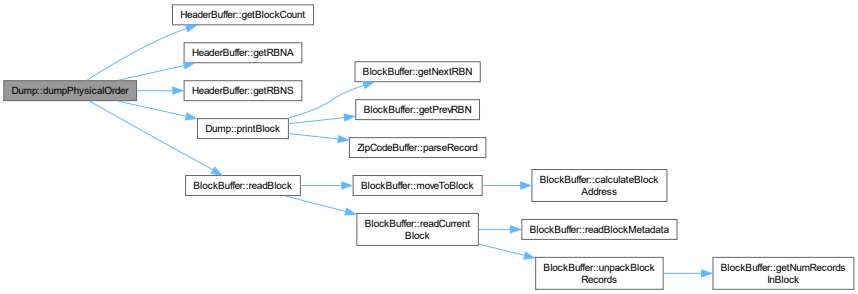
Dump records in physical order.

Prints the List Head and Avail Head Relative Block Numbers (RBNS and RBNA) and iterates through each block in physical order, printing its contents.

Definition at line 48 of file Dump.cpp.

```
00048                                {
00049     // Display the list head Relative Block Numbers
00050     std::cout « "List Head RBN: " « headerBuffer.getRBNS() « std::endl;
00051     std::cout « "Avail Head RBN: " « headerBuffer.getRBNA() « std::endl;
00052 
00053     int i = 0;
00054     int endpoint = headerBuffer.getBlockCount();
00055     while (i < endpoint)
00056     {
00057         // Read the number of blocks listed in the file metadata
00058         std::vector<std::string> records = blockBuffer.readBlock(i++);
00059         printBlock(records);
00060     }
00061 }
```

Here is the call graph for this function:




#### 3.3.3.3 printBlock()

```
void Dump::printBlock (
            std::vector< std::string > records )
```

Print a block of records.

Prints the Previous Relative Block Number (PrevRBN), the Zip Codes from the records in the block, and the Next Relative Block Number (NextRBN).

**Parameters**

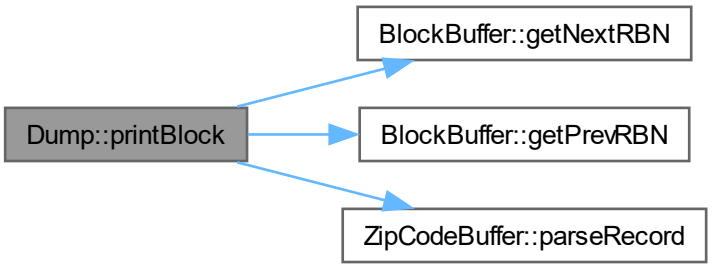
| | |
|---|---|
| *records* | A vector of strings representing the records in the block. |

Definition at line 66 of file Dump.cpp.

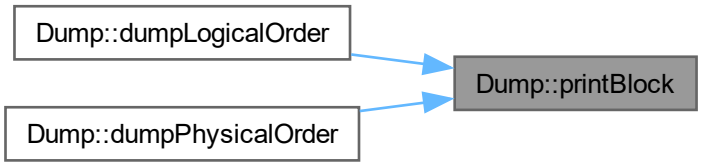
```
00066                                                {
00067 
00068     std::cout « std::left « std::setw(6) « blockBuffer.getPrevRBN(); // Display preceding RBN
```

```
00069     for (const std::string& recordString : records) {
00070         ZipCodeRecord record = recordBuffer.parseRecord(recordString);
00071         std::cout « std::setw(6) « record.zipCode;                    // Display the key (zipCode) for
      each record in the block
00072     }
00073     std::cout « std::left « std::setw(6) « blockBuffer.getNextRBN(); // Display succeeding RBN
00074     std::cout « std::endl;
00075 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




#### 3.3.3.4 dumpBlockIndex()

```
void Dump::dumpBlockIndex (
            const std::string & filename )
```

Dump the block index from a file.

Reads and prints the Relative Block Numbers (RBN) and Primary Key values from each line of the specified file.

**Parameters**

| | |
|---|---|
| *filename* | The name of the file containing the block index. |

Definition at line 80 of file Dump.cpp.

```
00080                                                   {
00081     std::ifstream mainFile(filename);
00082     if (!mainFile.is_open()) {
00083         std::cerr « "Error opening index file." « std::endl;
00084         return;
00085     }
00086 
00087     std::string line;
00088     while (std::getline(mainFile, line)) {
00089         std::istringstream ss(line);
00090         std::vector<std::string> tokens;
00091 
00092         // Split the line by comma and store tokens in the vector
00093         while (std::getline(ss, line, ',')) {
00094             tokens.push_back(line);
00095         }
00096         std::cout « "RBN: ";
00097         int key = 0;
00098         // Print each value in the tokens vector
00099         for (const auto& token : tokens) {
00100             std::cout « token « " ";
00101             if(key == 0){
00102                 std::cout « "Primary Key: ";
00103                 key = 1;
00104             }else{
00105                 key = 0;
00106             }
00107 
00108         }
00109 
00110         std::cout « "\n";
00111     }
00112 }
```

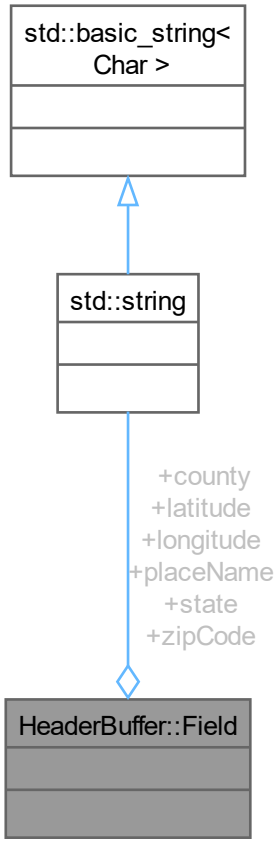
The documentation for this class was generated from the following files:

- Dump.h
- Dump.cpp

## 3.4 HeaderBuffer::Field Struct Reference

`#include <HeaderBuffer.h>`

Collaboration diagram for HeaderBuffer::Field:




**Public Attributes**

- std::string zipCode
- std::string placeName
- std::string state
- std::string county
- std::string latitude
- std::string longitude

## 3.4.1 Detailed Description

Definition at line 55 of file HeaderBuffer.h.

## 3.4.2 Member Data Documentation

### 3.4.2.1 zipCode

```
std::string HeaderBuffer::Field::zipCode
```

Definition at line 56 of file HeaderBuffer.h.

#### 3.4.2.2 placeName

```
std::string HeaderBuffer::Field::placeName
```

Definition at line 57 of file HeaderBuffer.h.

#### 3.4.2.3 state

```
std::string HeaderBuffer::Field::state
```

Definition at line 58 of file HeaderBuffer.h.

#### 3.4.2.4 county

```
std::string HeaderBuffer::Field::county
```

Definition at line 59 of file HeaderBuffer.h.

#### 3.4.2.5 latitude

```
std::string HeaderBuffer::Field::latitude
```

Definition at line 60 of file HeaderBuffer.h.

#### 3.4.2.6 longitude

```
std::string HeaderBuffer::Field::longitude
```

Definition at line 61 of file HeaderBuffer.h.

The documentation for this struct was generated from the following file:

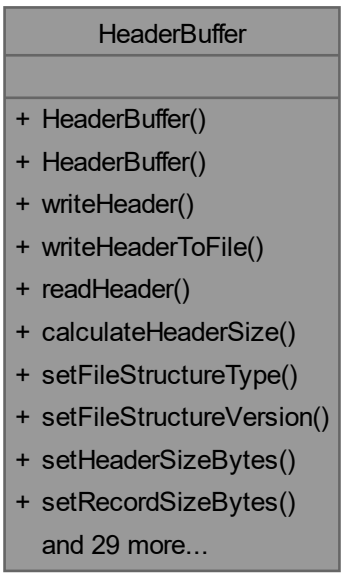
- HeaderBuffer.h

## 3.5 HeaderBuffer Class Reference

Implementation of the HeaderBuffer class for for handling header data.

`#include <HeaderBuffer.h>`

Collaboration diagram for HeaderBuffer:




### Classes

- struct Field

### Public Member Functions

- HeaderBuffer ()

  *Constructor to initialize HeaderBuffer without a filename.*
- HeaderBuffer (const std::string &filename)

  *Constructor to initialize HeaderBuffer with a filename.*
- void writeHeader ()

  *Write the header data to a file held the by object.*
- void writeHeaderToFile (const std::string &filename)

  *Write the header data to a file passed to the object.*
- void readHeader ()

  *Read header data from a file.*
- int calculateHeaderSize () const

  *calculates the size of the header in bytes*
- void setFileStructureType (const std::string &fileStructureType)

*Setters for various header fields.*

- void setFileStructureVersion (const std::string &fileStructureVersion)
- void setHeaderSizeBytes (int headerSizeBytes)
- void setRecordSizeBytes (int recordSizeBytes)
- void setSizeFormatType (const std::string &sizeFormatType)
- void setBlockSize (int blockSize)
- void setminimumBlockCapacity (int minimumBlockCapacity)
- void setPrimaryKeyIndexFileName (const std::string &primaryKeyIndexFileName)
- void setprimaryKeyIndexFileSchema (const std::string &primaryKeyIndexFileSchema)
- void setRecordCount (int recordCount)
- void setBlockCount (int blockCount)
- void setFieldCount (int fieldCount)
- void setPrimaryKeyFieldIndex (int primaryKeyFieldIndex)
- void setRBNA (int RBNA)
- void setRBNS (int RBNS)
- void setstaleFlag (int staleFlag)
- void addField (const Field &field)

  *Add a field to the header.*
- std::string getFileStructureType () const

  *Getters for header fields.*
- std::string getFileStructureVersion () const
- int getHeaderSizeBytes () const
- int getRecordSizeBytes () const
- std::string getSizeFormatType () const
- int getBlockSize () const
- int getMinimumBlockCapacity () const
- std::string getPrimaryKeyIndexFileName () const
- int getRecordCount () const
- int getBlockCount () const
- int getFieldCount () const
- int getPrimaryKeyFieldIndex () const
- int getRBNA () const
- int getRBNS () const
- int getStaleFlag () const
- const std::vector< Field > & getFields () const

### 3.5.1 Detailed Description

Implementation of the HeaderBuffer class for for handling header data.

Represents a class for handling header data.

The HeaderBuffer class is responsible for reading and writing header data to and from a file.

Header Fields:
– File Structure Type (string)
– File Structure Version (string)
– Header Size (bytes) (int)
– Record Size (bytes) (int)
– Size Format Type (string)
– Primary Key Index File (string)
– Record Count (int)
– Field Count (int)

– Primary Key Field Index (int)
– Fields
– Zip Code (string)
– Place Name (string)
– State (string)
– County (string)
– Latiitude (double)
– Longitude (double)

Whenever readHeader is called, it reads the header data from the file specified in the constructor.

The name of the header file to be opened is passed to the class constructor as a string.

Assumptions:
– The header file is in the same directory as the program.
– The header file format follows a specific structure, as described in the code.

See HeaderBuffer.h for the class declaration and documentation.

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Tristan Adams

**Date**

2023-10-16

**Version**

2.0

Definition at line 52 of file HeaderBuffer.h.

## 3.5.2 Constructor & Destructor Documentation

### 3.5.2.1 HeaderBuffer() [1/2]

```
HeaderBuffer::HeaderBuffer ( )
```

Constructor to initialize HeaderBuffer without a filename.

Constructor to initialize HeaderBuffer with a filename.

**Parameters**

| | |
|---|---|
| *none.* | |
| *filename* | The name of the header file to be opened as a string. |

Definition at line 15 of file HeaderBuffer.cpp.

```
00015                                {
00016         // Set default values for member variables
00017         fileStructureType_ = "DefaultType";
00018         fileStructureVersion_ = "0.0";
00019         headerSizeBytes_ = 0;
00020         recordSizeBytes_ = 0;
00021         sizeFormatType_ = "ASCII";
00022         blockSize_ = 0;
00023         minimumBlockCapacity_ = 0;
00024         primaryKeyIndexFileName_ = "default_index.txt";
00025         primaryKeyIndexFileSchema_ = "default_schema";
00026         recordCount_ = 0;
00027         blockCount_ = 0;
00028         fieldCount_ = 0;
00029         primaryKeyFieldIndex_ = 0;
00030         RBNA_ = 0;
00031         RBNS_ = 0;
00032         staleFlag_ = 0;
00033 
00034         // Add some default fields
00035         Field defaultField;
00036         defaultField.zipCode = "default_zip";
00037         defaultField.placeName = "default_place";
00038         defaultField.state = "default_state";
00039         defaultField.county = "default_county";
00040         defaultField.latitude = "default_latitude";
00041         defaultField.longitude = "default_longitude";
00042 
00043         fields_.push_back(defaultField);
00044     }
```

#### 3.5.2.2 HeaderBuffer() [2/2]

```
HeaderBuffer::HeaderBuffer (
            const std::string & filename )
```

Constructor to initialize HeaderBuffer with a filename.

**Parameters**

| | |
|---|---|
| *filename* | The name of the header file to be opened as a string. |

Definition at line 48 of file HeaderBuffer.cpp.

```
00048                                                    : filename_(filename) {
00049     }
```

### 3.5.3 Member Function Documentation

#### 3.5.3.1 writeHeader()

```
void HeaderBuffer::writeHeader ( )
```

Write the header data to a file held the by object.

Write the header data to a file.

**Precondition**

The file must be successfully opened for writing.

Used for updating the file in the object

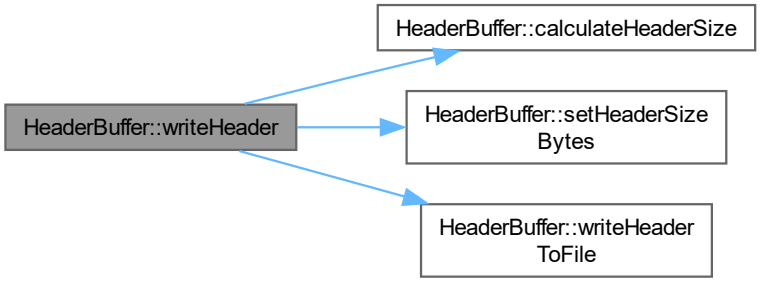
### Precondition

The file must be successfully opened for writing.

Definition at line 53 of file HeaderBuffer.cpp.

```
00053                                   {
00054         const std::string tempFilename = "tempfile.txt";
00055 
00056         // Step 1: Write the data portion to the temporary file
00057         std::ofstream tempFile(tempFilename);
00058 
00059         if (!tempFile.is_open()) {
00060             std::cerr « "Error creating temporary file." « std::endl;
00061             return;
00062         }
00063 
00064         // Open the main file
00065         std::ifstream mainFile(filename_);
00066 
00067         if (!mainFile.is_open()) {
00068             std::cerr « "Error opening main file." « std::endl;
00069             tempFile.close();
00070             return;
00071         }
00072 
00073         // Write your data to the temporary file here
00074         std::string line;
00075         bool copyStarted = false;
00076 
00077         while (std::getline(mainFile, line)) {
00078             if (copyStarted) {
00079                 tempFile « line « std::endl;
00080             } else if (line.find("Data:") != std::string::npos) {
00081                 copyStarted = true;
00082             }
00083         }
00084 
00085         // Close the main file and the temporary file
00086         mainFile.close();
00087         tempFile.close();
00088 
00089         // Step 2: Overwrite the main file with the header
00090         this->setHeaderSizeBytes(calculateHeaderSize());
00091         writeHeaderToFile(filename_);
00092 
00093         // Step 3: Append the data from the temporary file to the main file
00094         std::ifstream tempFileReader(tempFilename);
00095         std::ofstream mainFileWriter(filename_, std::ios::app); // Open the file in append mode
00096 
00097         if (!tempFileReader.is_open() || !mainFileWriter.is_open()) {
00098             std::cerr « "Error opening files." « std::endl;
00099             tempFileReader.close();
00100             mainFileWriter.close();
00101             return;
00102         }
00103 
00104         mainFileWriter « tempFileReader.rdbuf();
00105 
00106         // Close files and remove the temporary file
00107         tempFileReader.close();
00108         mainFileWriter.close();
00109         std::remove(tempFilename.c_str());
00110     }
```

Here is the call graph for this function:




Here is the caller graph for this function:


#### 3.5.3.2 writeHeaderToFile()

```
void HeaderBuffer::writeHeaderToFile (
            const std::string & filename )
```

Write the header data to a file passed to the object.

Write the header data to a file.

**Precondition**

The file must be successfully opened for writing.

Used for writing to a file different than the one in the object

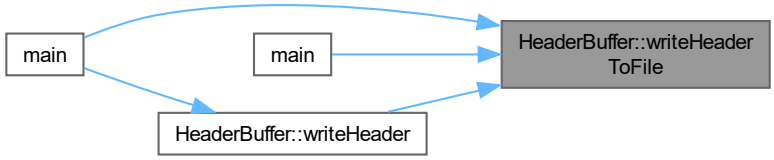
**Precondition**

filename the name of the file to be written to.

Definition at line 116 of file HeaderBuffer.cpp.

```
00116                                                                {
00117         std::ofstream file(filename);
00118 
00119         if (!file.is_open()) {
00120             // Print an error mesage if the file cannot be opened
00121 
00122             std::cerr « "Error opening the file(writeHeaderToFile)." « std::endl;
00123             return;
00124         }
00125 
00126         //version for seeing all the stuff
00127         file « "Header:" « std::endl;
00128         file « " - File structure type: " « fileStructureType_ « std::endl;
00129         file « " - File structure version: " « fileStructureVersion_ « std::endl;
00130         file « " - Header Size (bytes): " « headerSizeBytes_ « std::endl;
00131         file « " - Record Size (bytes): " « recordSizeBytes_ « std::endl;
00132         file « " - Size Format Type: " « sizeFormatType_ « std::endl;
00133         file « " - Block Size: " « blockSize_ « std::endl;
00134         file « " - Minimum Block Capacity: " « minimumBlockCapacity_ « std::endl;
00135         file « " - Primary Key Index File: " « primaryKeyIndexFileName_ « std::endl;
00136         file « " - Primary Key Index File Schema: " « primaryKeyIndexFileSchema_ « std::endl;
00137         file « " - Record Count: " « recordCount_ « std::endl;
00138         file « " - Block Count: " « blockCount_ « std::endl;
00139         file « " - Field Count: " « fieldCount_ « std::endl;
00140         file « " - Primary Key: " « primaryKeyFieldIndex_ « std::endl;
00141         file « " - RBN link for Avail List: " « RBNA_ « std::endl;
00142         file « " - RBN link for active sequence set List: " « RBNS_ « std::endl;
00143         file « " - Stale Flag: " « staleFlag_ « std::endl;
00144 
00145         for (const Field& field : fields_) {
00146             file « std::endl;
00147             file « "Fields:" « std::endl;
00148             file « "    - Zip Code: " « field.zipCode « std::endl;
00149             file « "    - Place Name: " « field.placeName « std::endl;
00150             file « "    - State: " « field.state « std::endl;
00151             file « "    - County: " « field.county « std::endl;
00152             file « "    - Latitude: " « field.latitude « std::endl;
00153             file « "    - Longitude: " « field.longitude « std::endl;
00154         }
00155 
00156         file « std::endl;
00157         file « "Data:" « std::endl;
00158 
00159         file.close();
00160     }
```

Here is the caller graph for this function:




### 3.5.3.3 readHeader()

```
void HeaderBuffer::readHeader ( )
```

Read header data from a file.

Reader header data from a file.

### Precondition

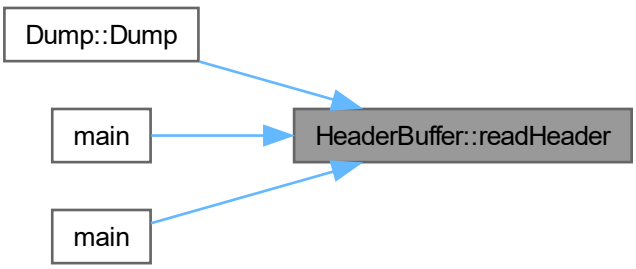
The file must be successfully opened for reading.

Definition at line 164 of file HeaderBuffer.cpp.

```
00164                                {
00165         std::ifstream file(filename_);
00166 
00167         if (!file.is_open()) {
00168             // Print an error mesage if the file cannot be opened
00169             std::cerr « "Error opening the file(readHeader)." « std::endl;
00170             return;
00171         }
00172 
00173         std::string line;
00174 
00175         while (std::getline(file, line)) {
00176             if (line.find(" - File structure type: ") != std::string::npos) {
00177                 fileStructureType_ = line.substr(line.find(": ") + 2);
00178 
00179             }
00180             else if (line.find(" - File structure version: ") != std::string::npos) {
00181                 fileStructureVersion_ = line.substr(line.find(": ") + 2);
00182 
00183             }
00184             else if (line.find("- Header Size (bytes): ") != std::string::npos) {
00185                 headerSizeBytes_ = std::stoi(line.substr(line.find(": ") + 2));
00186 
00187             }
00188             else if (line.find(" - Record Size (bytes): ") != std::string::npos) {
00189                 recordSizeBytes_ = std::stoi(line.substr(line.find(": ") + 2));
00190 
00191             }
00192             else if (line.find(" - Size Format Type: ") != std::string::npos) {
00193                 sizeFormatType_ = line.substr(line.find(": ") + 2);
00194 
00195             }
00196             else if (line.find(" - Block Size: ") != std::string::npos) {
00197                 blockSize_ = std::stoi(line.substr(line.find(": ") + 2));
00198 
00199             }
00200             else if (line.find(" - Minimum Block Capacity: ") != std::string::npos) {
00201                 minimumBlockCapacity_ = std::stoi(line.substr(line.find(": ") + 2));
00202 
00203             }
00204             else if (line.find(" - Primary Key Index File: ") != std::string::npos) {
00205                 primaryKeyIndexFileName_ = line.substr(line.find(": ") + 2);
00206 
00207             }
00208             else if (line.find(" - Primary Key Index File Schema: ") != std::string::npos) {
00209                 primaryKeyIndexFileSchema_ = line.substr(line.find(": ") + 2);
00210 
00211             }
00212             else if (line.find(" - Record Count: ") != std::string::npos) {
00213                 recordCount_ = std::stoi(line.substr(line.find(": ") + 2));
00214 
00215             }
00216             else if (line.find(" - Block Count: ") != std::string::npos) {
00217                 blockCount_ = std::stoi(line.substr(line.find(": ") + 2));
00218 
00219             }
00220             else if (line.find(" - Field Count: ") != std::string::npos) {
00221                 fieldCount_ = std::stoi(line.substr(line.find(": ") + 2));
00222 
00223             }
00224             else if (line.find(" - Primary Key: ") != std::string::npos) {
00225                 primaryKeyFieldIndex_ = std::stoi(line.substr(line.find(": ") + 2));
00226 
00227             }
00228             else if (line.find(" - RBN link for Avail List: ") != std::string::npos) {
00229                 RBNA_ = std::stoi(line.substr(line.find(": ") + 2));
00230 
00231             }
00232             else if (line.find(" - RBN link for active sequence set List: ") != std::string::npos) {
00233                 RBNS_ = std::stoi(line.substr(line.find(": ") + 2));
00234 
00235             }
00236             else if (line.find(" - Stale Flag: ") != std::string::npos) {
00237                 staleFlag_ = std::stoi(line.substr(line.find(": ") + 2));
00238 
00239             }
00240             else if (line.find("Fields:") != std::string::npos) {
00241 
00242 
00243                 Field field;
```

```
00244                 while (std::getline(file, line)) {
00245                     if (line.find("   - Zip Code: ") != std::string::npos) {
00246                         field.zipCode = line.substr(line.find(": ") + 2);
00247                     }
00248                     else if (line.find("   - Place Name: ") != std::string::npos) {
00249                         field.placeName = line.substr(line.find(": ") + 2);
00250                     }
00251                     else if (line.find("   - State: ") != std::string::npos) {
00252                         field.state = line.substr(line.find(": ") + 2);
00253                     }
00254                     else if (line.find("   - County: ") != std::string::npos) {
00255                         field.county = line.substr(line.find(": ") + 2);
00256                     }
00257                     else if (line.find("   - Latitude: ") != std::string::npos) {
00258                         field.latitude = line.substr(line.find(": ") + 2);
00259                     }
00260                     else if (line.find("   - Longitude: ") != std::string::npos) {
00261                         field.longitude = line.substr(line.find(": ") + 2);
00262                     }
00263                 }
00264                 fields_.push_back(field);
00265             }
00266         }
00267 
00268         file.close();
00269     }
```

Here is the caller graph for this function:




#### 3.5.3.4 calculateHeaderSize()

```
int HeaderBuffer::calculateHeaderSize ( ) const
```

calculates the size of the header in bytes

calculates the total bytes the header will take up based on its static structure and variables

**Precondition**

values must be in the istance of headerBuffer's variables to count

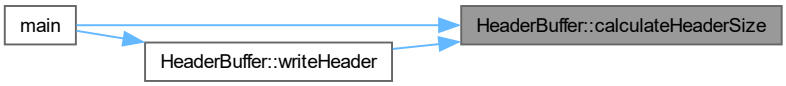
the header object must have data to work with

Definition at line 273 of file HeaderBuffer.cpp.

```
00273                                           {
00274         std::stringstream headerStream;
00275 
00276         // Write header data to a stringstream
```

```
00277         headerStream « "Header:\n";
00278         headerStream « " - File structure type: " « fileStructureType_ « "\n";
00279         headerStream « " - File structure version: " « fileStructureVersion_ « "\n";
00280         headerStream « " - Header Size (bytes): " « headerSizeBytes_ « "\n";
00281         headerStream « " - Record Size (bytes): " « recordSizeBytes_ « "\n";
00282         headerStream « " - Size Format Type: " « sizeFormatType_ « "\n";
00283         headerStream « " - Block Size: " « blockSize_ « "\n";
00284         headerStream « " - Minimum Block Capacity: " « minimumBlockCapacity_ « "\n";
00285         headerStream « " - Primary Key Index File: " « primaryKeyIndexFileName_ « "\n";
00286         headerStream « " - Primary Key Index File Schema: " « primaryKeyIndexFileSchema_ « "\n";
00287         headerStream « " - Record Count: " « recordCount_ « "\n";
00288         headerStream « " - Block Count: " « blockCount_ « "\n";
00289         headerStream « " - Field Count: " « fieldCount_ « "\n";
00290         headerStream « " - Primary Key: " « primaryKeyFieldIndex_ « "\n";
00291         headerStream « " - RBN link for Avail List: " « RBNA_ « "\n";
00292         headerStream « " - RBN link for active sequence set List: " « RBNS_ « "\n";
00293         headerStream « " - Stale Flag: " « staleFlag_ « "\n";
00294 
00295         headerStream « "\nFields:\n";
00296         for (const Field& field : fields_) {
00297             headerStream « "    - Zip Code: " « field.zipCode « "\n";
00298             headerStream « "    - Place Name: " « field.placeName « "\n";
00299             headerStream « "    - State: " « field.state « "\n";
00300             headerStream « "    - County: " « field.county « "\n";
00301             headerStream « "    - Latitude: " « field.latitude « "\n";
00302             headerStream « "    - Longitude: " « field.longitude « "\n";
00303         }
00304 
00305         headerStream « "\nData:\n";
00306 
00307         // Calculate total size including the newline characters
00308         return static_cast<int>(headerStream.str().size());
00309 }
```

Here is the caller graph for this function:




#### 3.5.3.5 setFileStructureType()

```
void HeaderBuffer::setFileStructureType (
            const std::string & fileStructureType )
```

Setters for various header fields.

**Parameters**

| | |
|---|---|
| *fileStructureType* | The file structure type as a string. |

Definition at line 313 of file HeaderBuffer.cpp.

```
00313                                                                    {
00314         fileStructureType_ = fileStructureType;
00315     }
```

#### 3.5.3.6 setFileStructureVersion()

```
void HeaderBuffer::setFileStructureVersion (
            const std::string & fileStructureVersion )
```

**Parameters**

| | |
|---|---|
| *fileStructureVersion* | The file structure version as a string. |

Definition at line 318 of file HeaderBuffer.cpp.

```
00318                                                                                {
00319         fileStructureVersion_ = fileStructureVersion;
00320     }
```

### 3.5.3.7 setHeaderSizeBytes()

```
void HeaderBuffer::setHeaderSizeBytes (
            int headerSizeBytes )
```

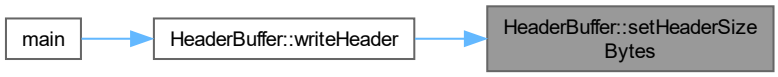
**Parameters**

| | |
|---|---|
| *headerSizeBytes* | The header size in bytes as an integer. |

Definition at line 323 of file HeaderBuffer.cpp.

```
00323                                                  {
00324         headerSizeBytes_ = headerSizeBytes;
00325     }
```

Here is the caller graph for this function:




### 3.5.3.8 setRecordSizeBytes()

```
void HeaderBuffer::setRecordSizeBytes (
            int recordSizeBytes )
```

**Parameters**

| | |
|---|---|
| *recordSizeBytes* | The record size in bytes as an integer. |

Definition at line 328 of file HeaderBuffer.cpp.

```
00328                                                  {
00329         recordSizeBytes_ = recordSizeBytes;
00330     }
```

### 3.5.3.9 setSizeFormatType()

```
void HeaderBuffer::setSizeFormatType (
            const std::string & sizeFormatType )
```

**Parameters**

| | |
|---|---|
| *sizeFormatType* | The size format type as a string (ASCII or binary). |

Definition at line 333 of file HeaderBuffer.cpp.

```
00333                                                                    {
00334         sizeFormatType_ = sizeFormatType;
00335     }
```

#### 3.5.3.10 setBlockSize()

```
void HeaderBuffer::setBlockSize (
            int blockSize )
```

**Parameters**

| | |
|---|---|
| *blockSize* | The size of the blocks. |

Definition at line 338 of file HeaderBuffer.cpp.

```
00338                                                {
00339         blockSize_ = blockSize;
00340     }
```

#### 3.5.3.11 setminimumBlockCapacity()

```
void HeaderBuffer::setminimumBlockCapacity (
            int minimumBlockCapacity )
```

**Parameters**

| | |
|---|---|
| *minimumBlockCapacity* | The smallest amount of a block that can be filled. |

Definition at line 343 of file HeaderBuffer.cpp.

```
00343                                                                    {
00344         minimumBlockCapacity_ = minimumBlockCapacity;
00345     }
```

#### 3.5.3.12 setPrimaryKeyIndexFileName()

```
void HeaderBuffer::setPrimaryKeyIndexFileName (
            const std::string & primaryKeyIndexFileName )
```

**Parameters**

| | |
|---|---|
| *primaryKeyIndexFileName* | The primary key index file name as a string. |

Definition at line 348 of file HeaderBuffer.cpp.

```
00348                                                                                                {
00349         primaryKeyIndexFileName_ = primaryKeyIndexFileName;
00350     }
```

#### 3.5.3.13 setprimaryKeyIndexFileSchema()

```
void HeaderBuffer::setprimaryKeyIndexFileSchema (
            const std::string & primaryKeyIndexFileSchema )
```

**Parameters**

| | |
|---|---|
| *primaryKeyIndexFileSchema* | The info on how to read the index file. |

Definition at line 353 of file HeaderBuffer.cpp.

```
00353                                                                                                    {
00354         primaryKeyIndexFileSchema_ = primaryKeyIndexFileSchema;
00355     }
```

#### 3.5.3.14 setRecordCount()

```
void HeaderBuffer::setRecordCount (
            int recordCount )
```

**Parameters**

| | |
|---|---|
| *recordCount* | The record count as an integer. |

Definition at line 358 of file HeaderBuffer.cpp.

```
00358                                                 {
00359         recordCount_ = recordCount;
00360     }
```

#### 3.5.3.15 setBlockCount()

```
void HeaderBuffer::setBlockCount (
            int blockCount )
```

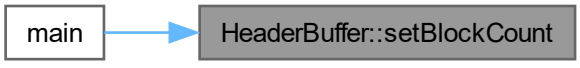
**Parameters**

| | |
|---|---|
| *blockCount* | The block count as an integer. |

Definition at line 363 of file HeaderBuffer.cpp.

```
00363                                                {
00364         blockCount_ = blockCount;
00365     }
```

Here is the caller graph for this function:



#### 3.5.3.16 setFieldCount()

```
void HeaderBuffer::setFieldCount (
            int fieldCount )
```

**Parameters**

| | |
|---|---|
| *fieldCount* | The field count as an integer. |

Definition at line 368 of file HeaderBuffer.cpp.

```
00368                                                   {
00369         fieldCount_ = fieldCount;
00370     }
```

#### 3.5.3.17 setPrimaryKeyFieldIndex()

```
void HeaderBuffer::setPrimaryKeyFieldIndex (
            int primaryKeyFieldIndex )
```

**Parameters**

| | |
|---|---|
| *primaryKeyFieldIndex* | The primary key field index as an integer. |

Definition at line 373 of file HeaderBuffer.cpp.

```
00373                                                                   {
00374         primaryKeyFieldIndex_ = primaryKeyFieldIndex;
00375     }
```

#### 3.5.3.18 setRBNA()

```
void HeaderBuffer::setRBNA (
            int RBNA )
```

**Parameters**

| | |
|---|---|
| *RBNA* | The RBNA as an integer. |

Definition at line 378 of file HeaderBuffer.cpp.

```
00378                                           {
00379         RBNA_ = RBNA;
00380     }
```

#### 3.5.3.19 setRBNS()

```
void HeaderBuffer::setRBNS (
            int RBNS )
```

**Parameters**

| | |
|---|---|
| *RBNS* | The RBNA as an integer. |

Definition at line 383 of file HeaderBuffer.cpp.

```
00383                                           {
00384         RBNS_ = RBNS;
00385     }
```

#### 3.5.3.20 setstaleFlag()

```
void HeaderBuffer::setstaleFlag (
             int staleFlag )
```

**Parameters**

| | |
|---|---|
| *staleFlag* | The tells if the header record is stale. |

Definition at line 388 of file HeaderBuffer.cpp.

```
00388                                                 {
00389         staleFlag_ = staleFlag;
00390     }
```

#### 3.5.3.21 addField()

```
void HeaderBuffer::addField (
             const Field & field )
```

Add a field to the header.

**Parameters**

| | |
|---|---|
| *field* | The Field structure to be added to the header. |

Definition at line 394 of file HeaderBuffer.cpp.

```
00394                                                  {
00395         fields_.push_back(field);
00396     }
```

#### 3.5.3.22 getFileStructureType()

```
std::string HeaderBuffer::getFileStructureType ( ) const
```

Getters for header fields.

Definition at line 399 of file HeaderBuffer.cpp.

```
00399                                                      {
00400         return fileStructureType_;
00401     }
```

#### 3.5.3.23 getFileStructureVersion()

```
std::string HeaderBuffer::getFileStructureVersion ( ) const
```

Definition at line 403 of file HeaderBuffer.cpp.

```
00403                                                        {
00404         return fileStructureVersion_;
00405     }
```

#### 3.5.3.24 getHeaderSizeBytes()

```
int HeaderBuffer::getHeaderSizeBytes ( ) const
```

Definition at line 407 of file HeaderBuffer.cpp.

```
00407                                                {
00408         return headerSizeBytes_;
00409     }
```

#### 3.5.3.25 getRecordSizeBytes()

```
int HeaderBuffer::getRecordSizeBytes ( ) const
```

Definition at line 411 of file HeaderBuffer.cpp.

```
00411                                                {
00412         return recordSizeBytes_;
00413     }
```

#### 3.5.3.26 getSizeFormatType()

```
std::string HeaderBuffer::getSizeFormatType ( ) const
```

Definition at line 415 of file HeaderBuffer.cpp.

```
00415                                                    {
00416         return sizeFormatType_;
00417     }
```

#### 3.5.3.27 getBlockSize()

```
int HeaderBuffer::getBlockSize ( ) const
```

Definition at line 419 of file HeaderBuffer.cpp.

```
00419                                               {
00420         return blockSize_;
00421     }
```

#### 3.5.3.28 getMinimumBlockCapacity()

```
int HeaderBuffer::getMinimumBlockCapacity ( ) const
```

Definition at line 423 of file HeaderBuffer.cpp.

```
00423                                                    {
00424         return minimumBlockCapacity_;
00425     }
```

#### 3.5.3.29 getPrimaryKeyIndexFileName()

```
std::string HeaderBuffer::getPrimaryKeyIndexFileName ( ) const
```

Definition at line 430 of file HeaderBuffer.cpp.

```
00430                                                        {
00431         return primaryKeyIndexFileName_;
00432     }
```

#### 3.5.3.30 getRecordCount()

```
int HeaderBuffer::getRecordCount ( ) const
```

Definition at line 434 of file HeaderBuffer.cpp.

```
00434                                           {
00435         return recordCount_;
00436     }
```

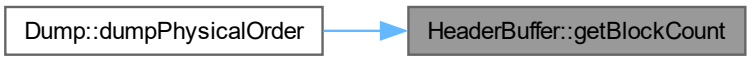
#### 3.5.3.31 getBlockCount()

```
int HeaderBuffer::getBlockCount ( ) const
```

Definition at line 427 of file HeaderBuffer.cpp.

```
00427                                           {
00428         return blockCount_;
00429     }
```

Here is the caller graph for this function:




#### 3.5.3.32 getFieldCount()

```
int HeaderBuffer::getFieldCount ( ) const
```

Definition at line 438 of file HeaderBuffer.cpp.

```
00438                                           {
00439         return fieldCount_;
00440     }
```

#### 3.5.3.33 getPrimaryKeyFieldIndex()

```
int HeaderBuffer::getPrimaryKeyFieldIndex ( ) const
```

Definition at line 442 of file HeaderBuffer.cpp.

```
00442                                                   {
00443         return primaryKeyFieldIndex_;
00444     }
```

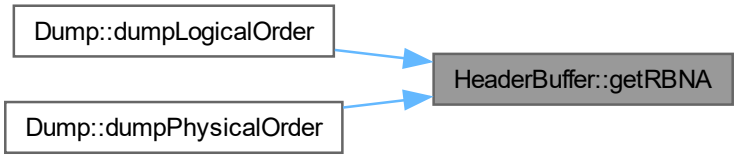
#### 3.5.3.34 getRBNA()

```
int HeaderBuffer::getRBNA ( ) const
```

Definition at line 446 of file HeaderBuffer.cpp.

```
00446                                   {
00447         return RBNA_;
00448     }
```

Here is the caller graph for this function:



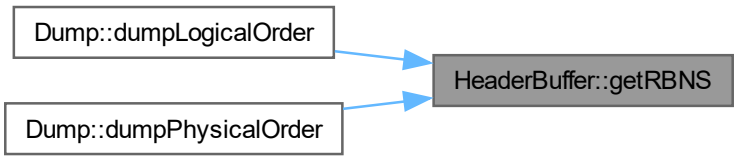

#### 3.5.3.35 getRBNS()

```
int HeaderBuffer::getRBNS ( ) const
```

Definition at line 450 of file HeaderBuffer.cpp.

```
00450                                   {
00451         return RBNS_;
00452     }
```

Here is the caller graph for this function:




#### 3.5.3.36 getStaleFlag()

```
int HeaderBuffer::getStaleFlag ( ) const
```

Definition at line 454 of file HeaderBuffer.cpp.

```
00454                                       {
00455         return staleFlag_;
00456     }
```

#### 3.5.3.37 getFields()

```
const std::vector< Field > & HeaderBuffer::getFields ( ) const
```

The documentation for this class was generated from the following files:

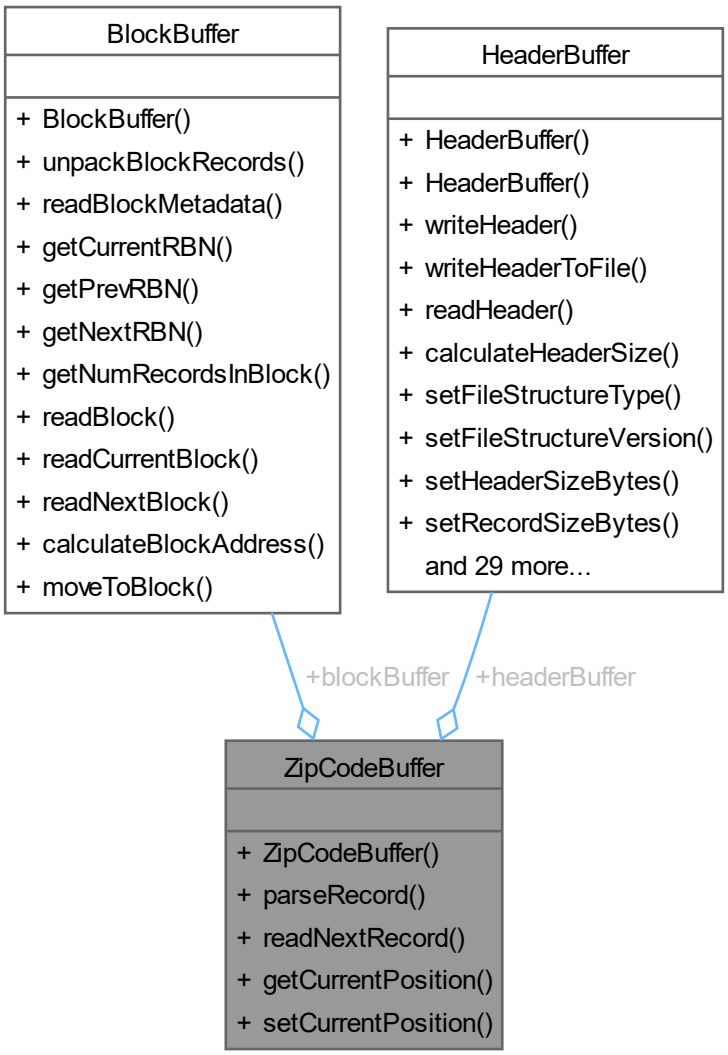
- HeaderBuffer.h
- HeaderBuffer.cpp

## 3.6 ZipCodeBuffer Class Reference

The ZipCodeBuffer class parses the file one record at a time and returns the fields in a ZipCodeRecord struct.

```
#include <ZipCodeBuffer.h>
```

Collaboration diagram for ZipCodeBuffer:



#### Public Member Functions

- ZipCodeBuffer (std::ifstream &file, char fileType, HeaderBuffer headerBuffer)

  *Constructor that accepts the filename.*
- ZipCodeRecord parseRecord (std::string)

  *Parses a string into a ZipCodeRecord struct.*
- ZipCodeRecord readNextRecord ()

  *Reads the next ZIP Code record from the file.*
- std::streampos getCurrentPosition ()

  *Method to get the current position in the file.*
- std::ifstream & setCurrentPosition (std::streampos)

  *Method to set the current position in the file to a given streampos.*

#### Public Attributes

- BlockBuffer blockBuffer
- HeaderBuffer headerBuffer = HeaderBuffer("us_postal_codes.txt")

#### Friends

- class Dump

### 3.6.1 Detailed Description

The ZipCodeBuffer class parses the file one record at a time and returns the fields in a ZipCodeRecord struct.

Class to parse ZIP code records in a file.

See ZipCodeBuffer.h for full documentation.

**Author**

Kent Biernath

Emma Hoffmann, Emily Yang

**Date**

2023-11-19

**Version**

3.0

Definition at line 60 of file ZipCodeBuffer.h.

## 3.6.2 Constructor & Destructor Documentation

### 3.6.2.1 ZipCodeBuffer()

```
ZipCodeBuffer::ZipCodeBuffer (
            std::ifstream & file,
            char fileType = 'L',
            HeaderBuffer headerBuffer = HeaderBuffer("us_postal_codes.txt") )
```

Constructor that accepts the filename.

#### Precondition

The file has one column header row to skip.

#### Postcondition

The file is opened and the header row is skipped.

#### Parameters

| | |
|---|---|
| *fileName* | The name of the file to open. |
| *fileType* | The type of the file. Case insensitive, stored in uppercase. |
| *headerBuffer* | A HeaderBuffer object for the file.<br>– 'C' = CSV, comma-separated values.<br>– 'L' = Length-indicated file structure format with the first field describing the length of the record.<br>– 'B' = Blocked length-indicated records. |

Definition at line 15 of file ZipCodeBuffer.cpp.

```
00015
      : file(file),
00016     fileType(std::toupper(fileType)), blockBuffer(BlockBuffer(file, headerBuffer)),
      headerBuffer(headerBuffer) { // TODO change HeaderBuffer initialization once it has a generic
      constructor
00017
00018     if (this->fileType == 'C') {
00019         // If CSV, skip the header line.
00020         std::string line;
00021         getline(file, line); // Skip header line
00022     }
00023     else if (this->fileType == 'L' || this->fileType == 'B') {
00024         // If length-indicated or blocked length-indicated file, skip the header line.
00025         // We have to skip past the metadata, up to the "Data: line"
00026         std::string line;
00027         std::getline(file, line);
00028         if (line.find("Header:") != std::string::npos)
00029         {
00030             // File contains a metadata header
00031
00032             // Read lines until "Data:" is found
00033             while (std::getline(file, line)) {
00034                 if (line.find("Data:") != std::string::npos) {
00035                     break;
00036                 }
00037             }
00038         }
00039
00040     }
00041 };
```

## 3.6.3 Member Function Documentation

### 3.6.3.1 parseRecord()

```
ZipCodeRecord ZipCodeBuffer::parseRecord (
            std::string recordString )
```

Parses a string into a ZipCodeRecord struct.

#### Precondition

Receives a string to parse.

#### Postcondition

The ZipCodeRecord struct is filled with data from the string and returned.

#### Parameters

| | |
|---|---|
| *recordString* | The string to parse into a ZipCodeRecord struct.<br>It must have six fields separated by commas and be in this order:<br>– ZIP Code (string)<br>– Place Name (string)<br>– State Code (string)<br>– County (string)<br>– Latitude (double)<br>– Longitude (double) |

#### Returns

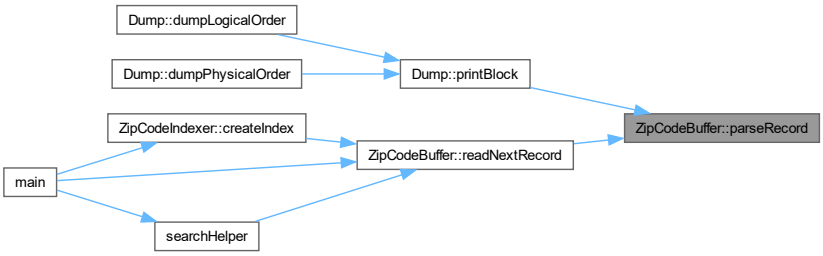
Returns the ZipCodeRecord struct filled with data parsed from the string.
If the record string is malformed, it returns an empty string for the zipCode field as the terminal string.

Definition at line 45 of file ZipCodeBuffer.cpp.

```
00045                                                                   {
00046     ZipCodeRecord record;
00047
00048     std::istringstream recordStream(recordString);
00049     std::string field;
00050
00051     // Parse the record fields using istringstream
00052     std::vector<std::string> fields;
00053     while (getline(recordStream, field, ',')) {
00054         fields.push_back(field);
00055     }
00056
00057     if (fields.size() == 6)
00058     {
00059         // Fill the ZipCodeRecord struct with the data from the record
00060         record.zipCode = fields[0];
00061         record.placeName = fields[1];
00062         record.state = fields[2];
00063         record.county = fields[3];
00064         record.latitude = std::stod(fields[4]);  // Convert string to double
00065         record.longitude = std::stod(fields[5]);
00066     }
00067     else
00068     {
00069         // The record is malformed and does not have 6 fields. Return terminal string
00070         record.zipCode = "";
00071         std::cerr « "A record contains an invalid number of fields: "
00072             « recordString « std::endl;
00073     }
```

```
00074
00075     return record;
00076 };
```

Here is the caller graph for this function:




### 3.6.3.2 readNextRecord()

```
ZipCodeRecord ZipCodeBuffer::readNextRecord ( )
```

Reads the next ZIP Code record from the file.

This function reads the next line from the file, parses it into a ZipCodeRecord struct, and returns it.

#### Precondition

The next record must have exactly six fields.

#### Postcondition

The next record in the file was returned.

#### Returns

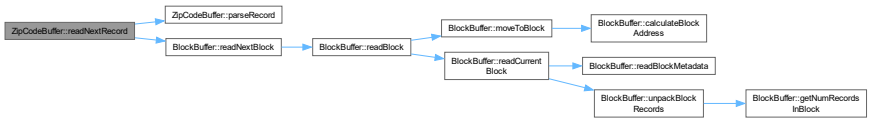
The next ZIP Code record from the file. When it reaches the end of the file or an invalid record, it returns a ZIP code of "" as a terminal string.

Definition at line 80 of file ZipCodeBuffer.cpp.

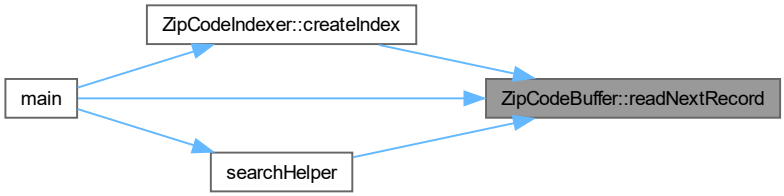
```
00080                                           {
00081     ZipCodeRecord record;
00082     std::string recordString;
00083
00084     if (file.eof())
00085     {
00086         // End of file reached. Return terminal character
00087         record.zipCode = "";
00088         return record;
00089     }
00090
00091     if (fileType == 'B')
00092     {
00093         if (blockRecordsIndex >= blockRecords.size() || blockRecordsIndex == -1)
00094         {
00095             // Reached the end of the block, so retrieve the next one
00096             blockRecords = blockBuffer.readNextBlock();
00097             if (blockRecords.size() > 0)
00098             {
00099                 recordString = blockRecords[0]; // Retrieve the first record in the block
```

```
00100                 blockRecordsIndex = 1;          // Skip 0 because it reads it immediately
00101             }
00102             else
00103             {
00104                 // Did not read a valid block (likely due to the end of file), so return terminal
      character
00105                 record.zipCode = "";
00106                 return record;
00107             }
00108         }
00109         else
00110         {
00111             recordString = blockRecords[blockRecordsIndex++];
00112         }
00113     }
00114     else if (fileType == 'C')
00115     {
00116         // If CSV, retrieve the next line in the file as the record to parse
00117         getline(file, recordString);
00118     }
00119     else if (fileType == 'L')
00120     {
00121         // If length-indicated, reads the length and retrieves that many characters for the record
      string
00122         int numCharactersToRead = 0;
00123         file » numCharactersToRead;   // Read the length indicator, the first field in each record
00124         file.ignore(1);                // Skip the comma after the length field
00125         recordString.resize(numCharactersToRead);
00126         file.read(&recordString[0], numCharactersToRead);
00127     }
00128
00129     // If not the end of the file, read the fields in the line into the record object
00130     if (recordString.empty())
00131     {
00132
00133         // Did not read a valid record (likely due to the end of file newline), so return terminal
      character
00134         record.zipCode = "";
00135         return record;
00136     }
00137
00138     record = parseRecord(recordString);
00139     return record;
00140 };
```

Here is the call graph for this function:




Here is the caller graph for this function:



#### 3.6.3.3 getCurrentPosition()

```
std::streampos ZipCodeBuffer::getCurrentPosition ( )
```

Method to get the current position in the file.

Definition at line 143 of file ZipCodeBuffer.cpp.

```
00143                                                {
00144     return file.tellg();
00145 }
```

Here is the caller graph for this function:


#### 3.6.3.4 setCurrentPosition()

```
std::ifstream & ZipCodeBuffer::setCurrentPosition (
            std::streampos pos )
```

Method to set the current position in the file to a given streampos.

Definition at line 148 of file ZipCodeBuffer.cpp.

```
00148                                                                    {
00149     file.seekg(pos);
00150     return file;
00151 }
```

Here is the caller graph for this function:


### 3.6.4 Friends And Related Symbol Documentation

#### 3.6.4.1 Dump

```
friend class Dump  [friend]
```

Definition at line 132 of file ZipCodeBuffer.h.

### 3.6.5 Member Data Documentation

#### 3.6.5.1 blockBuffer

```
BlockBuffer ZipCodeBuffer::blockBuffer
```

Definition at line 68 of file ZipCodeBuffer.h.

#### 3.6.5.2 headerBuffer

```
HeaderBuffer ZipCodeBuffer::headerBuffer = HeaderBuffer("us_postal_codes.txt")
```

Definition at line 69 of file ZipCodeBuffer.h.

The documentation for this class was generated from the following files:

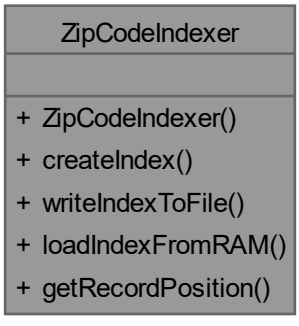
- ZipCodeBuffer.h
- ZipCodeBuffer.cpp

## 3.7 ZipCodeIndexer Class Reference

Implementation of the ZipCodeIndexer class for indexing ZIP code records in a file.

```
#include <ZipCodeIndexer.h>
```

Collaboration diagram for ZipCodeIndexer:



**Public Member Functions**

- ZipCodeIndexer (std::ifstream &file, char fileType, const std::string &idxFileName, HeaderBuffer headerBuffer)

  *Constructor: initializes the ZipCodeIndexer with a file name and index file name.*
- void createIndex ()

  *Method to create an index by reading the file and storing ZIP codes and their positions.*
- void writeIndexToFile ()

  *Method to write the created index to a file.*
- void loadIndexFromRAM ()

  *Method to load the index from a file into RAM.*
- std::streampos getRecordPosition (const std::string &zipCode)

  *Method to get the position of a specific ZIP code record in the file.*

## 3.7.1 Detailed Description

Implementation of the ZipCodeIndexer class for indexing ZIP code records in a file.

< For std::map container

Class for indexing ZIP code records from a file.

**Author**

Emily Yang
Kent Biernath
Emma Hoffmann

**Date**

2023-10-16

**Version**

1.0

The ZipCodeIndexer class is responsible for creating and managing an index of ZIP code records in a file. It provides methods for creating the index, saving it to a file, loading it into RAM, and retrieving the position of a specific ZIP code record in the file.

Assumptions:

– The file is in the same directory as the program. < For file operations < For accessing the ZipCodeBuffer class

Class for indexing ZIP code records from a file.

The ZipCodeIndexer class is responsible for creating and managing an index of ZIP code records in a file. It provides methods for creating the index, saving it to a file, loading it into RAM, and retrieving the position of a specific ZIP code record in the file.

Definition at line 49 of file ZipCodeIndexer.h.

## 3.7.2 Constructor & Destructor Documentation

### 3.7.2.1 ZipCodeIndexer()

```
ZipCodeIndexer::ZipCodeIndexer (
            std::ifstream & file,
            char fileType,
            const std::string & idxFileName,
            HeaderBuffer headerBuffer )
```

Constructor: initializes the ZipCodeIndexer with a file name and index file name.

Constructor for the ZipCodeIndexer class.

**Parameters**

| | |
|---|---|
| *fileName* | The name of the file to index as a string. |
| *fileType* | The type of the file, [C]SV or [L]ength-indicated |
| *idxFileName* | The name of the index file to save/load as a string. |
| *headerBuffer* | A HeaderBuffer object for the file. |
| *fileName* | The name of the file to index as a string. |
| *idxFileName* | The name of the index file to save/load as a string. |

Definition at line 13 of file ZipCodeIndexer.cpp.

```
00014     : buffer(file, fileType, headerBuffer), indexFileName(idxFileName) {}
```

## 3.7.3 Member Function Documentation

### 3.7.3.1 createIndex()

```
void ZipCodeIndexer::createIndex ( )
```

Method to create an index by reading the file and storing ZIP codes and their positions.

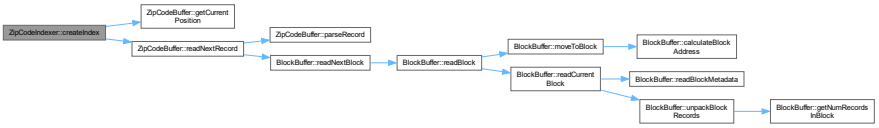
Create an index of ZIP codes to their positions in the file.

This method reads the file and creates an index of ZIP code records by storing each ZIP code and its position in the file.

Definition at line 19 of file ZipCodeIndexer.cpp.

```
00019                                 {
00020     ZipCodeRecord record;
00021     std::streampos position = buffer.getCurrentPosition();
00022     while (!(record = buffer.readNextRecord()).zipCode.empty()) {
00023         index[record.zipCode] = position; // Save the position of this ZIP code in the index
00024         position = buffer.getCurrentPosition(); // Get the position of the next record
00025     }
00026 }
```

Here is the call graph for this function:




Here is the caller graph for this function:

#### 3.7.3.2 writeIndexToFile()

```
void ZipCodeIndexer::writeIndexToFile ( )
```

Method to write the created index to a file.

Write the created index to a file.

This method saves the created index to a file specified by the index file name.

This function writes the created index to a file. Each line in the file contains a ZIP code and its position in the file.

Definition at line 30 of file ZipCodeIndexer.cpp.

```
00030                                           {
00031     std::ofstream outFile(indexFileName);
00032     for (const auto& pair : index) {
00033         outFile « pair.first « " " « pair.second « "\n"; // ZIP code and position
00034     }
00035     outFile.close();
00036 }
```

Here is the caller graph for this function:


#### 3.7.3.3 loadIndexFromRAM()

```
void ZipCodeIndexer::loadIndexFromRAM ( )
```

Method to load the index from a file into RAM.

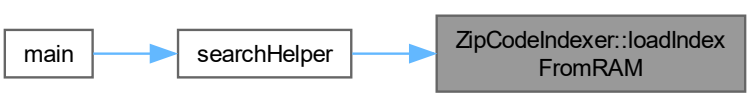
Load the index from a file into RAM.

This method loads the index data from a file into RAM for quick retrieval.

Definition at line 41 of file ZipCodeIndexer.cpp.

```
00041                                           {
00042     index.clear(); // Clear any existing index
00043     std::ifstream inFile(indexFileName);
00044     std::string zip;
00045     std::streampos pos;
00046     int posInt;
00047     while (inFile » zip » posInt) {
00048         pos = posInt;
00049         index[zip] = pos; // Load the ZIP code and its position into the index
00050     }
00051     inFile.close();
00052 }
```

Here is the caller graph for this function:



#### 3.7.3.4 getRecordPosition()

```
std::streampos ZipCodeIndexer::getRecordPosition (
            const std::string & zipCode )
```

Method to get the position of a specific ZIP code record in the file.

Get the position in the file of the given ZIP code.

**Parameters**

| | |
|---|---|
| *zipCode* | The ZIP code to find the position of. |

**Returns**

The position of the ZIP code record in the file.

**Parameters**

| | |
|---|---|
| *zipCode* | The ZIP code to find the position of. |

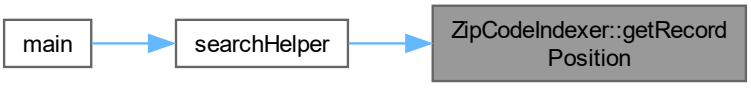
**Returns**

The position of the ZIP code record in the file. If not found, returns an invalid position (-1).

Definition at line 58 of file ZipCodeIndexer.cpp.

```
00058                                                                   {
00059     if (index.find(zipCode) != index.end()) { // If the ZIP code is in the index
00060         return index[zipCode]; // Return its position
00061     }
00062     else {
00063         return std::streampos(-1);  // Invalid position to indicate not found
00064     }
00065 }
```

Here is the caller graph for this function:




The documentation for this class was generated from the following files:

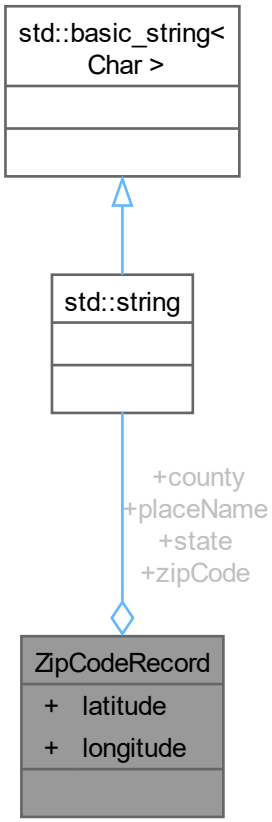
- ZipCodeIndexer.h
- ZipCodeIndexer.cpp

## 3.8 ZipCodeRecord Struct Reference

Structure to hold a ZIP Code record.

`#include <ZipCodeBuffer.h>`

Collaboration diagram for ZipCodeRecord:




### Public Attributes

- std::string zipCode
- std::string placeName
- std::string state
- std::string county
- double latitude = 0.0
- double longitude = 0.0

### 3.8.1 Detailed Description

Structure to hold a ZIP Code record.

The ZipCodeBuffer class reads a record from a file with these six fields:
– ZIP Code (string)
– Place Name (string)
– State Code (string)
– County (string)
– Latitude (double)
– Longitude (double)

Whenever readNextRecord is called, it reads the next record from the file and returns it in a ZipCodeRecord struct after parsing it with parseRecord.

The name of the file to be opened is passed to the class constructor as a string.

Assumptions:
– The file is in the same directory as the program.
– The records always contain exactly six fields.
– The file has column headers on the first line.

Definition at line 49 of file ZipCodeBuffer.h.

### 3.8.2 Member Data Documentation

#### 3.8.2.1 zipCode

```
std::string ZipCodeRecord::zipCode
```

Definition at line 50 of file ZipCodeBuffer.h.

#### 3.8.2.2 placeName

```
std::string ZipCodeRecord::placeName
```

Definition at line 51 of file ZipCodeBuffer.h.

#### 3.8.2.3 state

```
std::string ZipCodeRecord::state
```

Definition at line 52 of file ZipCodeBuffer.h.

#### 3.8.2.4 county

```
std::string ZipCodeRecord::county
```

Definition at line 53 of file ZipCodeBuffer.h.

#### 3.8.2.5 latitude

```
double ZipCodeRecord::latitude = 0.0
```

Definition at line 54 of file ZipCodeBuffer.h.

#### 3.8.2.6 longitude

```
double ZipCodeRecord::longitude = 0.0
```

Definition at line 55 of file ZipCodeBuffer.h.

The documentation for this struct was generated from the following file:

- ZipCodeBuffer.h

# Chapter 4

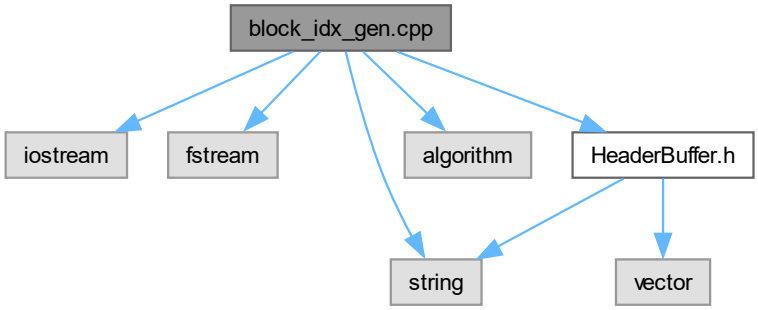
# File Documentation

## 4.1 block_idx_gen.cpp File Reference

This class creates an index file for a blocked data file.

```
#include <iostream>
#include <fstream>
#include <string>
#include <algorithm>
#include "HeaderBuffer.h"
```

Include dependency graph for block_idx_gen.cpp:




### Functions

- int findZipcode (const string &record)
- int main ()

### 4.1.1 Detailed Description

This class creates an index file for a blocked data file.

**Author**

Andrew Clayton

**Date**

11/13/2023

**Version**

1.4

Definition in file block_idx_gen.cpp.

### 4.1.2 Function Documentation

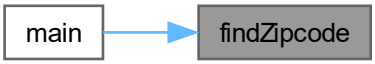
#### 4.1.2.1 findZipcode()

```
int findZipcode (
            const string & record )
```

Definition at line 27 of file block_idx_gen.cpp.

```
00027                                       {
00028     size_t firstComma = record.find(',');
00029     size_t secondComma = record.find(',', firstComma + 1);
00030     if (firstComma == string::npos || secondComma == string::npos) {
00031         cerr « "Error parsing record for zipcode: " « record « "\n";
00032         return -1;
00033     }
00034     return stoi(record.substr(firstComma + 1, secondComma - firstComma - 1));
00035 }
```

Here is the caller graph for this function:



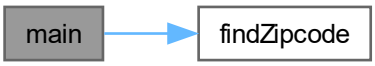
#### 4.1.2.2 main()

```
int main ( )
```

Definition at line 38 of file block_idx_gen.cpp.

```
00038           {
00039
00040     // We need to first read and write the header of the file
00041     /* HeaderBuffer header = HeaderBuffer("blocked_postal_codes.txt");
00042     header.readHeader();
00043     header.writeHeaderToFile("blocked_Index.txt"); */          // The blocked index file actually does
      not include any metadata
00044
00045
00046     ofstream writeFile;
00047     writeFile.open("blocked_Index.txt");
00048     if (!writeFile.is_open()) {
00049         cerr « "Error: Could not open file 'blocked_Index.txt' for writing.\n";
00050         return 1;
00051     }
00052
00053     ifstream readFile("us_postal_codes_blocked.txt");
00054     if (!readFile.is_open()) {
00055         cerr « "Error: Could not open file 'us_postal_codes_blocked.txt' for reading.\n";
00056         return 1;
00057     }
00058
00059     // We need to skip past the metadata, up to the "Data: line"
00060     string line;
00061     while (getline(readFile, line)) {
00062         if (line == "Data:") {
00063             break;
00064         }
00065     }
00066
00067     int blockNumber = 0;
00068     int maxZipcode = 0;
00069     string currentBlock;
00070
00071     while (getline(readFile, currentBlock)) {
00072         // for each line, we have to skip the metadata!
00073         int start = stoi(currentBlock.substr(0, 2));
00074         size_t endOfBlock = currentBlock.find('~'); // Assuming '~' is the padding character
00075
00076         maxZipcode = 0;
00077
00078         // Put all the records into a vector
00079         vector<string> records;
00080
00081         while (start < endOfBlock) {
00082             size_t recordLength;
00083             try {
00084                 recordLength = stoi(currentBlock.substr(start, 2)) + 3; // plus three since `LI,' does
      not include itself
00085             } catch (const std::invalid_argument& ia) {
00086                 cerr « "Invalid argument: " « ia.what() « " for record length at block " « blockNumber
      « "\n";
00087                 return 1;
00088             }
00089
00090             // Traversing record by record
00091             string currentRecord = currentBlock.substr(start, recordLength);
00092             records.push_back(currentRecord);
00093             // Checking the zipcode of each individual record
00094
00095
00096             start += recordLength;
00097         }
00098
00099         maxZipcode = findZipcode(records.back());
00100
00101         writeFile « blockNumber « "," « maxZipcode « "\n";
00102
00103         blockNumber++;
00104         // maxZipcode = 0;
00105     }
00106
00107     readFile.close();
00108     writeFile.close();
00109     return 0;
00110 }
```

Here is the call graph for this function:




## 4.2 block_idx_gen.cpp

Go to the documentation of this file.

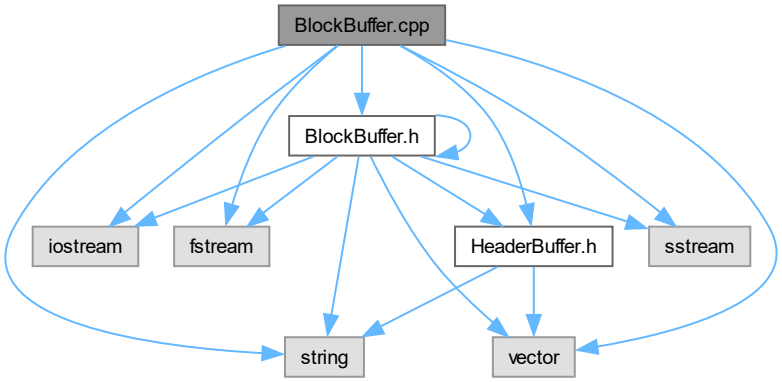
```
00001 // ---------------------------------------------------------------------------
00009 // ---------------------------------------------------------------------------
00017 // ---------------------------------------------------------------------------
00018
00019 #include <iostream>
00020 #include <fstream>
00021 #include <string>
00022 #include <algorithm>
00023 #include "HeaderBuffer.h"
00024
00025 using namespace std;
00026
00027 int findZipcode(const string& record) {
00028     size_t firstComma = record.find(',');
00029     size_t secondComma = record.find(',', firstComma + 1);
00030     if (firstComma == string::npos || secondComma == string::npos) {
00031         cerr « "Error parsing record for zipcode: " « record « "\n";
00032         return -1;
00033     }
00034     return stoi(record.substr(firstComma + 1, secondComma - firstComma - 1));
00035 }
00036
00037
00038 int main() {
00039
00040     // We need to first read and write the header of the file
00041     /* HeaderBuffer header = HeaderBuffer("blocked_postal_codes.txt");
00042     header.readHeader();
00043     header.writeHeaderToFile("blocked_Index.txt"); */          // The blocked index file actually does
      not include any metadata
00044
00045
00046     ofstream writeFile;
00047     writeFile.open("blocked_Index.txt");
00048     if (!writeFile.is_open()) {
00049         cerr « "Error: Could not open file 'blocked_Index.txt' for writing.\n";
00050         return 1;
00051     }
00052
00053     ifstream readFile("us_postal_codes_blocked.txt");
00054     if (!readFile.is_open()) {
00055         cerr « "Error: Could not open file 'us_postal_codes_blocked.txt' for reading.\n";
00056         return 1;
00057     }
00058
00059     // We need to skip past the metadata, up to the "Data: line"
00060     string line;
00061     while (getline(readFile, line)) {
00062         if (line == "Data:") {
00063             break;
00064         }
00065     }
00066
00067     int blockNumber = 0;
00068     int maxZipcode = 0;
00069     string currentBlock;
00070
00071     while (getline(readFile, currentBlock)) {
00072         // for each line, we have to skip the metadata!
00073         int start = stoi(currentBlock.substr(0, 2));
00074         size_t endOfBlock = currentBlock.find('~'); // Assuming '~' is the padding character
```

```
00075
00076         maxZipcode = 0;
00077
00078         // Put all the records into a vector
00079         vector<string> records;
00080
00081         while (start < endOfBlock) {
00082             size_t recordLength;
00083             try {
00084                 recordLength = stoi(currentBlock.substr(start, 2)) + 3; // plus three since `LI,' does
      not include itself
00085             } catch (const std::invalid_argument& ia) {
00086                 cerr << "Invalid argument: " << ia.what() << " for record length at block " << blockNumber
      << "\n";
00087                 return 1;
00088             }
00089
00090             // Traversing record by record
00091             string currentRecord = currentBlock.substr(start, recordLength);
00092             records.push_back(currentRecord);
00093             // Checking the zipcode of each individual record
00094
00095
00096             start += recordLength;
00097         }
00098
00099         maxZipcode = findZipcode(records.back());
00100
00101         writeFile << blockNumber << "," << maxZipcode << "\n";
00102
00103         blockNumber++;
00104         // maxZipcode = 0;
00105     }
00106
00107     readFile.close();
00108     writeFile.close();
00109     return 0;
00110 }
```

## 4.3 BlockBuffer.cpp File Reference

```
#include <iostream>
#include <fstream>
#include <string>
#include <vector>
#include "BlockBuffer.h"
#include "HeaderBuffer.h"
#include <sstream>
```

Include dependency graph for BlockBuffer.cpp:



## 4.4 BlockBuffer.cpp

Go to the documentation of this file.

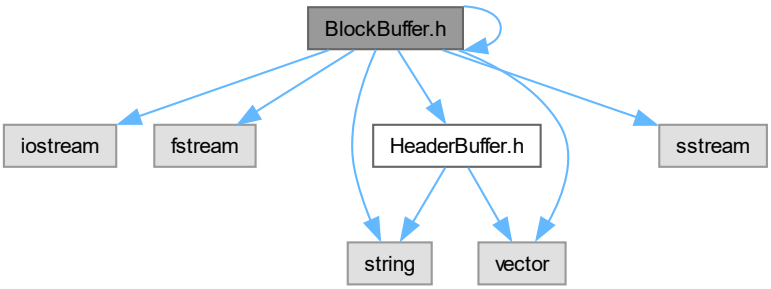
```
00001
00004
00005 #include <iostream>
00006 #include <fstream> // for file operations
00007 #include <string>
00008 #include <vector>
00009 #include "BlockBuffer.h"
00010 #include "HeaderBuffer.h"
00011 #include <sstream>
00012
00013
00014
00015 BlockBuffer::BlockBuffer(std::ifstream &file, HeaderBuffer headerBuffer =
      HeaderBuffer("blocked_postal_codes.txt")) : file(file) { // TODO remove HeaderBuffer filename once it
      allows generic constructor
00016     headerBuffer.readHeader();
00017     headerSize = headerBuffer.getHeaderSizeBytes();
00018     blockSize = headerBuffer.getBlockSize();
00019     nextRBN = headerBuffer.getRBNS();
00020 }
00021
00022
00023 vector<string> BlockBuffer::unpackBlockRecords() {
00024     // This will convert a block to a vector of records
00025     size_t idx = 0;
00026     vector<string> records;
00027
00028     for (size_t i = 0; i < getNumRecordsInBlock(); i++)
00029     {
00030         // Reads the length and retrieves that many characters for the record
00031         std::string recordString;
00032         int numCharactersToRead = 0;
00033         file » numCharactersToRead;   // Read the length indicator, the first field in each record
00034         file.ignore(1);                // Skip the comma after the length field
00035         recordString.resize(numCharactersToRead);
00036         file.read(&recordString[0], numCharactersToRead);
00037         records.push_back(recordString);
00038     }
00039
00040     return records;
00041 }
00042
00043
00044
00046 void BlockBuffer::readBlockMetadata() {
00047     int metadataRecordLength = -1;
00048     int newRelativeBlockNumber = -1;
00049     int newNumRecordsInBlock = -1;
00050     int newPrevRBN = -1;
00051     int newNextRBN = -1;
00052
00053     file » metadataRecordLength;
00054     file.ignore(1); // Ignore the commas separating the fields
00055     file » newRelativeBlockNumber;
00056     file.ignore(1);
00057     file » newNumRecordsInBlock;
00058     file.ignore(1);
00059     file » newPrevRBN;
00060     file.ignore(1);
00061     file » newNextRBN;
00062     file.ignore(1); // Skip the comma after the last metadata field
00063
00064     // TODO throw exception if any of these reads failed or the values are invalid
00065
00066     currentRBN = newRelativeBlockNumber;
00067     numRecordsInBlock = newNumRecordsInBlock;
00068     prevRBN = newPrevRBN;
00069     nextRBN = newNextRBN;
00070 }
00071
00072
00073
00075 int BlockBuffer::calculateBlockAddress(int relativeBlockNumber) {
00076     return headerSize + relativeBlockNumber*blockSize;
00077 }
00078
00079
00080
00082 void BlockBuffer::moveToBlock(int relativeBlockNumber) {
00083     int address = calculateBlockAddress(relativeBlockNumber);
00084     file.seekg(address);
00085 }
```

```
00086
00087
00088
00090 vector<string> BlockBuffer::readBlock(int relativeBlockNumber) {
00091     vector<string> recordStrings;
00092     std::string line;
00093
00094     // If the RBN is -1, the end of the chain has been reached.
00095     if (relativeBlockNumber == -1)
00096     {
00097         currentRBN = -1;
00098         return recordStrings;
00099     }
00100
00101     moveToBlock(relativeBlockNumber);               // Move to the next block
00102     return readCurrentBlock();          // Read the metadata and the records
00103 }
00104
00105
00106
00108 vector<string> BlockBuffer::readCurrentBlock() {
00109     readBlockMetadata();                // Read the metadata for the block
00110     return unpackBlockRecords();        // Read the length-indicated records into strings and return
    them
00111 }
00112
00113
00114 vector<string> BlockBuffer::readNextBlock() {
00115     return readBlock(nextRBN);
00116 }
```

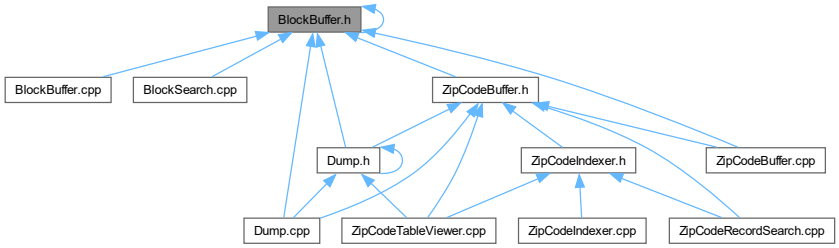
## 4.5 BlockBuffer.h File Reference

```
#include <iostream>
#include <fstream>
#include <string>
#include <vector>
#include "BlockBuffer.h"
#include "HeaderBuffer.h"
#include <sstream>
```

Include dependency graph for BlockBuffer.h:



This graph shows which files directly or indirectly include this file:




### Classes

- class BlockBuffer

  *See BlockBuffer.h for full documentation.*

## 4.6 BlockBuffer.h

Go to the documentation of this file.

```
00001 // ---------------------------------------------------------------------------
00011 // ---------------------------------------------------------------------------
00033 // ---------------------------------------------------------------------------
00034
00035 #ifndef BLOCKBUFFER_H
00036 #define BLOCKBUFFER_H
00037
00038 #include <iostream>
00039 #include <fstream> // for file operations
00040 #include <string>
00041 #include <vector>
00042 #include "BlockBuffer.h"
00043 #include "HeaderBuffer.h"
00044 #include <sstream>
00045
00046 using namespace std;
00047
00048 class BlockBuffer {
00049 private:
00050     std::ifstream &file;         // The ifstream to read blocks from.
00051     int numRecordsInBlock = 0;  // Number of records in the current block (read from metadata)
00052     int currentRBN = 0;         // Relative Block Number (RBN) of the current block
00053     int prevRBN = -1;           // RBN of the previous block in the linked list
00054     int nextRBN = 0;            // RBN of the next block in the linked list
00055     int blockSize = 512;        // Number of bytes in every block, which will be read from the
      metadata
00056     int headerSize = 53;        // Number of bytes in the metadata header record, which will be read
      from the metadata
00057
00058 public:
00066     BlockBuffer(std::ifstream &file, HeaderBuffer headerBuffer);
00067     //BlockBuffer(std::ifstream &file) : BlockBuffer(file, HeaderBuffer("blocked_postal_codes.txt"))
      {} // TODO replace hardcoded file name once HeaderBuffer allows generic constructor
00068
00069
00076     vector<string> unpackBlockRecords();
00077
00078
00084     void readBlockMetadata();
00085
00086     // Metadata getters
00087     int getCurrentRBN() const { return currentRBN; }
00088     int getPrevRBN() const { return prevRBN; }
00089     int getNextRBN() const { return nextRBN; }
00090     int getNumRecordsInBlock() const { return numRecordsInBlock; }
00091
00092
00100     vector<string> readBlock(int relativeBlockNumber);
```

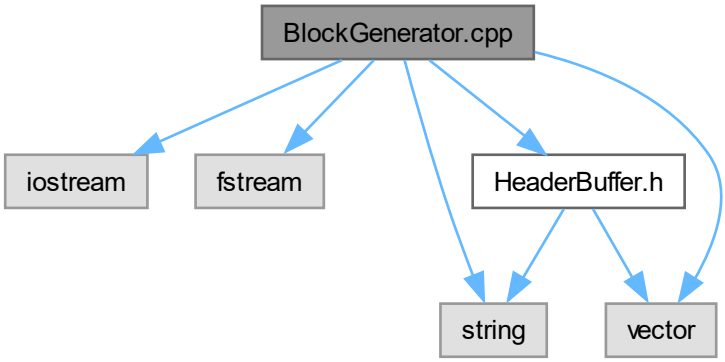
```
00101
00109     vector<string> readCurrentBlock();
00110
00118     vector<string> readNextBlock();
00119     //vector<string> readPreviousBlock();
00120
00121
00128     int calculateBlockAddress(int relativeBlockNumber);
00129
00130
00136     void moveToBlock(int relativeBlockNumber);
00137
00138 };
00139
00140 //#include "BlockBuffer.cpp"
00141
00142 #endif
```

## 4.7 BlockGenerator.cpp File Reference

(Blocked Sequence Set Generator)

```
#include <iostream>
#include <fstream>
#include <string>
#include <vector>
#include "HeaderBuffer.h"
```

Include dependency graph for BlockGenerator.cpp:




### Functions

- int main (int argc, char ∗argv[ ])

### 4.7.1 Detailed Description

(Blocked Sequence Set Generator)

File for generating a blocked sequence set

**Author**

Andrew Clayton

**Date**

11/13/2023

**Version**

1.5

Definition in file BlockGenerator.cpp.

## 4.7.2 Function Documentation

### 4.7.2.1 main()

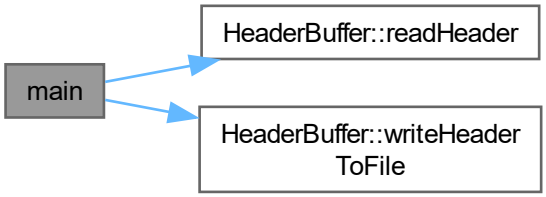
```
int main (
            int argc,
            char * argv[] )
```

Definition at line 30 of file BlockGenerator.cpp.

```
00030                                   {
00031     const int BLOCK_SIZE = 510;
00032     const int BLOCK_CAPACITY = 0.75 * BLOCK_SIZE; // 75% of the block size
00033
00034
00035     // We need to first read and write the header of the file
00036     HeaderBuffer header = HeaderBuffer("us_postal_codes_blocked.txt");
00037     header.readHeader();
00038     header.writeHeaderToFile("us_postal_codes_blocked.txt");
00039
00040     // Now we can proceed with the blocked data generation, but we have to make sure the file opens up
      where we left off
00041
00042
00043
00044     // Check if the correct number of command line arguments were given
00045     if (argc < 2) {
00046         cerr « "Error: No file name given.\n";
00047         return 1;
00048     }
00049
00050     // File to write data out to
00051     string blockedDataFile = argv[1]; // Assumes the first command line argument is the file name
00052     ofstream writeFile;
00053     // we need to append to the file, not overwrite it
00054     writeFile.open(blockedDataFile + ".txt", ios::app);
00055     if (!writeFile.is_open()) {
00056         cerr « "Error: Could not open file " « blockedDataFile « " for writing.\n";
00057         return 1;
00058     }
00059
00060     // File to read information from
00061     ifstream readFile("uspostal_codes.txt");
00062     if (!readFile.is_open()) {
00063         cerr « "Error: Could not open file uspostal_codes.txt for reading.\n";
00064         return 1;
00065     }
00066
00067     // We need to have the file open to the actual content, past the metadata.
00068
00069     // Now we go through the file and convert the length-indicated data to blocked data, ensuring that
00070     // records stay complete within the BLOCK_CAPACITY
00071
00072     // Initialize variables for looping
00073     string currentLine;
00074     getline(readFile, currentLine); // Skipping metadata
00075     int currentBlockSize = 0;
00076     int currentBlock = 0;
```

```
00077     int numRecords = 0;
00078     vector<string> recordsInBlock;
00079     bool isLastBlock = false;
00080 
00081     /*
00082     As we process through records, we store all of them in a vector. When the vector cannot add another record without reaching block capacity, then we
00083     write the (length-indicated) metadata to the file, followed by all of the vectors. Then we proceeding with checking more records.
00084         - First block will have its previous block number as -1
00085         - Last block (when we reach the end of the file for records) will have its next block number as -1          */
00086 
00087     while (getline(readFile, currentLine)) {
00088         int currentLineLength = stoi(currentLine.substr(0, 2)) + 3; // Including LI and comma
00089         recordsInBlock.push_back(currentLine);
00090         numRecords++;
00091         currentBlockSize += currentLineLength;
00092 
00093         if (currentBlockSize > BLOCK_CAPACITY || readFile.eof()) {
00094             isLastBlock = readFile.eof();
00095 
00096             // Metadata calculation
00097             string metadata = to_string(currentBlock) + "," + to_string(numRecords) + "," + (currentBlock == 0 ? "-1" : to_string(currentBlock - 1)) + "," + (isLastBlock ? "-1" : to_string(currentBlock + 1)) + ",";
00098             int metadataLength = metadata.length() + 3; // Including LI and comma and ending comma
00099 
00100             // Write metadata and records
00101             // Metadata format: LI,RBN,#ofRecords,prevBlock,nextBlock,
00102             writeFile « metadataLength « "," « metadata;
00103             for (const string& record : recordsInBlock) {
00104                 writeFile « record;
00105             }
00106 
00107             // Pad the block with '~'
00108             for (int i = 0; i < BLOCK_SIZE - currentBlockSize - metadataLength; i++) {
00109                 writeFile « "~";
00110             }
00111             writeFile « "\n"; // New block
00112 
00113             // Reset for the next block
00114             recordsInBlock.clear();
00115             currentBlockSize = 0;
00116             numRecords = 0;
00117             currentBlock++;
00118         }
00119     }
00120 
00121     // Anything left in the vector now will be the last block
00122     isLastBlock = true;
00123 
00124     // We need to print out everything left in the vector
00125     string metadata = to_string(currentBlock) + "," + to_string(numRecords) + "," + (currentBlock == 0 ? "-1" : to_string(currentBlock - 1)) + "," + (isLastBlock ? "-1" : to_string(currentBlock + 1)) + ",";
00126     int metadataLength = metadata.length() + 3; // Including LI and comma and ending comma
00127 
00128     // Write metadata and records
00129     // Metadata format: LI,RBN,#ofRecords,prevBlock,nextBlock,
00130     writeFile « metadataLength « "," « metadata;
00131     for (const string& record : recordsInBlock) {
00132         writeFile « record;
00133     }
00134 
00135     // Pad the block with '~'
00136     for (int i = 0; i < BLOCK_SIZE - currentBlockSize - metadataLength; i++) {
00137         writeFile « "~";
00138     }
00139 
00140 
00141     // Once all of this is done, we need to create an empty avail list. The next and previous RBNs will be -1
00142     // The avail list will be at the end of the file, and will be the last block
00143     // The metadata will be: LI,RBN,#ofRecords,prevBlock,nextBlock,
00144     string availListMetadata = to_string(currentBlock+1) + ",0,-1,-1,";
00145     int availListMetadataLength = availListMetadata.length() + 3; // Including LI and comma and ending comma
00146     writeFile « "\n" « availListMetadataLength « "," « availListMetadata;
00147     for (int i = 0; i < BLOCK_SIZE - availListMetadataLength; i++) {
00148         writeFile « "~";
00149     }
00150 
00151     readFile.close();
00152     writeFile.close();
00153     return 0;
00154 }
```

Here is the call graph for this function:




## 4.8 BlockGenerator.cpp

Go to the documentation of this file.

```
00001 // ---------------------------------------------------------------------------
00009  // ---------------------------------------------------------------------------
//-----------------------------------------------------------------------------  00020
00021
00022 #include <iostream>
00023 #include <fstream>
00024 #include <string>
00025 #include <vector>
00026 #include "HeaderBuffer.h"
00027
00028 using namespace std;
00029
00030 int main(int argc, char* argv[]) {
00031     const int BLOCK_SIZE = 510;
00032     const int BLOCK_CAPACITY = 0.75 * BLOCK_SIZE; // 75% of the block size
00033
00034
00035     // We need to first read and write the header of the file
00036     HeaderBuffer header = HeaderBuffer("us_postal_codes_blocked.txt");
00037     header.readHeader();
00038     header.writeHeaderToFile("us_postal_codes_blocked.txt");
00039
00040     // Now we can proceed with the blocked data generation, but we have to make sure the file opens up
      where we left off
00041
00042
00043
00044     // Check if the correct number of command line arguments were given
00045     if (argc < 2) {
00046         cerr << "Error: No file name given.\n";
00047         return 1;
00048     }
00049
00050     // File to write data out to
00051     string blockedDataFile = argv[1]; // Assumes the first command line argument is the file name
00052     ofstream writeFile;
00053     // we need to append to the file, not overwrite it
00054     writeFile.open(blockedDataFile + ".txt", ios::app);
00055     if (!writeFile.is_open()) {
00056         cerr << "Error: Could not open file " << blockedDataFile << " for writing.\n";
00057         return 1;
00058     }
00059
00060     // File to read information from
00061     ifstream readFile("uspostal_codes.txt");
00062     if (!readFile.is_open()) {
00063         cerr << "Error: Could not open file uspostal_codes.txt for reading.\n";
00064         return 1;
00065     }
00066
00067     // We need to have the file open to the actual content, past the metadata.
00068
00069     // Now we go through the file and convert the length-indicated data to blocked data, ensuring that
00070     // records stay complete within the BLOCK_CAPACITY
```

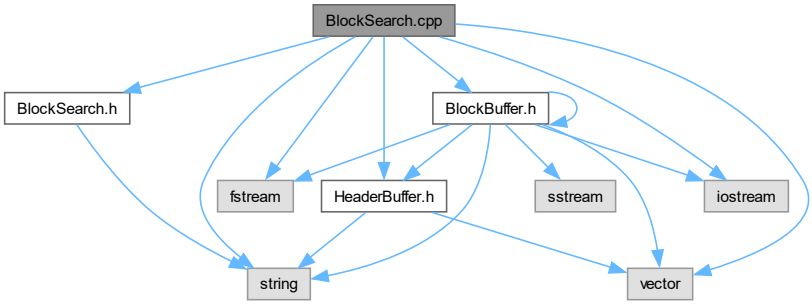
```
00071
00072     // Initialize variables for looping
00073     string currentLine;
00074     getline(readFile, currentLine); // Skipping metadata
00075     int currentBlockSize = 0;
00076     int currentBlock = 0;
00077     int numRecords = 0;
00078     vector<string> recordsInBlock;
00079     bool isLastBlock = false;
00080
00081     /*
00082     As we process through records, we store all of them in a vector. When the vector cannot add another record without reaching block capacity, then we
00083     write the (length-indicated) metadata to the file, followed by all of the vectors. Then we proceeding with checking more records.
00084         - First block will have its previous block number as -1
00085         - Last block (when we reach the end of the file for records) will have its next block number as -1           */
00086
00087     while (getline(readFile, currentLine)) {
00088         int currentLineLength = stoi(currentLine.substr(0, 2)) + 3; // Including LI and comma
00089         recordsInBlock.push_back(currentLine);
00090         numRecords++;
00091         currentBlockSize += currentLineLength;
00092
00093         if (currentBlockSize > BLOCK_CAPACITY || readFile.eof()) {
00094             isLastBlock = readFile.eof();
00095
00096             // Metadata calculation
00097             string metadata = to_string(currentBlock) + "," + to_string(numRecords) + "," + (currentBlock == 0 ? "-1" : to_string(currentBlock - 1)) + "," + (isLastBlock ? "-1" : to_string(currentBlock + 1)) + ",";
00098             int metadataLength = metadata.length() + 3; // Including LI and comma and ending comma
00099
00100             // Write metadata and records
00101             // Metadata format: LI,RBN,#ofRecords,prevBlock,nextBlock,
00102             writeFile « metadataLength « "," « metadata;
00103             for (const string& record : recordsInBlock) {
00104                 writeFile « record;
00105             }
00106
00107             // Pad the block with '~'
00108             for (int i = 0; i < BLOCK_SIZE - currentBlockSize - metadataLength; i++) {
00109                 writeFile « "~";
00110             }
00111             writeFile « "\n"; // New block
00112
00113             // Reset for the next block
00114             recordsInBlock.clear();
00115             currentBlockSize = 0;
00116             numRecords = 0;
00117             currentBlock++;
00118         }
00119     }
00120
00121     // Anything left in the vector now will be the last block
00122     isLastBlock = true;
00123
00124     // We need to print out everything left in the vector
00125     string metadata = to_string(currentBlock) + "," + to_string(numRecords) + "," + (currentBlock == 0 ? "-1" : to_string(currentBlock - 1)) + "," + (isLastBlock ? "-1" : to_string(currentBlock + 1)) + ",";
00126     int metadataLength = metadata.length() + 3; // Including LI and comma and ending comma
00127
00128     // Write metadata and records
00129     // Metadata format: LI,RBN,#ofRecords,prevBlock,nextBlock,
00130     writeFile « metadataLength « "," « metadata;
00131     for (const string& record : recordsInBlock) {
00132         writeFile « record;
00133     }
00134
00135     // Pad the block with '~'
00136     for (int i = 0; i < BLOCK_SIZE - currentBlockSize - metadataLength; i++) {
00137         writeFile « "~";
00138     }
00139
00140
00141     // Once all of this is done, we need to create an empty avail list. The next and previous RBNs will be -1
00142     // The avail list will be at the end of the file, and will be the last block
00143     // The metadata will be: LI,RBN,#ofRecords,prevBlock,nextBlock,
00144     string availListMetadata = to_string(currentBlock+1) + ",0,-1,-1,";
00145     int availListMetadataLength = availListMetadata.length() + 3; // Including LI and comma and ending comma
00146     writeFile « "\n" « availListMetadataLength « "," « availListMetadata;
00147     for (int i = 0; i < BLOCK_SIZE - availListMetadataLength; i++) {
00148         writeFile « "~";
```

```
00149     }
00150
00151     readFile.close();
00152     writeFile.close();
00153     return 0;
00154 }
```

## 4.9 BlockSearch.cpp File Reference

```
#include <string>
#include <fstream>
#include <iostream>
#include "BlockSearch.h"
#include <vector>
#include "BlockBuffer.h"
#include "HeaderBuffer.h"
```

Include dependency graph for BlockSearch.cpp:




### Functions

- int findZipcode (const string &record)

### 4.9.1 Function Documentation

#### 4.9.1.1 findZipcode()

```
int findZipcode (
            const string & record )
```

Definition at line 23 of file BlockSearch.cpp.

```
00023                                   {
00024     // The zipcode is the substring between the first and second comma
00025     size_t firstComma = record.find(',');
00026     size_t secondComma = record.find(',', firstComma + 1);
00027     if (firstComma == string::npos || secondComma == string::npos) {
00028         cerr « "Error parsing record for zipcode: " « record « "\n";
00029         return -1;
00030     }
00031     return stoi(record.substr(firstComma + 1, secondComma - firstComma - 1));
00032 }
```

# 4.10 BlockSearch.cpp

Go to the documentation of this file.

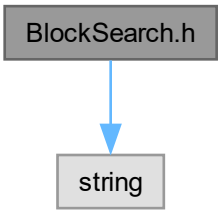
```
00001
00005
00006 #include <string>
00007 #include <fstream>
00008 #include <iostream>
00009 #include "BlockSearch.h"
00010 #include <vector>
00011 #include "BlockBuffer.h"
00012 #include "HeaderBuffer.h"
00013
00014 using namespace std;
00015
00016
00017 // Default constructor
00018 BlockSearch::BlockSearch(string idxFile) {
00019     indexFile = idxFile;
00020 }
00021
00022
00023 int findZipcode(const string& record) {
00024     // The zipcode is the substring between the first and second comma
00025     size_t firstComma = record.find(',');
00026     size_t secondComma = record.find(',', firstComma + 1);
00027     if (firstComma == string::npos || secondComma == string::npos) {
00028         cerr « "Error parsing record for zipcode: " « record « "\n";
00029         return -1;
00030     }
00031     return stoi(record.substr(firstComma + 1, secondComma - firstComma - 1));
00032 }
00033
00034 // Searches for a record in the blocked index file by key (zipcode)
00035 string BlockSearch::searchForRecord(int target) {
00036     // Open the index file
00037     ifstream readFile(indexFile);
00038     string line;
00039
00040     // Read through the file until we find target < greatestKeyInBlock
00041
00042     // Iterate through each line of the file
00043     while (getline(readFile, line)) {
00044         int commaIdx = line.find(',');
00045         int rbn = 0;
00046         try {
00047             rbn = stoi(line.substr(0, commaIdx));
00048         } catch (invalid_argument& e) {
00049             cerr « "Error parsing RBN: " « e.what() « endl;
00050             // return "-1";
00051         }
00052
00053         int greatestKeyInBlock;
00054         try {
00055             greatestKeyInBlock = stoi(line.substr(commaIdx+1));
00056         } catch (invalid_argument& e) {
00057             cerr « "Error parsing greatest key in block: " « e.what() « endl;
00058             // return "-1";
00059         }
00060
00061         if (target < greatestKeyInBlock) {
00062             // We have found the block that contains the record we are looking for
00063             // now we need to actually access the block itself, which we should be able to do with
    BlockBuffer
00064
00065             ifstream dataFile("us_postal_codes_blocked.txt", std::ios::app);
00066             HeaderBuffer headerBuffer2("us_postal_codes_blocked.txt");
00067             BlockBuffer blockbuffer(dataFile, headerBuffer2);
00068
00069             // We break down all the block into a vector of records
00070
00071             vector<string> records = blockbuffer.readBlock(rbn);
00072
00073             for (string record : records) { // Check if each record is the target record
00074                 int commaIdx = record.find(',');
00075                 int zipcode = stoi(record.substr(0, commaIdx));
00076
00077                 if (zipcode == target) {
00078                     return record;
00079                 }
00080             }
00081             break; // not  found in this block, and next blocks have greater keys
00082         }
00083     }
00084     // We could not find the block that contains the record we are looking for
```

```
00085     return "-1";
00086 }
00087
00088 void BlockSearch::displayRecord(string record) {
00089     // The format of a record is: zipcode,town,state,county,latitude,longitude
00090     vector<string> fields;
00091     stringstream ss(record);
00092     string field;
00093
00094     while (getline(ss, field, ',')) {
00095         fields.push_back(field);
00096     }
00097
00098     if (fields.size() == 6) { // Ensure there are exactly 6 fields: zipcode, town, state, county,
      latitude, longitude
00099         cout « "Zipcode: " « fields[0] « endl;
00100         cout « "Town: " « fields[1] « endl;
00101         cout « "State: " « fields[2] « endl;
00102         cout « "County: " « fields[3] « endl;
00103         cout « "Latitude: " « fields[4] « endl;
00104         cout « "Longitude: " « fields[5] « "\n\n";
00105     } else {
00106         cerr « "Zipcode not found." « endl;
00107     }
00108
00109 }
```

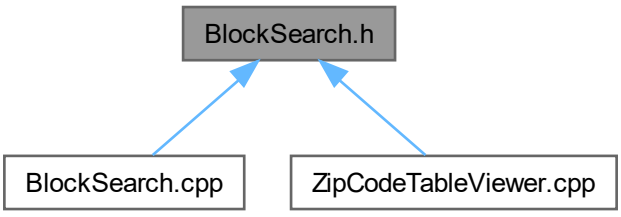
## 4.11 BlockSearch.h File Reference

`#include <string>`

Include dependency graph for BlockSearch.h:




This graph shows which files directly or indirectly include this file:



### Classes

- class BlockSearch

  *Implementation of the BlockSearch class for searching for records in the blocked index file.*

## 4.12 BlockSearch.h

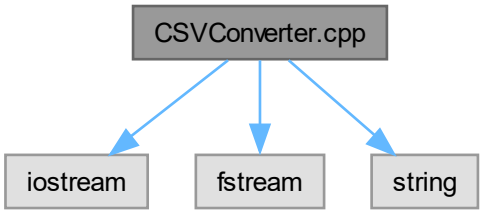
Go to the documentation of this file.

```
00001 // ---------------------------------------------------------------------------
00010 // ---------------------------------------------------------------------------
00018 // ---------------------------------------------------------------------------
00019
00020 #ifndef BLOCKSEARCH_H
00021 #define BLOCKSEARCH_H
00022
00023 #include <string>
00024 using namespace std;
00025
00026 class BlockSearch {
00027 private:
00028
00029     // The index file to open
00030     string indexFile;
00031
00032
00033 public:
00039     BlockSearch() { indexFile = "blocked_Index.txt"; }
00040
00047     BlockSearch(string idxFile);
00048
00049
00057     string searchForRecord(int target);
00058
00065     void displayRecord(string record);
00066
00067 };
00068 #endif
```

## 4.13 CSVConverter.cpp File Reference

```
#include <iostream>
#include <fstream>
#include <string>
```

Include dependency graph for CSVConverter.cpp:




### Functions

- int convertCSV ()

### 4.13.1 Function Documentation

#### 4.13.1.1 convertCSV()

```
int convertCSV ( )
```

Definition at line 7 of file CSVConverter.cpp.

```
00007                 {
00008     std::ifstream inputFile("us_postal_codes.csv");  // Open the input file
00009     std::ofstream outputFile("us_postal_codes.txt");  // Open the output file
00010
00011     if (!inputFile.is_open() || !outputFile.is_open()) {
00012         std::cerr « "Error opening files." « std::endl;
00013         return 1;
00014     }
00015
00016     std::string record;
00017     int recordNumber = 1;
00018
00019     std::getline(inputFile, record); // Skip the header line
00020
00021     while (std::getline(inputFile, record)) {
00022         // Calculate the length of the record
00023         int recordLength = record.length();
00024
00025         outputFile « recordLength « ',' « record « std::endl;
00026
00027         ++recordNumber;
00028     }
00029
00030     inputFile.close();  // Close the input file
00031     outputFile.close();  // Close the output file
00032
00033     std::cout « "Prepended length field to " « recordNumber - 1 « " records." « std::endl;
00034 }
```

## 4.14 CSVConverter.cpp

Go to the documentation of this file.

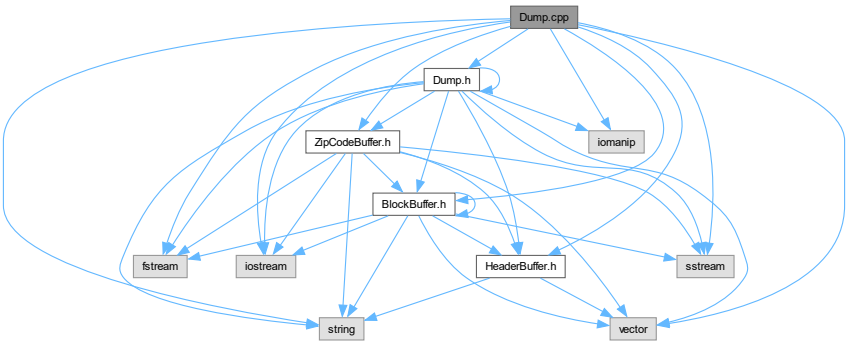
```
00001 // Program to convert a CSV file to the length-indicated file structure.
00002
00003 #include <iostream>
00004 #include <fstream>
00005 #include <string>
00006
00007 int convertCSV() {
00008     std::ifstream inputFile("us_postal_codes.csv");  // Open the input file
00009     std::ofstream outputFile("us_postal_codes.txt");  // Open the output file
00010
00011     if (!inputFile.is_open() || !outputFile.is_open()) {
00012         std::cerr « "Error opening files." « std::endl;
00013         return 1;
00014     }
00015
00016     std::string record;
00017     int recordNumber = 1;
00018
00019     std::getline(inputFile, record); // Skip the header line
00020
00021     while (std::getline(inputFile, record)) {
00022         // Calculate the length of the record
00023         int recordLength = record.length();
00024
00025         outputFile « recordLength « ',' « record « std::endl;
00026
00027         ++recordNumber;
00028     }
00029
00030     inputFile.close();  // Close the input file
00031     outputFile.close();  // Close the output file
00032
00033     std::cout « "Prepended length field to " « recordNumber - 1 « " records." « std::endl;
00034 }
```

## 4.15 Dump.cpp File Reference

Implementation of the Dump class methods for printing and dumping records.

```
#include "Dump.h"
#include <iostream>
#include <iomanip>
#include "ZipCodeBuffer.h"
#include "BlockBuffer.h"
#include "HeaderBuffer.h"
#include <string>
#include <vector>
#include <sstream>
#include <fstream>
```

Include dependency graph for Dump.cpp:




### 4.15.1 Detailed Description

Implementation of the Dump class methods for printing and dumping records.

See Dump.h for the class declaration and documentation.

Definition in file Dump.cpp.

## 4.16 Dump.cpp

Go to the documentation of this file.

```
00001
00004
00005 #include "Dump.h"
00006 #include <iostream>
00007 #include <iomanip>
00008 #include "ZipCodeBuffer.h"
00009 #include "BlockBuffer.h"
00010 #include "HeaderBuffer.h"
00011
00012 #include <string>
00013 #include <vector>
00014 #include <sstream>
00015 #include <fstream>
00016 using namespace std;
00017
```

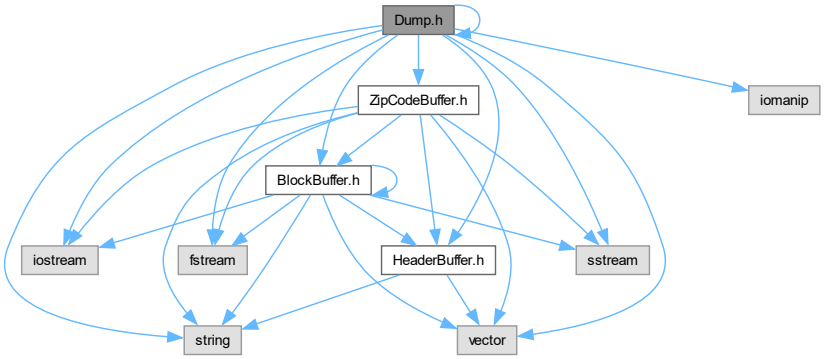
```
00018 Dump::Dump(ZipCodeBuffer &recordBuffer) : recordBuffer(recordBuffer),
      blockBuffer(recordBuffer.blockBuffer), headerBuffer(recordBuffer.headerBuffer) {
00019     // The constructor takes an ifstream and HeaderBuffer, initializing the BlockBuffer
00020     // with the provided file and headerBuffer.
00021     headerBuffer.readHeader();
00022 }
00023
00024
00025
00027 void Dump::dumpLogicalOrder() {
00028     // Display the list head Relative Block Numbers
00029     std::cout << "List Head RBN: " << headerBuffer.getRBNS() << std::endl;
00030     std::cout << "Avail Head RBN: " << headerBuffer.getRBNA() << std::endl;
00031
00032     while (true)
00033     {
00034         std::vector<std::string> records = blockBuffer.readNextBlock();
00035         if (records.size() == 0) // TODO could change to when it reads -1 as next RBN to skip a step
00036         {
00037             // When it receives an empty vector, end the loop
00038             break;
00039         }
00040
00041         printBlock(records);
00042     }
00043 }
00044
00045
00046
00048 void Dump::dumpPhysicalOrder() {
00049     // Display the list head Relative Block Numbers
00050     std::cout << "List Head RBN: " << headerBuffer.getRBNS() << std::endl;
00051     std::cout << "Avail Head RBN: " << headerBuffer.getRBNA() << std::endl;
00052
00053     int i = 0;
00054     int endpoint = headerBuffer.getBlockCount();
00055     while (i < endpoint)
00056     {
00057         // Read the number of blocks listed in the file metadata
00058         std::vector<std::string> records = blockBuffer.readBlock(i++);
00059         printBlock(records);
00060     }
00061 }
00062
00063
00064
00066 void Dump::printBlock(std::vector<std::string> records) {
00067
00068     std::cout << std::left << std::setw(6) << blockBuffer.getPrevRBN(); // Display preceding RBN
00069     for (const std::string& recordString : records) {
00070         ZipCodeRecord record = recordBuffer.parseRecord(recordString);
00071         std::cout << std::setw(6) << record.zipCode;                    // Display the key (zipCode) for
      each record in the block
00072     }
00073     std::cout << std::left << std::setw(6) << blockBuffer.getNextRBN(); // Display succeeding RBN
00074     std::cout << std::endl;
00075 }
00076
00077
00078
00080 void Dump::dumpBlockIndex(const std::string& filename) {
00081     std::ifstream mainFile(filename);
00082     if (!mainFile.is_open()) {
00083         std::cerr << "Error opening index file." << std::endl;
00084         return;
00085     }
00086
00087     std::string line;
00088     while (std::getline(mainFile, line)) {
00089         std::istringstream ss(line);
00090         std::vector<std::string> tokens;
00091
00092         // Split the line by comma and store tokens in the vector
00093         while (std::getline(ss, line, ',')) {
00094             tokens.push_back(line);
00095         }
00096         std::cout << "RBN: ";
00097         int key = 0;
00098         // Print each value in the tokens vector
00099         for (const auto& token : tokens) {
00100             std::cout << token << " ";
00101             if(key == 0){
00102                 std::cout << "Primary Key: ";
00103                 key = 1;
00104             }else{
00105                 key = 0;
00106             }
```

```
00107
00108         }
00109
00110         std::cout « "\n";
00111     }
00112 }
```

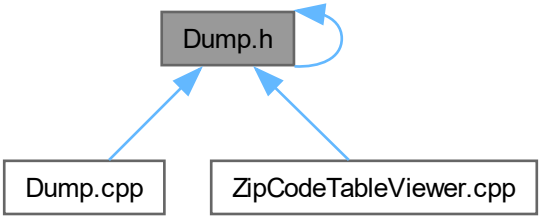
## 4.17 Dump.h File Reference

```
#include "Dump.h"
#include <iostream>
#include <iomanip>
#include "ZipCodeBuffer.h"
#include "BlockBuffer.h"
#include "HeaderBuffer.h"
#include <string>
#include <vector>
#include <sstream>
#include <fstream>
```

Include dependency graph for Dump.h:




This graph shows which files directly or indirectly include this file:



### Classes

- class Dump

  *Class for dumping and printing block records in logical and physical order and for dumping the simple index for the blocks.*

## 4.18 Dump.h

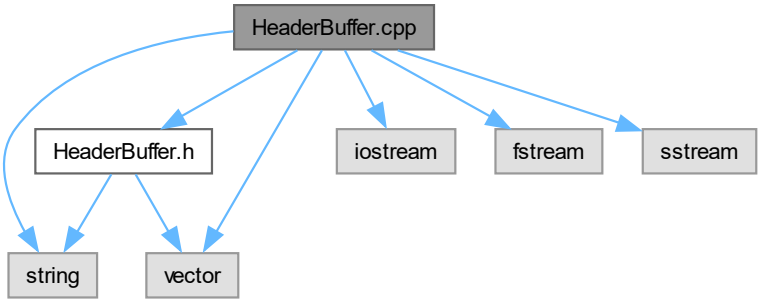
Go to the documentation of this file.

```
00001 // ---------------------------------------------------------------------------
00012 // ---------------------------------------------------------------------------
00039 // ---------------------------------------------------------------------------
00040
00041 #ifndef PRINTBLOCK_H
00042 #define PRINTBLOCK_H
00043
00044 #include "Dump.h"
00045 #include <iostream>
00046 #include <iomanip>
00047 #include "ZipCodeBuffer.h"
00048 #include "BlockBuffer.h"
00049 #include "HeaderBuffer.h"
00050
00051 #include <string>
00052 #include <vector>
00053 #include <sstream>
00054 #include <fstream>
00055
00056 class Dump {
00057 private:
00058     ZipCodeBuffer &recordBuffer;
00059     BlockBuffer &blockBuffer;
00060     HeaderBuffer &headerBuffer;
00061
00062 public:
00063     Dump(ZipCodeBuffer &recordBuffer);
00064
00070     void dumpLogicalOrder();
00071
00077     void dumpPhysicalOrder();
00078
00085     void printBlock(std::vector<std::string> records);
00086
00092     void dumpBlockIndex(const std::string& filename);
00093 };
00094 #endif  // PRINTBLOCK_H
```

## 4.19 HeaderBuffer.cpp File Reference

```
#include "HeaderBuffer.h"
#include <iostream>
#include <fstream>
#include <string>
#include <vector>
#include <sstream>
```

Include dependency graph for HeaderBuffer.cpp:




### Functions

- int headerBuffer ()

## 4.19.1 Function Documentation

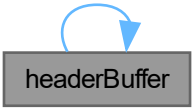
### 4.19.1.1 headerBuffer()

```
int headerBuffer ( )
```

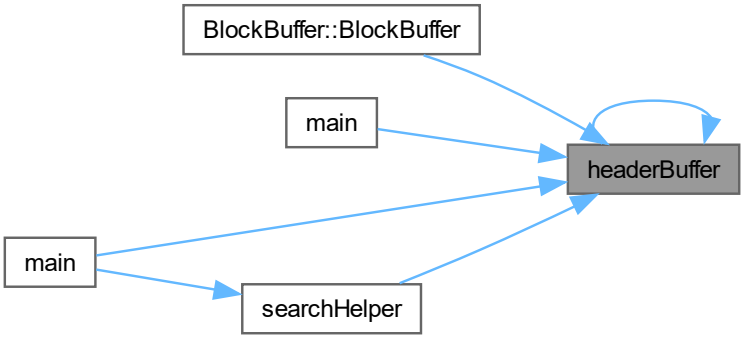
Definition at line 461 of file HeaderBuffer.cpp.

```
00461                    {
00462     HeaderBuffer headerBuffer("header.txt");
00463 
00464     // Set header fields
00465     headerBuffer.setFileStructureType("1.0");
00466     headerBuffer.setFileStructureVersion("1.0");
00467     headerBuffer.setHeaderSizeBytes(256);
00468     headerBuffer.setRecordSizeBytes(128);
00469     headerBuffer.setSizeFormatType("ASCII");
00470     headerBuffer.setPrimaryKeyIndexFileName("index.txt");
00471     headerBuffer.setRecordCount(1000);
00472     headerBuffer.setFieldCount(2);  // Set field count
00473     headerBuffer.setPrimaryKeyFieldIndex(1);  // Set primary key index
00474 
00475     // Add fields
00476     HeaderBuffer::Field field1;
00477     field1.zipCode = "string";
00478     field1.placeName = "string";
00479     field1.state = "string";
00480     field1.county = "string";
00481     field1.latitude = "double";
00482     field1.longitude = "double";
00483     headerBuffer.addField(field1);
00484 
00485     // Write the header to a file
00486     headerBuffer.writeHeader();
00487 
00488     // Read the header from a file
00489     headerBuffer.readHeader();
00490 
00491     return 0;
00492 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




## 4.20 HeaderBuffer.cpp

Go to the documentation of this file.

```
00001
00005
00006 #include "HeaderBuffer.h"
00007 #include <iostream>
00008 #include <fstream>
00009 #include <string>
00010 #include <vector>
00011 #include <sstream>
00012
00015     HeaderBuffer::HeaderBuffer(){
00016         // Set default values for member variables
00017         fileStructureType_ = "DefaultType";
00018         fileStructureVersion_ = "0.0";
00019         headerSizeBytes_ = 0;
00020         recordSizeBytes_ = 0;
00021         sizeFormatType_ = "ASCII";
00022         blockSize_ = 0;
00023         minimumBlockCapacity_ = 0;
00024         primaryKeyIndexFileName_ = "default_index.txt";
00025         primaryKeyIndexFileSchema_ = "default_schema";
00026         recordCount_ = 0;
00027         blockCount_ = 0;
00028         fieldCount_ = 0;
00029         primaryKeyFieldIndex_ = 0;
00030         RBNA_ = 0;
00031         RBNS_ = 0;
```

```
00032         staleFlag_ = 0;
00033
00034         // Add some default fields
00035         Field defaultField;
00036         defaultField.zipCode = "default_zip";
00037         defaultField.placeName = "default_place";
00038         defaultField.state = "default_state";
00039         defaultField.county = "default_county";
00040         defaultField.latitude = "default_latitude";
00041         defaultField.longitude = "default_longitude";
00042
00043         fields_.push_back(defaultField);
00044     }
00045
00048     HeaderBuffer::HeaderBuffer(const std::string& filename) : filename_(filename) {
00049     }
00050
00053     void HeaderBuffer::writeHeader() {
00054         const std::string tempFilename = "tempfile.txt";
00055
00056         // Step 1: Write the data portion to the temporary file
00057         std::ofstream tempFile(tempFilename);
00058
00059         if (!tempFile.is_open()) {
00060             std::cerr « "Error creating temporary file." « std::endl;
00061             return;
00062         }
00063
00064         // Open the main file
00065         std::ifstream mainFile(filename_);
00066
00067         if (!mainFile.is_open()) {
00068             std::cerr « "Error opening main file." « std::endl;
00069             tempFile.close();
00070             return;
00071         }
00072
00073         // Write your data to the temporary file here
00074         std::string line;
00075         bool copyStarted = false;
00076
00077         while (std::getline(mainFile, line)) {
00078             if (copyStarted) {
00079                 tempFile « line « std::endl;
00080             } else if (line.find("Data:") != std::string::npos) {
00081                 copyStarted = true;
00082             }
00083         }
00084
00085         // Close the main file and the temporary file
00086         mainFile.close();
00087         tempFile.close();
00088
00089         // Step 2: Overwrite the main file with the header
00090         this->setHeaderSizeBytes(calculateHeaderSize());
00091         writeHeaderToFile(filename_);
00092
00093         // Step 3: Append the data from the temporary file to the main file
00094         std::ifstream tempFileReader(tempFilename);
00095         std::ofstream mainFileWriter(filename_, std::ios::app); // Open the file in append mode
00096
00097         if (!tempFileReader.is_open() || !mainFileWriter.is_open()) {
00098             std::cerr « "Error opening files." « std::endl;
00099             tempFileReader.close();
00100             mainFileWriter.close();
00101             return;
00102         }
00103
00104         mainFileWriter « tempFileReader.rdbuf();
00105
00106         // Close files and remove the temporary file
00107         tempFileReader.close();
00108         mainFileWriter.close();
00109         std::remove(tempFilename.c_str());
00110     }
00111
00112
00113     //version of writeHeader that prints to a file of choice rather than the file held by the object
00116     void HeaderBuffer::writeHeaderToFile(const std::string& filename) {
00117         std::ofstream file(filename);
00118
00119         if (!file.is_open()) {
00120             // Print an error mesage if the file cannot be opened
00121
00122             std::cerr « "Error opening the file(writeHeaderToFile)." « std::endl;
00123             return;
00124         }
```

```
00125
00126         //version for seeing all the stuff
00127         file « "Header:" « std::endl;
00128         file « " - File structure type: " « fileStructureType_ « std::endl;
00129         file « " - File structure version: " « fileStructureVersion_ « std::endl;
00130         file « " - Header Size (bytes): " « headerSizeBytes_ « std::endl;
00131         file « " - Record Size (bytes): " « recordSizeBytes_ « std::endl;
00132         file « " - Size Format Type: " « sizeFormatType_ « std::endl;
00133         file « " - Block Size: " « blockSize_ « std::endl;
00134         file « " - Minimum Block Capacity: " « minimumBlockCapacity_ « std::endl;
00135         file « " - Primary Key Index File: " « primaryKeyIndexFileName_ « std::endl;
00136         file « " - Primary Key Index File Schema: " « primaryKeyIndexFileSchema_ « std::endl;
00137         file « " - Record Count: " « recordCount_ « std::endl;
00138         file « " - Block Count: " « blockCount_ « std::endl;
00139         file « " - Field Count: " « fieldCount_ « std::endl;
00140         file « " - Primary Key: " « primaryKeyFieldIndex_ « std::endl;
00141         file « " - RBN link for Avail List: " « RBNA_ « std::endl;
00142         file « " - RBN link for active sequence set List: " « RBNS_ « std::endl;
00143         file « " - Stale Flag: " « staleFlag_ « std::endl;
00144
00145         for (const Field& field : fields_) {
00146             file « std::endl;
00147             file « "Fields:" « std::endl;
00148             file « "    - Zip Code: " « field.zipCode « std::endl;
00149             file « "    - Place Name: " « field.placeName « std::endl;
00150             file « "    - State: " « field.state « std::endl;
00151             file « "    - County: " « field.county « std::endl;
00152             file « "    - Latitude: " « field.latitude « std::endl;
00153             file « "    - Longitude: " « field.longitude « std::endl;
00154         }
00155
00156         file « std::endl;
00157         file « "Data:" « std::endl;
00158
00159         file.close();
00160     }
00161
00164     void HeaderBuffer::readHeader() {
00165         std::ifstream file(filename_);
00166
00167         if (!file.is_open()) {
00168             // Print an error mesage if the file cannot be opened
00169             std::cerr « "Error opening the file(readHeader)." « std::endl;
00170             return;
00171         }
00172
00173         std::string line;
00174
00175         while (std::getline(file, line)) {
00176             if (line.find(" - File structure type: ") != std::string::npos) {
00177                 fileStructureType_ = line.substr(line.find(": ") + 2);
00178
00179             }
00180             else if (line.find(" - File structure version: ") != std::string::npos) {
00181                 fileStructureVersion_ = line.substr(line.find(": ") + 2);
00182
00183             }
00184             else if (line.find("- Header Size (bytes): ") != std::string::npos) {
00185                 headerSizeBytes_ = std::stoi(line.substr(line.find(": ") + 2));
00186
00187             }
00188             else if (line.find(" - Record Size (bytes): ") != std::string::npos) {
00189                 recordSizeBytes_ = std::stoi(line.substr(line.find(": ") + 2));
00190
00191             }
00192             else if (line.find(" - Size Format Type: ") != std::string::npos) {
00193                 sizeFormatType_ = line.substr(line.find(": ") + 2);
00194
00195             }
00196             else if (line.find(" - Block Size: ") != std::string::npos) {
00197                 blockSize_ = std::stoi(line.substr(line.find(": ") + 2));
00198
00199             }
00200             else if (line.find(" - Minimum Block Capacity: ") != std::string::npos) {
00201                 minimumBlockCapacity_ = std::stoi(line.substr(line.find(": ") + 2));
00202
00203             }
00204             else if (line.find(" - Primary Key Index File: ") != std::string::npos) {
00205                 primaryKeyIndexFileName_ = line.substr(line.find(": ") + 2);
00206
00207             }
00208             else if (line.find(" - Primary Key Index File Schema: ") != std::string::npos) {
00209                 primaryKeyIndexFileSchema_ = line.substr(line.find(": ") + 2);
00210
00211             }
00212             else if (line.find(" - Record Count: ") != std::string::npos) {
00213                 recordCount_ = std::stoi(line.substr(line.find(": ") + 2));
```

```
00214
00215             }
00216             else if (line.find(" - Block Count: ") != std::string::npos) {
00217                 blockCount_ = std::stoi(line.substr(line.find(": ") + 2));
00218
00219             }
00220             else if (line.find(" - Field Count: ") != std::string::npos) {
00221                 fieldCount_ = std::stoi(line.substr(line.find(": ") + 2));
00222
00223             }
00224             else if (line.find(" - Primary Key: ") != std::string::npos) {
00225                 primaryKeyFieldIndex_ = std::stoi(line.substr(line.find(": ") + 2));
00226
00227             }
00228             else if (line.find(" - RBN link for Avail List: ") != std::string::npos) {
00229                 RBNA_ = std::stoi(line.substr(line.find(": ") + 2));
00230
00231             }
00232             else if (line.find(" - RBN link for active sequence set List: ") != std::string::npos) {
00233                 RBNS_ = std::stoi(line.substr(line.find(": ") + 2));
00234
00235             }
00236             else if (line.find(" - Stale Flag: ") != std::string::npos) {
00237                 staleFlag_ = std::stoi(line.substr(line.find(": ") + 2));
00238
00239             }
00240             else if (line.find("Fields:") != std::string::npos) {
00241
00242
00243                 Field field;
00244                 while (std::getline(file, line)) {
00245                     if (line.find("   - Zip Code: ") != std::string::npos) {
00246                         field.zipCode = line.substr(line.find(": ") + 2);
00247                     }
00248                     else if (line.find("   - Place Name: ") != std::string::npos) {
00249                         field.placeName = line.substr(line.find(": ") + 2);
00250                     }
00251                     else if (line.find("   - State: ") != std::string::npos) {
00252                         field.state = line.substr(line.find(": ") + 2);
00253                     }
00254                     else if (line.find("   - County: ") != std::string::npos) {
00255                         field.county = line.substr(line.find(": ") + 2);
00256                     }
00257                     else if (line.find("   - Latitude: ") != std::string::npos) {
00258                         field.latitude = line.substr(line.find(": ") + 2);
00259                     }
00260                     else if (line.find("   - Longitude: ") != std::string::npos) {
00261                         field.longitude = line.substr(line.find(": ") + 2);
00262                     }
00263                 }
00264                 fields_.push_back(field);
00265             }
00266         }
00267
00268         file.close();
00269     }
00270
00273     int HeaderBuffer::calculateHeaderSize() const {
00274         std::stringstream headerStream;
00275
00276         // Write header data to a stringstream
00277         headerStream « "Header:\n";
00278         headerStream « " - File structure type: " « fileStructureType_ « "\n";
00279         headerStream « " - File structure version: " « fileStructureVersion_ « "\n";
00280         headerStream « " - Header Size (bytes): " « headerSizeBytes_ « "\n";
00281         headerStream « " - Record Size (bytes): " « recordSizeBytes_ « "\n";
00282         headerStream « " - Size Format Type: " « sizeFormatType_ « "\n";
00283         headerStream « " - Block Size: " « blockSize_ « "\n";
00284         headerStream « " - Minimum Block Capacity: " « minimumBlockCapacity_ « "\n";
00285         headerStream « " - Primary Key Index File: " « primaryKeyIndexFileName_ « "\n";
00286         headerStream « " - Primary Key Index File Schema: " « primaryKeyIndexFileSchema_ « "\n";
00287         headerStream « " - Record Count: " « recordCount_ « "\n";
00288         headerStream « " - Block Count: " « blockCount_ « "\n";
00289         headerStream « " - Field Count: " « fieldCount_ « "\n";
00290         headerStream « " - Primary Key: " « primaryKeyFieldIndex_ « "\n";
00291         headerStream « " - RBN link for Avail List: " « RBNA_ « "\n";
00292         headerStream « " - RBN link for active sequence set List: " « RBNS_ « "\n";
00293         headerStream « " - Stale Flag: " « staleFlag_ « "\n";
00294
00295         headerStream « "\nFields:\n";
00296         for (const Field& field : fields_) {
00297             headerStream « "   - Zip Code: " « field.zipCode « "\n";
00298             headerStream « "   - Place Name: " « field.placeName « "\n";
00299             headerStream « "   - State: " « field.state « "\n";
00300             headerStream « "   - County: " « field.county « "\n";
00301             headerStream « "   - Latitude: " « field.latitude « "\n";
00302             headerStream « "   - Longitude: " « field.longitude « "\n";
```

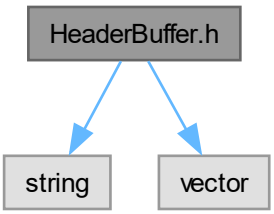
```
00303         }
00304
00305         headerStream << "\nData:\n";
00306
00307         // Calculate total size including the newline characters
00308         return static_cast<int>(headerStream.str().size());
00309 }
00310
00313     void HeaderBuffer::setFileStructureType(const std::string& fileStructureType) {
00314         fileStructureType_ = fileStructureType;
00315     }
00316
00318     void HeaderBuffer::setFileStructureVersion(const std::string& fileStructureVersion) {
00319         fileStructureVersion_ = fileStructureVersion;
00320     }
00321
00323     void HeaderBuffer::setHeaderSizeBytes(int headerSizeBytes) {
00324         headerSizeBytes_ = headerSizeBytes;
00325     }
00326
00328     void HeaderBuffer::setRecordSizeBytes(int recordSizeBytes) {
00329         recordSizeBytes_ = recordSizeBytes;
00330     }
00331
00333     void HeaderBuffer::setSizeFormatType(const std::string& sizeFormatType) {
00334         sizeFormatType_ = sizeFormatType;
00335     }
00336
00338     void HeaderBuffer::setBlockSize(int blockSize) {
00339         blockSize_ = blockSize;
00340     }
00341
00343     void HeaderBuffer::setminimumBlockCapacity(int minimumBlockCapacity) {
00344         minimumBlockCapacity_ = minimumBlockCapacity;
00345     }
00346
00348     void HeaderBuffer::setPrimaryKeyIndexFileName(const std::string& primaryKeyIndexFileName) {
00349         primaryKeyIndexFileName_ = primaryKeyIndexFileName;
00350     }
00351
00353     void HeaderBuffer::setprimaryKeyIndexFileSchema(const std::string& primaryKeyIndexFileSchema) {
00354         primaryKeyIndexFileSchema_ = primaryKeyIndexFileSchema;
00355     }
00356
00358     void HeaderBuffer::setRecordCount(int recordCount) {
00359         recordCount_ = recordCount;
00360     }
00361
00363     void HeaderBuffer::setBlockCount(int blockCount) {
00364         blockCount_ = blockCount;
00365     }
00366
00368     void HeaderBuffer::setFieldCount(int fieldCount) {
00369         fieldCount_ = fieldCount;
00370     }
00371
00373     void HeaderBuffer::setPrimaryKeyFieldIndex(int primaryKeyFieldIndex) {
00374         primaryKeyFieldIndex_ = primaryKeyFieldIndex;
00375     }
00376
00378     void HeaderBuffer::setRBNA(int RBNA) {
00379         RBNA_ = RBNA;
00380     }
00381
00383     void HeaderBuffer::setRBNS(int RBNS) {
00384         RBNS_ = RBNS;
00385     }
00386
00388     void HeaderBuffer::setstaleFlag(int staleFlag) {
00389         staleFlag_ = staleFlag;
00390     }
00391
00394     void HeaderBuffer::addField(const Field& field) {
00395         fields_.push_back(field);
00396     }
00397
00399     std::string HeaderBuffer::getFileStructureType() const {
00400         return fileStructureType_;
00401     }
00402
00403     std::string HeaderBuffer::getFileStructureVersion() const {
00404         return fileStructureVersion_;
00405     }
00406
00407     int HeaderBuffer::getHeaderSizeBytes() const {
00408         return headerSizeBytes_;
00409     }
```

```
00410
00411     int HeaderBuffer::getRecordSizeBytes() const {
00412         return recordSizeBytes_;
00413     }
00414
00415     std::string HeaderBuffer::getSizeFormatType() const {
00416         return sizeFormatType_;
00417     }
00418
00419     int HeaderBuffer::getBlockSize() const {
00420         return blockSize_;
00421     }
00422
00423     int HeaderBuffer::getMinimumBlockCapacity() const {
00424         return minimumBlockCapacity_;
00425     }
00426
00427     int HeaderBuffer::getBlockCount() const {
00428         return blockCount_;
00429     }
00430     std::string HeaderBuffer::getPrimaryKeyIndexFileName() const {
00431         return primaryKeyIndexFileName_;
00432     }
00433
00434     int HeaderBuffer::getRecordCount() const {
00435         return recordCount_;
00436     }
00437
00438     int HeaderBuffer::getFieldCount() const {
00439         return fieldCount_;
00440     }
00441
00442     int HeaderBuffer::getPrimaryKeyFieldIndex() const {
00443         return primaryKeyFieldIndex_;
00444     }
00445
00446     int HeaderBuffer::getRBNA() const {
00447         return RBNA_;
00448     }
00449
00450     int HeaderBuffer::getRBNS() const {
00451         return RBNS_;
00452     }
00453
00454     int HeaderBuffer::getStaleFlag() const {
00455         return staleFlag_;
00456     }
00457     //const std::vector<Field>& HeaderBuffer::getFields() const {
00458      //   return fields_;
00459    // }
00460
00461 int headerBuffer() {
00462     HeaderBuffer headerBuffer("header.txt");
00463
00464     // Set header fields
00465     headerBuffer.setFileStructureType("1.0");
00466     headerBuffer.setFileStructureVersion("1.0");
00467     headerBuffer.setHeaderSizeBytes(256);
00468     headerBuffer.setRecordSizeBytes(128);
00469     headerBuffer.setSizeFormatType("ASCII");
00470     headerBuffer.setPrimaryKeyIndexFileName("index.txt");
00471     headerBuffer.setRecordCount(1000);
00472     headerBuffer.setFieldCount(2);  // Set field count
00473     headerBuffer.setPrimaryKeyFieldIndex(1);  // Set primary key index
00474
00475     // Add fields
00476     HeaderBuffer::Field field1;
00477     field1.zipCode = "string";
00478     field1.placeName = "string";
00479     field1.state = "string";
00480     field1.county = "string";
00481     field1.latitude = "double";
00482     field1.longitude = "double";
00483     headerBuffer.addField(field1);
00484
00485     // Write the header to a file
00486     headerBuffer.writeHeader();
00487
00488     // Read the header from a file
00489     headerBuffer.readHeader();
00490
00491     return 0;
00492 }
```

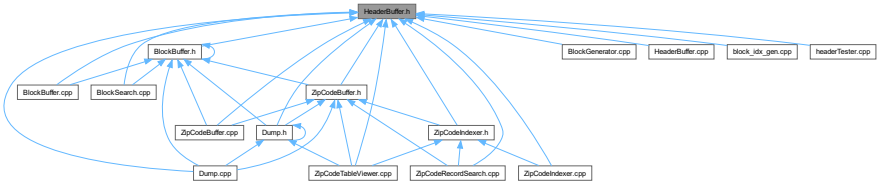
## 4.21 HeaderBuffer.h File Reference

```
#include <string>
#include <vector>
```

Include dependency graph for HeaderBuffer.h:




This graph shows which files directly or indirectly include this file:




### Classes

- class HeaderBuffer

  *Implementation of the HeaderBuffer class for for handling header data.*
- struct HeaderBuffer::Field

## 4.22 HeaderBuffer.h

Go to the documentation of this file.

```
00001 // ---------------------------------------------------------------------------
00012 // ---------------------------------------------------------------------------
00043 // ---------------------------------------------------------------------------
00044
00045
00046 #ifndef HEADERBUFFER_H
00047 #define HEADERBUFFER_H
00048
00049 #include <string>
00050 #include <vector>
00051
00052 class HeaderBuffer {
00053 public:
00054
00055     struct Field {
00056         std::string zipCode;
00057         std::string placeName;
```

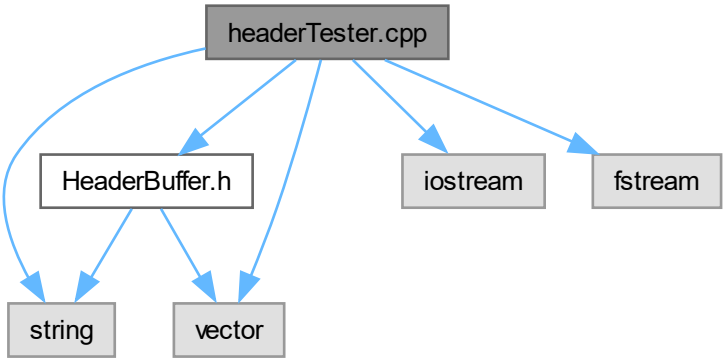
```
00058         std::string state;
00059         std::string county;
00060         std::string latitude;
00061         std::string longitude;
00062     };
00063
00066     HeaderBuffer();
00067
00070     HeaderBuffer(const std::string& filename);
00071
00072
00075     void writeHeader();
00076
00079     void writeHeaderToFile(const std::string& filename);
00080
00083     void readHeader();
00084
00087     int calculateHeaderSize() const;
00088
00089     void setFileStructureType(const std::string& fileStructureType);
00090     void setFileStructureVersion(const std::string& fileStructureVersion);
00091     void setHeaderSizeBytes(int headerSizeBytes);
00092     void setRecordSizeBytes(int recordSizeBytes);
00093     void setSizeFormatType(const std::string& sizeFormatType);
00094     void setBlockSize(int blockSize);
00095     void setminimumBlockCapacity(int minimumBlockCapacity);
00096     void setPrimaryKeyIndexFileName(const std::string& primaryKeyIndexFileName);
00097     void setprimaryKeyIndexFileSchema(const std::string& primaryKeyIndexFileSchema);
00098     void setRecordCount(int recordCount);
00099     void setBlockCount(int blockCount);
00100     void setFieldCount(int fieldCount);
00101     void setPrimaryKeyFieldIndex(int primaryKeyFieldIndex);
00102     void setRBNA(int RBNA);
00103     void setRBNS(int RBNS);
00104     void setstaleFlag(int staleFlag);
00105     void addField(const Field& field);
00106
00107     std::string getFileStructureType() const;
00108     std::string getFileStructureVersion() const;
00109     int getHeaderSizeBytes() const;
00110     int getRecordSizeBytes() const;
00111     std::string getSizeFormatType() const;
00112     int getBlockSize() const;
00113     int getMinimumBlockCapacity() const;
00114     std::string getPrimaryKeyIndexFileName() const;
00115     int getRecordCount() const;
00116     int getBlockCount() const;
00117     int getFieldCount() const;
00118     int getPrimaryKeyFieldIndex() const;
00119     int getRBNA() const;
00120     int getRBNS() const;
00121     int getStaleFlag() const;
00122     const std::vector<Field>& getFields() const;
00123
00124 private:
00125     std::string filename_;
00126     std::string fileStructureType_;
00127     std::string fileStructureVersion_;
00128     int headerSizeBytes_;
00129     int recordSizeBytes_;
00130     std::string sizeFormatType_;
00131     int blockSize_;
00132     int minimumBlockCapacity_;
00133     std::string primaryKeyIndexFileName_;
00134     std::string primaryKeyIndexFileSchema_;
00135     int recordCount_;
00136     int blockCount_;
00137     int fieldCount_;
00138     int primaryKeyFieldIndex_;
00139     int RBNA_;
00140     int RBNS_;
00141     int staleFlag_;
00142     std::vector<Field> fields_;
00143 };
00144 // #include "HeaderBuffer.cpp"
00145 #endif // HEADERBUFFER_H
```

## 4.23 headerTester.cpp File Reference

```
#include "HeaderBuffer.h"
#include <string>
```

```
#include <vector>
#include <iostream>
#include <fstream>
```

Include dependency graph for headerTester.cpp:




### Functions

- int main ()

## 4.23.1 Function Documentation

### 4.23.1.1 main()

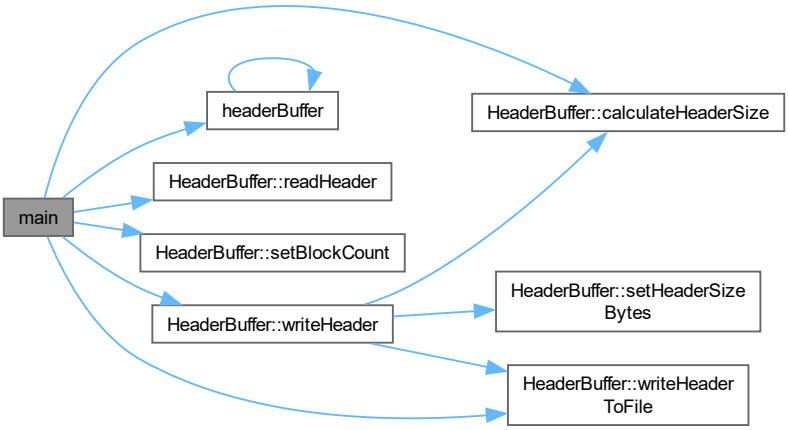
```
int main ( )
```

Definition at line 10 of file headerTester.cpp.

```
00010         {
00011     cout « "testing of the write function\n" « endl;
00012     HeaderBuffer headerBuffer("testwrite.txt");
00013     // Set header fields
00014     headerBuffer.setFileStructureType("1.0");
00015     headerBuffer.setFileStructureVersion("1.0");
00016     headerBuffer.setHeaderSizeBytes(256);
00017     headerBuffer.setRecordSizeBytes(128);
00018     headerBuffer.setSizeFormatType("ASCII");
00019     headerBuffer.setBlockSize(54);
00020     headerBuffer.setminimumBlockCapacity(6422);
00021     headerBuffer.setPrimaryKeyIndexFileName("index.txt");
00022     headerBuffer.setprimaryKeyIndexFileSchema("sample");
00023     headerBuffer.setRecordCount(1000);
00024     headerBuffer.setBlockCount(1001);
00025     headerBuffer.setFieldCount(5);  // Set field count
00026     headerBuffer.setPrimaryKeyFieldIndex(1);  // Set primary key index
00027     headerBuffer.setRBNA(1);
00028     headerBuffer.setRBNS(1);
00029     headerBuffer.setstaleFlag(0);
00030
00031     // Add fields
00032     HeaderBuffer::Field field1;
00033     field1.zipCode = "string";
00034     field1.placeName = "string";
00035     field1.state = "string";
00036     field1.county = "string";
00037     field1.latitude = "double";
00038     field1.longitude = "double";
```

```
00039     headerBuffer.addField(field1);
00040
00041     // Write the header to a file
00042     //headerBuffer.writeHeader();
00043
00044     // Read the header from a file
00045     HeaderBuffer headerBuffer2("us_postal_codes.txt");
00046     headerBuffer2.readHeader();
00047     headerBuffer2.setBlockCount(29);
00048     headerBuffer2.writeHeaderToFile("testread.txt");
00049     headerBuffer2.writeHeader();
00050
00051     int calculatedSize = headerBuffer.calculateHeaderSize();
00052     std::cout « "Calculated Header Size: " « calculatedSize « " bytes\n" « std::endl;
00053
00054     int calculatedSize2 = headerBuffer2.calculateHeaderSize();
00055     std::cout « "Calculated Header Size: " « calculatedSize2 « " bytes\n" « std::endl;
00056     return 0;
00057
00058 }
```

Here is the call graph for this function:




## 4.24 headerTester.cpp

Go to the documentation of this file.

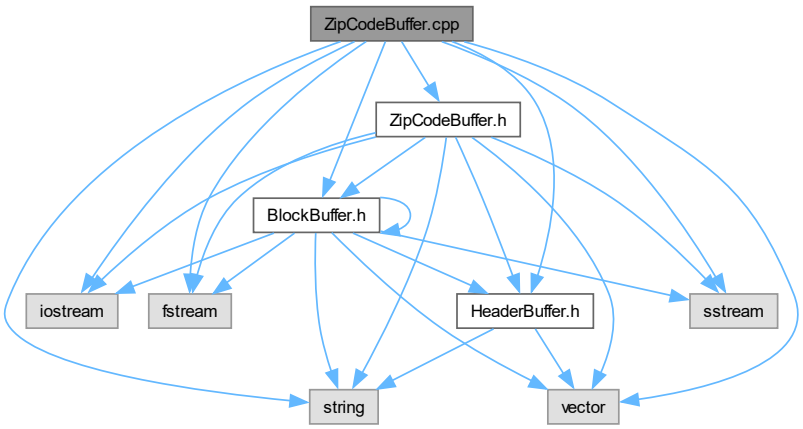
```
00001 #include "HeaderBuffer.h"
00002 #include <string>
00003 #include <vector>
00004 #include <iostream>
00005 #include <fstream>
00006 using namespace std;
00007
00008
00009
00010 int main(){
00011     cout « "testing of the write function\n" « endl;
00012     HeaderBuffer headerBuffer("testwrite.txt");
00013     // Set header fields
00014     headerBuffer.setFileStructureType("1.0");
00015     headerBuffer.setFileStructureVersion("1.0");
00016     headerBuffer.setHeaderSizeBytes(256);
00017     headerBuffer.setRecordSizeBytes(128);
00018     headerBuffer.setSizeFormatType("ASCII");
00019     headerBuffer.setBlockSize(54);
00020     headerBuffer.setminimumBlockCapacity(6422);
00021     headerBuffer.setPrimaryKeyIndexFileName("index.txt");
00022     headerBuffer.setprimaryKeyIndexFileSchema("sample");
00023     headerBuffer.setRecordCount(1000);
00024     headerBuffer.setBlockCount(1001);
```

```
00025     headerBuffer.setFieldCount(5);  // Set field count
00026     headerBuffer.setPrimaryKeyFieldIndex(1);  // Set primary key index
00027     headerBuffer.setRBNA(1);
00028     headerBuffer.setRBNS(1);
00029     headerBuffer.setstaleFlag(0);
00030
00031     // Add fields
00032     HeaderBuffer::Field field1;
00033     field1.zipCode = "string";
00034     field1.placeName = "string";
00035     field1.state = "string";
00036     field1.county = "string";
00037     field1.latitude = "double";
00038     field1.longitude = "double";
00039     headerBuffer.addField(field1);
00040
00041     // Write the header to a file
00042     //headerBuffer.writeHeader();
00043
00044     // Read the header from a file
00045     HeaderBuffer headerBuffer2("us_postal_codes.txt");
00046     headerBuffer2.readHeader();
00047     headerBuffer2.setBlockCount(29);
00048     headerBuffer2.writeHeaderToFile("testread.txt");
00049     headerBuffer2.writeHeader();
00050
00051     int calculatedSize = headerBuffer.calculateHeaderSize();
00052     std::cout « "Calculated Header Size: " « calculatedSize « " bytes\n" « std::endl;
00053
00054     int calculatedSize2 = headerBuffer2.calculateHeaderSize();
00055     std::cout « "Calculated Header Size: " « calculatedSize2 « " bytes\n" « std::endl;
00056     return 0;
00057
00058 }
```

## 4.25 ZipCodeBuffer.cpp File Reference

```
#include <iostream>
#include <fstream>
#include <string>
#include <vector>
#include <sstream>
#include "ZipCodeBuffer.h"
#include "BlockBuffer.h"
#include "HeaderBuffer.h"
```

Include dependency graph for ZipCodeBuffer.cpp:



# 4.26 ZipCodeBuffer.cpp

Go to the documentation of this file.

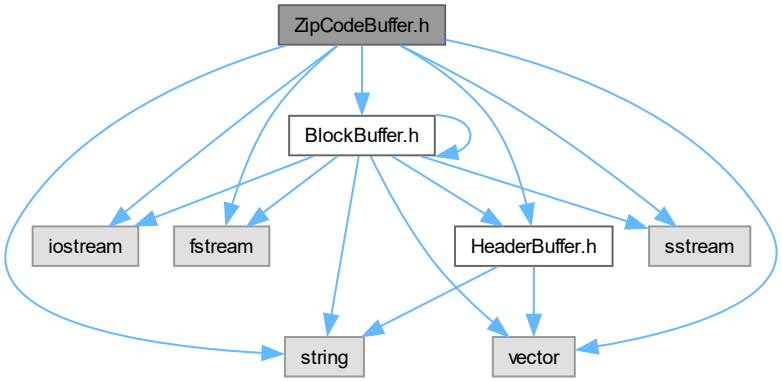
```
00001
00004
00005 #include <iostream>
00006 #include <fstream>
00007 #include <string>
00008 #include <vector>
00009 #include <sstream>
00010 #include "ZipCodeBuffer.h"
00011 #include "BlockBuffer.h"
00012 #include "HeaderBuffer.h"
00013
00015 ZipCodeBuffer::ZipCodeBuffer(std::ifstream &file, char fileType = 'L', HeaderBuffer headerBuffer =
      HeaderBuffer("us_postal_codes.txt")) : file(file),
00016     fileType(std::toupper(fileType)), blockBuffer(BlockBuffer(file, headerBuffer)),
      headerBuffer(headerBuffer) { // TODO change HeaderBuffer initialization once it has a generic
      constructor
00017
00018     if (this->fileType == 'C') {
00019         // If CSV, skip the header line.
00020         std::string line;
00021         getline(file, line); // Skip header line
00022     }
00023     else if (this->fileType == 'L' || this->fileType == 'B') {
00024         // If length-indicated or blocked length-indicated file, skip the header line.
00025         // We have to skip past the metadata, up to the "Data: line"
00026         std::string line;
00027         std::getline(file, line);
00028         if (line.find("Header:") != std::string::npos)
00029         {
00030             // File contains a metadata header
00031
00032             // Read lines until "Data:" is found
00033             while (std::getline(file, line)) {
00034                 if (line.find("Data:") != std::string::npos) {
00035                     break;
00036                 }
00037             }
00038         }
00039
00040     }
00041 };
00042
00043
00045 ZipCodeRecord ZipCodeBuffer::parseRecord(std::string recordString) {
00046     ZipCodeRecord record;
00047
00048     std::istringstream recordStream(recordString);
00049     std::string field;
00050
00051     // Parse the record fields using istringstream
00052     std::vector<std::string> fields;
00053     while (getline(recordStream, field, ',')) {
00054         fields.push_back(field);
00055     }
00056
00057     if (fields.size() == 6)
00058     {
00059         // Fill the ZipCodeRecord struct with the data from the record
00060         record.zipCode = fields[0];
00061         record.placeName = fields[1];
00062         record.state = fields[2];
00063         record.county = fields[3];
00064         record.latitude = std::stod(fields[4]);  // Convert string to double
00065         record.longitude = std::stod(fields[5]);
00066     }
00067     else
00068     {
00069         // The record is malformed and does not have 6 fields. Return terminal string
00070         record.zipCode = "";
00071         std::cerr « "A record contains an invalid number of fields: "
00072             « recordString « std::endl;
00073     }
00074
00075     return record;
00076 };
00077
00078
00080 ZipCodeRecord ZipCodeBuffer::readNextRecord() {
00081     ZipCodeRecord record;
00082     std::string recordString;
00083
00084     if (file.eof())
```

```
00085     {
00086         // End of file reached. Return terminal character
00087         record.zipCode = "";
00088         return record;
00089     }
00090 
00091     if (fileType == 'B')
00092     {
00093         if (blockRecordsIndex >= blockRecords.size() || blockRecordsIndex == -1)
00094         {
00095             // Reached the end of the block, so retrieve the next one
00096             blockRecords = blockBuffer.readNextBlock();
00097             if (blockRecords.size() > 0)
00098             {
00099                 recordString = blockRecords[0]; // Retrieve the first record in the block
00100                 blockRecordsIndex = 1;          // Skip 0 because it reads it immediately
00101             }
00102             else
00103             {
00104                 // Did not read a valid block (likely due to the end of file), so return terminal
      character
00105                 record.zipCode = "";
00106                 return record;
00107             }
00108         }
00109         else
00110         {
00111             recordString = blockRecords[blockRecordsIndex++];
00112         }
00113     }
00114     else if (fileType == 'C')
00115     {
00116         // If CSV, retrieve the next line in the file as the record to parse
00117         getline(file, recordString);
00118     }
00119     else if (fileType == 'L')
00120     {
00121         // If length-indicated, reads the length and retrieves that many characters for the record
      string
00122         int numCharactersToRead = 0;
00123         file » numCharactersToRead;   // Read the length indicator, the first field in each record
00124         file.ignore(1);                // Skip the comma after the length field
00125         recordString.resize(numCharactersToRead);
00126         file.read(&recordString[0], numCharactersToRead);
00127     }
00128 
00129     // If not the end of the file, read the fields in the line into the record object
00130     if (recordString.empty())
00131     {
00132 
00133         // Did not read a valid record (likely due to the end of file newline), so return terminal
      character
00134         record.zipCode = "";
00135         return record;
00136     }
00137 
00138     record = parseRecord(recordString);
00139     return record;
00140 };
00141 
00143 std::streampos ZipCodeBuffer::getCurrentPosition() {
00144     return file.tellg();
00145 }
00146 
00148 std::ifstream& ZipCodeBuffer::setCurrentPosition(std::streampos pos) {
00149     file.seekg(pos);
00150     return file;
00151 }
```

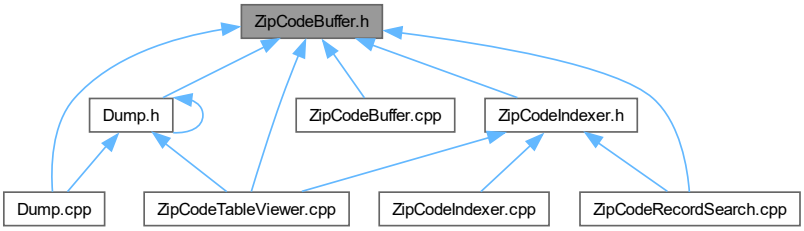
## 4.27 ZipCodeBuffer.h File Reference

```
#include <iostream>
#include <fstream>
#include <string>
#include <vector>
#include <sstream>
#include "BlockBuffer.h"
```

`#include "HeaderBuffer.h"`
Include dependency graph for ZipCodeBuffer.h:




This graph shows which files directly or indirectly include this file:




### Classes

- struct ZipCodeRecord

  *Structure to hold a ZIP Code record.*
- class ZipCodeBuffer

  *The ZipCodeBuffer class parses the file one record at a time and returns the fields in a ZipCodeRecord struct.*

## 4.28 ZipCodeBuffer.h

Go to the documentation of this file.

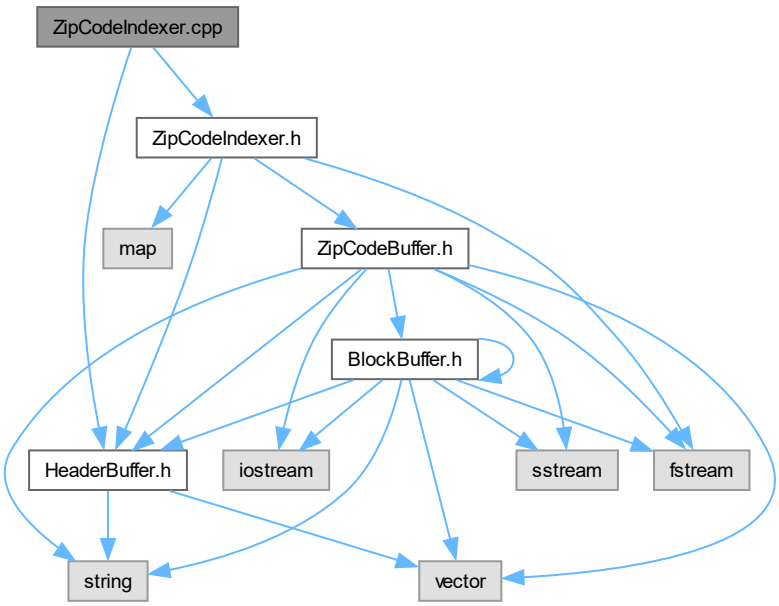
```
00001 // ---------------------------------------------------------------------------
00011 // ---------------------------------------------------------------------------
00034 // ---------------------------------------------------------------------------
00035
00036
00037 #ifndef ZIPCODEBUFFER_H
00038 #define ZIPCODEBUFFER_H
00039
00040 #include <iostream>
```

```
00041 #include <fstream>
00042 #include <string>
00043 #include <vector>
00044 #include <sstream>
00045 #include "BlockBuffer.h"
00046 #include "HeaderBuffer.h"
00047
00049 struct ZipCodeRecord {
00050     std::string zipCode;
00051     std::string placeName;
00052     std::string state;
00053     std::string county;
00054     double latitude = 0.0;
00055     double longitude = 0.0;
00056 };
00057
00060 class ZipCodeBuffer {
00061 private:
00062     std::ifstream &file;
00063     char fileType;
00064     vector<string> blockRecords; // Stores the current block of records if using a block file format
00065     int blockRecordsIndex = -1; // Default to index 0 so it retrieves the first block on first check
00066
00067 public:
00068     BlockBuffer blockBuffer; // Stores the block metadata if using a block file format
00069     HeaderBuffer headerBuffer = HeaderBuffer("us_postal_codes.txt"); // Stores the header buffer
00070     // TODO once default constructor is added, make it use generic constructor instead
00071
00084     ZipCodeBuffer(std::ifstream &file, char fileType, HeaderBuffer headerBuffer);
00085
00086
00087     //** @brief Destructor to close the file when done. */
00088     //~ZipCodeBuffer();
00089
00109     ZipCodeRecord parseRecord(std::string);
00110
00124     ZipCodeRecord readNextRecord();
00125
00127     std::streampos getCurrentPosition();
00129     std::ifstream& setCurrentPosition(std::streampos);
00130
00131     // Give Dump access to private member functions and variables.
00132     friend class Dump;
00133 };
00134
00135 #endif // ZIPCODEBUFFER_H
```

## 4.29 ZipCodeIndexer.cpp File Reference

```
#include "ZipCodeIndexer.h"
#include "HeaderBuffer.h"
```

Include dependency graph for ZipCodeIndexer.cpp:




## 4.30 ZipCodeIndexer.cpp

Go to the documentation of this file.

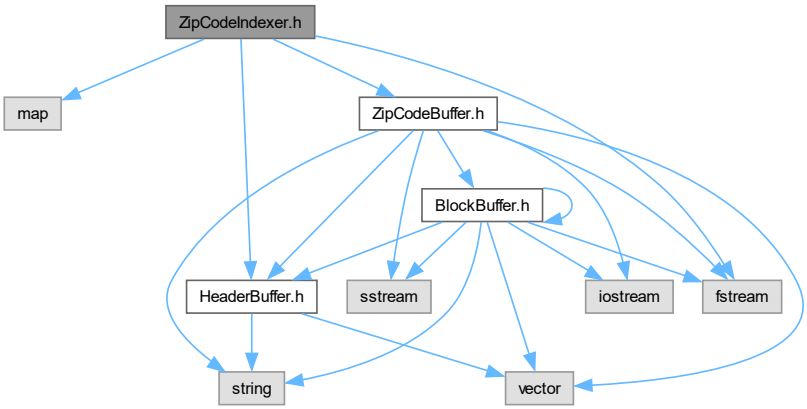
```
00001
00004
00005 #include "ZipCodeIndexer.h"
00006 #include "HeaderBuffer.h"
00007
00009 // Initializes the buffer object with the given file name
00010 // and sets the index file name
00013 ZipCodeIndexer::ZipCodeIndexer(std::ifstream &file, char fileType, const std::string& idxFileName,
      HeaderBuffer headerBuffer)
00014     : buffer(file, fileType, headerBuffer), indexFileName(idxFileName) {}
00015
00017 // This function creates an index of ZIP codes to their positions in the file
00018 // by reading each record in the file using the buffer.
00019 void ZipCodeIndexer::createIndex() {
00020     ZipCodeRecord record;
00021     std::streampos position = buffer.getCurrentPosition();
00022     while (!(record = buffer.readNextRecord()).zipCode.empty()) {
00023         index[record.zipCode] = position; // Save the position of this ZIP code in the index
00024         position = buffer.getCurrentPosition(); // Get the position of the next record
00025     }
00026 }
00027
00030 void ZipCodeIndexer::writeIndexToFile() {
00031     std::ofstream outFile(indexFileName);
00032     for (const auto& pair : index) {
00033         outFile « pair.first « " " « pair.second « "\n"; // ZIP code and position
00034     }
00035     outFile.close();
00036 }
00037
00039 // This function loads the index from a file into RAM. The index is stored in a std::map
00040 // where the key is the ZIP code and the value is its position in the file.
00041 void ZipCodeIndexer::loadIndexFromRAM() {
00042     index.clear(); // Clear any existing index
00043     std::ifstream inFile(indexFileName);
00044     std::string zip;
00045     std::streampos pos;
00046     int posInt;
```

```
00047     while (inFile » zip » posInt) {
00048         pos = posInt;
00049         index[zip] = pos; // Load the ZIP code and its position into the index
00050     }
00051     inFile.close();
00052 }
00053
00055 // If the ZIP code is not in the index, it returns an invalid position (-1).
00058 std::streampos ZipCodeIndexer::getRecordPosition(const std::string& zipCode) {
00059     if (index.find(zipCode) != index.end()) { // If the ZIP code is in the index
00060         return index[zipCode]; // Return its position
00061     }
00062     else {
00063         return std::streampos(-1);  // Invalid position to indicate not found
00064     }
00065 }
```

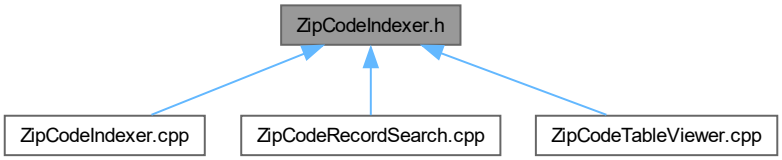
## 4.31 ZipCodeIndexer.h File Reference

```
#include <map>
#include <fstream>
#include "ZipCodeBuffer.h"
#include "HeaderBuffer.h"
```

Include dependency graph for ZipCodeIndexer.h:




This graph shows which files directly or indirectly include this file:




### Classes

- class ZipCodeIndexer

  *Implementation of the ZipCodeIndexer class for indexing ZIP code records in a file.*

## 4.32 ZipCodeIndexer.h

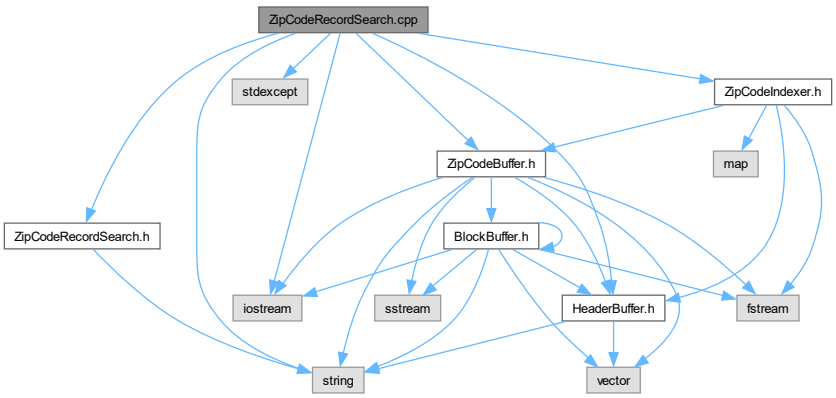
Go to the documentation of this file.

```
00001 // ---------------------------------------------------------------------------
00012  // ---------------------------------------------------------------------------
00027   // ---------------------------------------------------------------------------
00028
00029
00030 // Include guards to prevent double inclusion of this header file.
00031 #ifndef ZIPCODEINDEXER_H
00032 #define ZIPCODEINDEXER_H
00033
00034 // Include necessary header files
00035 #include <map>
00036 #include <fstream>
00037 #include "ZipCodeBuffer.h"
00038 #include "HeaderBuffer.h"
00039
00049 class ZipCodeIndexer {
00050 private:
00051     // Map to store each ZIP code and its position in the file.
00052     std::map<std::string, std::streampos> index;
00053
00054     // File name of the index to be saved/loaded.
00055     std::string indexFileName;
00056
00057     // Instance of ZipCodeBuffer to read ZIP code records from the file.
00058     ZipCodeBuffer buffer;
00059
00060 public:
00069     ZipCodeIndexer(std::ifstream &file, char fileType, const std::string& idxFileName, HeaderBuffer
      headerBuffer);
00070
00077     void createIndex();
00078
00084     void writeIndexToFile();
00085
00091     void loadIndexFromRAM();
00092
00099     std::streampos getRecordPosition(const std::string& zipCode);
00100 };
00101
00102 // End of the include guard.
00103 #endif // ZIPCODEINDEXER_H
```

## 4.33 ZipCodeRecordSearch.cpp File Reference

```
#include <iostream>
#include <string>
#include <stdexcept>
#include "ZipCodeBuffer.h"
#include "ZipCodeRecordSearch.h"
#include "ZipCodeIndexer.h"
#include "HeaderBuffer.h"
```

Include dependency graph for ZipCodeRecordSearch.cpp:




### Functions

- bool isNumber (const char *s)

  *See ZipCodeRecordSearch.h for details.*
- void displayHelp (const std::string &commandName)

  *Prints usage information to the console.*
- void defaultMessage (const std::string &commandName)

  *Prints basic message to the console.*
- void searchHelper (std::string fileName, char fileType, char *zip)

  *Helper function to search the buffer for a given ZIP code.*

## 4.33.1 Function Documentation

### 4.33.1.1 isNumber()

```
bool isNumber (
            const char * s )
```

See ZipCodeRecordSearch.h for details.

See ZipCodeRecordSearch.cpp for details.

Checks to see if a given string is a number.

**Parameters**

| | |
|---|---|
| *s* | |

**Returns**

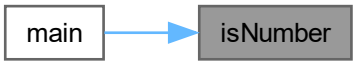
true

false

Definition at line 18 of file ZipCodeRecordSearch.cpp.

```
00018                                {
00019   try{
00020     int num = std::stoi(std::string(s));
00021     return true;
00022   } catch (std::invalid_argument& e) {
00023     return false;
00024   }
00025 }
```

Here is the caller graph for this function:




#### 4.33.1.2 displayHelp()

```
void displayHelp (
             const std::string & commandName )
```

Prints usage information to the console.

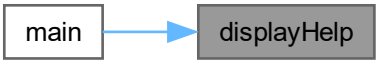
**Parameters**

| *commandName* | |
|---|---|

Definition at line 32 of file ZipCodeRecordSearch.cpp.

```
00032                                                {
00033   std::cout « std::endl
00034     « "Usage: " « commandName « " [options]" « std::endl
00035     « "-h, --help            Show help options" « std::endl
00036     « "-Z <zipcode>," « std::endl
00037     « "--zipcode <zipcode>   Search record file for <zipcode>" « std::endl « std::endl;
00038 }
```

Here is the caller graph for this function:




#### 4.33.1.3 defaultMessage()

```
void defaultMessage (
             const std::string & commandName )
```

Prints basic message to the console.

**Parameters**

| *commandName* | |
|---|---|

Definition at line 45 of file ZipCodeRecordSearch.cpp.

```
00045                                                {
00046   std::cout « std::endl
00047     « "Try \"" « commandName « " -h\" for more information." « std::endl « std::endl;
00048 }
```

Here is the caller graph for this function:


#### 4.33.1.4 searchHelper()

```
void searchHelper (
            std::string fileName,
            char fileType,
            char * zip )
```

Helper function to search the buffer for a given ZIP code.

**Parameters**

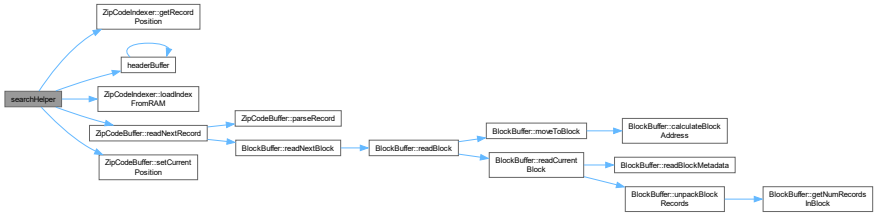
| | |
|---|---|
| *fileName* | Name of the file to open. |
| *fileType* | Type of the file to open to pass to the indexer for the buffer. |
| *zip* | ZIP codes to search for, if any. |

Definition at line 57 of file ZipCodeRecordSearch.cpp.

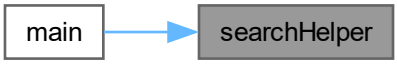
```
00057                                                                {
00058     // Create an index and load it from the index file
00059     std::ifstream file(fileName);
00060     HeaderBuffer headerBuffer(fileName);
00061     ZipCodeIndexer index(file, fileType, fileName + "_index.txt", headerBuffer);
00062     index.loadIndexFromRAM();
00063 
00064     // Get the position of the ZIP code in the file
00065     std::streampos position = index.getRecordPosition(zip);
00066 
00067     if (position != std::streampos(-1)) {
00068         // Open the buffer and set the position
00069         ZipCodeBuffer buffer(file, fileType, headerBuffer);
00070         buffer.setCurrentPosition(position);
00071 
00072         // Read the record at the specified position
00073         ZipCodeRecord record = buffer.readNextRecord();
00074 
00075         // Print the record info
00076         std::cout « "Zip Code: " « record.zipCode « std::endl
```

```
00077             « "Place Name: " « record.placeName « std::endl
00078             « "State: " « record.state « std::endl
00079             « "County: " « record.county « std::endl
00080             « "Latitude: " « record.latitude « " Longitude: " « record.longitude
00081             « std::endl « std::endl;
00082     }
00083     else {
00084         // If record not found, print a message
00085         std::cout « "No record of " « zip « std::endl « std::endl;
00086     }
00087 }
```

Here is the call graph for this function:




Here is the caller graph for this function:




## 4.34 ZipCodeRecordSearch.cpp

Go to the documentation of this file.

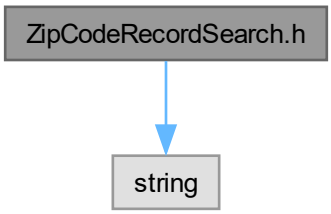
```
00001
00002
00003 #include <iostream>
00004 #include <string>
00005 #include <stdexcept>
00006 #include "ZipCodeBuffer.h"
00007 #include "ZipCodeRecordSearch.h"
00008 #include "ZipCodeIndexer.h"
00009 #include "HeaderBuffer.h"
00010
00018 bool isNumber(const char* s) {
00019   try{
00020     int num = std::stoi(std::string(s));
00021     return true;
00022   } catch (std::invalid_argument& e) {
00023     return false;
00024   }
00025 }
00026
00032 void displayHelp(const std::string& commandName) {
00033   std::cout « std::endl
00034     « "Usage: " « commandName « " [options]" « std::endl
00035     « "-h, --help            Show help options" « std::endl
00036     « "-Z <zipcode>," « std::endl
00037     « "--zipcode <zipcode>   Search record file for <zipcode>" « std::endl « std::endl;
00038 }
00039
```

```
00045 void defaultMessage(const std::string& commandName) {
00046   std::cout « std::endl
00047     « "Try \"" « commandName « " -h\" for more information." « std::endl « std::endl;
00048 }
00049
00057 void searchHelper(std::string fileName, char fileType, char* zip) {
00058     // Create an index and load it from the index file
00059     std::ifstream file(fileName);
00060     HeaderBuffer headerBuffer(fileName);
00061     ZipCodeIndexer index(file, fileType, fileName + "_index.txt", headerBuffer);
00062     index.loadIndexFromRAM();
00063
00064     // Get the position of the ZIP code in the file
00065     std::streampos position = index.getRecordPosition(zip);
00066
00067     if (position != std::streampos(-1)) {
00068         // Open the buffer and set the position
00069         ZipCodeBuffer buffer(file, fileType, headerBuffer);
00070         buffer.setCurrentPosition(position);
00071
00072         // Read the record at the specified position
00073         ZipCodeRecord record = buffer.readNextRecord();
00074
00075         // Print the record info
00076         std::cout « "Zip Code: " « record.zipCode « std::endl
00077             « "Place Name: " « record.placeName « std::endl
00078             « "State: " « record.state « std::endl
00079             « "County: " « record.county « std::endl
00080             « "Latitude: " « record.latitude « " Longitude: " « record.longitude
00081             « std::endl « std::endl;
00082     }
00083     else {
00084         // If record not found, print a message
00085         std::cout « "No record of " « zip « std::endl « std::endl;
00086     }
00087 }
```

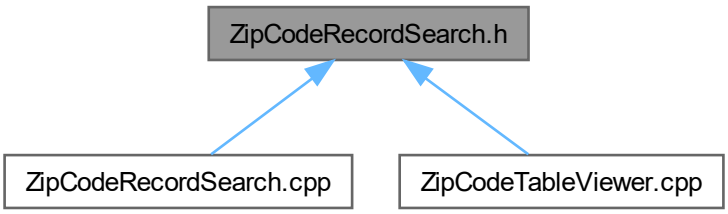
## 4.35 ZipCodeRecordSearch.h File Reference

`#include <string>`

Include dependency graph for ZipCodeRecordSearch.h:



This graph shows which files directly or indirectly include this file:




### Macros

- #define ZIPCODERECORDSEARCH_H

### Functions

- bool isNumber (const char *s)

  *See ZipCodeRecordSearch.cpp for details.*
- void displayHelp (const std::string &commandName)

  *Prints usage information to the console.*
- void defaultMessage (const std::string &commandName)

  *Prints basic message to the console.*
- void searchHelper (std::string fileName, char fileType, char *zip)

  *Helper function to search the buffer for a given ZIP code.*

## 4.35.1 Macro Definition Documentation

### 4.35.1.1 ZIPCODERECORDSEARCH_H

```
#define ZIPCODERECORDSEARCH_H
```

Definition at line 59 of file ZipCodeRecordSearch.h.

## 4.35.2 Function Documentation

### 4.35.2.1 isNumber()

```
bool isNumber (
            const char * s )
```

See ZipCodeRecordSearch.cpp for details.

See ZipCodeRecordSearch.cpp for details.

Checks to see if a given string is a number.

**Parameters**

| | |
|---|---|
| *s* | |

**Returns**

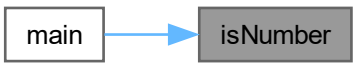
true

false

Definition at line 18 of file ZipCodeRecordSearch.cpp.

```
00018                                {
00019   try{
00020     int num = std::stoi(std::string(s));
00021     return true;
00022   } catch (std::invalid_argument& e) {
00023     return false;
00024   }
00025 }
```

Here is the caller graph for this function:




#### 4.35.2.2 displayHelp()

```
void displayHelp (
            const std::string & commandName )
```

Prints usage information to the console.

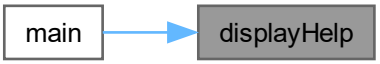
**Parameters**

| | |
|---|---|
| *commandName* | |

Definition at line 32 of file ZipCodeRecordSearch.cpp.

```
00032                                                {
00033   std::cout « std::endl
00034     « "Usage: " « commandName « " [options]" « std::endl
00035     « "-h, --help            Show help options" « std::endl
00036     « "-Z <zipcode>," « std::endl
00037     « "--zipcode <zipcode>   Search record file for <zipcode>" « std::endl « std::endl;
00038 }
```

Here is the caller graph for this function:




#### 4.35.2.3 defaultMessage()

```
void defaultMessage (
            const std::string & commandName )
```

Prints basic message to the console.

**Parameters**

| *commandName* | |
|---|---|

Definition at line 45 of file ZipCodeRecordSearch.cpp.

```
00045                                                   {
00046   std::cout « std::endl
00047     « "Try \"" « commandName « " -h\" for more information." « std::endl « std::endl;
00048 }
```

Here is the caller graph for this function:


#### 4.35.2.4 searchHelper()

```
void searchHelper (
            std::string fileName,
            char fileType,
            char * zip )
```

Helper function to search the buffer for a given ZIP code.

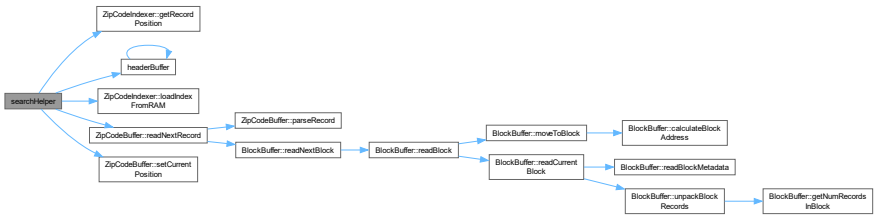
### Parameters

| | |
|---|---|
| *fileName* | Name of the file to open. |
| *fileType* | Type of the file to open to pass to the indexer for the buffer. |
| *zip* | ZIP codes to search for, if any. |

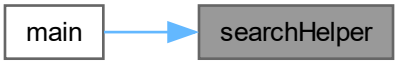
Definition at line 57 of file ZipCodeRecordSearch.cpp.

```
00057                                                                    {
00058     // Create an index and load it from the index file
00059     std::ifstream file(fileName);
00060     HeaderBuffer headerBuffer(fileName);
00061     ZipCodeIndexer index(file, fileType, fileName + "_index.txt", headerBuffer);
00062     index.loadIndexFromRAM();
00063 
00064     // Get the position of the ZIP code in the file
00065     std::streampos position = index.getRecordPosition(zip);
00066 
00067     if (position != std::streampos(-1)) {
00068         // Open the buffer and set the position
00069         ZipCodeBuffer buffer(file, fileType, headerBuffer);
00070         buffer.setCurrentPosition(position);
00071 
00072         // Read the record at the specified position
00073         ZipCodeRecord record = buffer.readNextRecord();
00074 
00075         // Print the record info
00076         std::cout « "Zip Code: " « record.zipCode « std::endl
00077             « "Place Name: " « record.placeName « std::endl
00078             « "State: " « record.state « std::endl
00079             « "County: " « record.county « std::endl
00080             « "Latitude: " « record.latitude « " Longitude: " « record.longitude
00081             « std::endl « std::endl;
00082     }
00083     else {
00084         // If record not found, print a message
00085         std::cout « "No record of " « zip « std::endl « std::endl;
00086     }
00087 }
```

Here is the call graph for this function:




Here is the caller graph for this function:



## 4.36 ZipCodeRecordSearch.h

Go to the documentation of this file.

```
00001 /*****************************************************************************
00002  * @file ZipCodeRecordSearch.h
00003  * @author Devon Lattery
00004  * @author Kent Biernath
00005  * @author Emma Hoffmann
00006  * @author Emily Yang, Rediet Gelaw, Bhukima Basnet
00007  * @brief Console program for searching a record file for one or more ZIP
00008  *      codes as given by the user input.
00009  * @version 1.0
00010  * @date 2023-10-16
00011  *
00012  *****************************************************************************
00013  * @details
00014  * \n Searches the records for given search terms in the console using flags.
00015  *    To perform a search, the -Z flag should be used followed by the ZIP code.
00016  *    e.g. -Z 12345 searches for the ZIP code 12345.
00017  * \n
00018  * \n If the record is in the file, it will be displayed in the console.
00019  *    e.g. -Z 12345 would return the following:
00020  *
00021  * \n Zip Code: 12345
00022  * \n Place Name: Example City
00023  * \n State: EG
00024  * \n County: Example
00025  * \n Latitude: 12.3456 Longitude: -12.3456
00026  * \n
00027  * \n If the record is not in the file, the console will display the message:
00028  *      No record of 12345
00029  * \n
00030  * \n The user may enter as many searches as they like, using the -Z flag for
00031  *    every search entry. This will result in multiple lines in the results
00032  *    table and any records not in the file will be stated after the table.
00033  *    e.g. -Z 12345 -Z 23456 -Z 34567 -Z 45678 would return the following:
00034  * \n
00035  * \n Zip Code: 12345
00036  * \n  Place Name: Example City
00037  * \n State: EG
00038  * \n County: Example
00039  * \n Latitude: 12.3456 Longitude: -12.3456
00040  * \n
00041  * \n Zip Code: 34567
00042  * \n Place Name: Sample City
00043  * \n State: ST
00044  * \n County: Sample
00045  * \n Latitude: 34.5678 Longitude: -34.5678
00046  * \n
00047  * \n No record of 23456
00048  * \n
00049  * \n No record of 45678
00050  * \n
00051  * \n Assumptions:
00052  * \n -- The record file is in the same directory as the program.
00053  * \n -- The first line of the file contains the label for each column.
00054  *****************************************************************************/
00055
00056 #pragma once
00057
00058 #ifndef ZIPCODERECORDSEARCH_H
00059 #define ZIPCODERECORDSEARCH_H
00060
00061 #include <string>
00062
00064 bool isNumber(const char* s);
00065 void displayHelp(const std::string& commandName);
00066 void defaultMessage(const std::string& commandName);
00067 void searchHelper(std::string fileName, char fileType, char* zip);
00068
00069 #endif
```

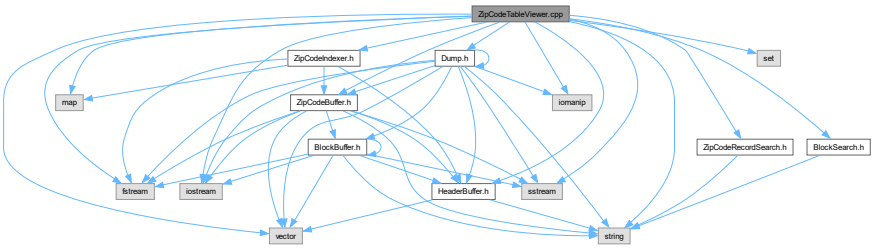
## 4.37 ZipCodeTableViewer.cpp File Reference

Console program for displaying a table of the most eastern, western, northern, and southern ZIP codes for each state code in a file.

```
#include <iostream>
#include <fstream>
```

```
#include <sstream>
#include <string>
#include <map>
#include <vector>
#include <set>
#include <iomanip>
#include "ZipCodeBuffer.h"
#include "ZipCodeRecordSearch.h"
#include "ZipCodeIndexer.h"
#include "HeaderBuffer.h"
#include "BlockSearch.h"
#include "Dump.h"
```

Include dependency graph for ZipCodeTableViewer.cpp:




### Functions

- int main (int argc, char *argv[])

## 4.37.1 Detailed Description

Console program for displaying a table of the most eastern, western, northern, and southern ZIP codes for each state code in a file.

**Author**

Kent Biernath

Andrew Clayton

Emma Hoffmann, Emily Yang, Devon Lattery

**Date**

2023-11-19

**Version**

3.0

Definition in file ZipCodeTableViewer.cpp.

## 4.37.2 Function Documentation

### 4.37.2.1 main()

```
int main (
            int argc,
            char * argv[] )
```

Displays a table of the most eastern, western, northern, and southern ZIP codes for each state code contained in a given file.

It uses the ZipCodeBuffer class to retrieve each record as a ZipCodeRecord struct.

As it processes each record, it stores the state codes in a sorted set and the most eastern/western/northern/southern ZIP codes and coordinates in maps.

Once it has processed every record in the file, it displays a table with five columns on the console sorted alphabetically by state code.

The table columns are (in order):
– State Code
– Easternmost ZIP Code
– Westernmost ZIP Code
– Northernmost ZIP Code
– Southernmost ZIP Code

Length-indicated files also have a "Record Length" field at the start of the record.

If the program is launched with command line arguments -Z or –Zip, it
will do a search. See ZipCodeRecordSearch.cpp and BlockSearch.cpp for details.

Assumptions:
– The file is in the same directory as the program.
– The file records always contain exactly six fields.
– The file has column headers on the first line.

Definition at line 66 of file ZipCodeTableViewer.cpp.

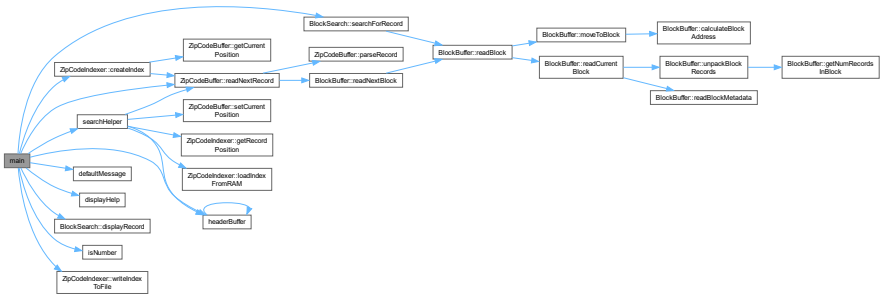
```
00066                                {
00067
00068     std::ifstream file;
00069     std::string fileName;
00070     char fileType = 'L'; // Default to length-indicated file type
00071
00072     // Loop until a valid file name is provided by the user
00073     while (true) {
00074         // Prompt the user for a file name until a valid one is given
00075
00076         std::cout « "Enter the file name to open: ";
00077         std::cin » fileName;
00078
00079         // Attempt to open the file
00080         file.open(fileName);
00081
00082         if (file.is_open()) {
00083             std::cout « "File successfully opened." « std::endl;
00084             break;  // Exit the loop when a valid file is provided
00085         }
00086         else {
00087             std::cerr « "Failed to open the file. Please enter a valid file name." « std::endl;
00088         }
00089     }
00090
00091
00092     HeaderBuffer headerBuffer(fileName);
00093
00094     if (fileName.find(".csv") != std::string::npos)
```

```
00095     {
00096         fileType = 'C';
00097     }
00098     else
00099     {
00100         // If not a CSV, then it is either a length-indicated or blocked file with a metadata record,
      so read metadata
00101         headerBuffer.readHeader();
00102         if (headerBuffer.getBlockSize() == 0)
00103         {
00104             // The file does not use blocks, so it is length-indicated
00105 
00106             fileType = 'L';
00107         }
00108         else
00109         {
00110             // The file uses blocks
00111             fileType = 'B';
00112         }
00113 
00114     }
00115 
00116 
00117     // Create a ZipCodeBuffer for accessing the records in the file
00118     ZipCodeBuffer recordBuffer(file, fileType, headerBuffer);
00119     ZipCodeRecord record;
00120 
00121 
00122     // Test code for the dumps
00123     /*
00124     ifstream dumpInputFile(fileName);
00125     ZipCodeBuffer dumpRecordBuffer(dumpInputFile, fileType, HeaderBuffer(fileName));
00126     Dump dump(dumpRecordBuffer);
00127     dump.dumpPhysicalOrder();
00128     dump.dumpBlockIndex("blocked_Index.txt");
00129     */
00130 
00131 
00132     // If the program is given no arguments, display the table
00133     if (argc == 1) {
00134 
00135         // Make a set and maps to store the state code and ZIP code coordinate extrema
00136         std::set<std::string> stateCodes;
00137         std::map<std::string, std::vector<double» stateCodeToCoordinatesMap;
00138         std::map<std::string, std::vector<std::string» stateCodeToZipCodesMap;
00139 
00140         // Iterate through records until the terminal string "" is returned from the buffer
00141         while (true)
00142         {
00143             ZipCodeRecord record = recordBuffer.readNextRecord();
00144             if (record.zipCode == "") {
00145                 // Exit the loop if the terminal string "" was returned from the buffer
00146                 break;
00147             }
00148 
00149             // Try to add the state initial to the set and save the boolean result of whether it
      succeeded
00150             std::pair<std::set<std::string>::iterator, bool> result = stateCodes.insert(record.state);
00151 
00152             if (result.second) {
00153                 // The initial was not already present in the set, so add it to the maps too
00154 
00155                 // Create a vector with the current longitude and latitude values in all four extrema
00156                 std::vector<double> coordinates;
00157                 coordinates.push_back(record.longitude); // [0] Easternmost
00158                 coordinates.push_back(record.longitude); // [1] Westernmost
00159                 coordinates.push_back(record.latitude);  // [2] Northernmost
00160                 coordinates.push_back(record.latitude);  // [3] Southernmost
00161                 stateCodeToCoordinatesMap[record.state] = coordinates;
00162 
00163                 // Create a vector with the current ZIP code in all four extrema
00164                 std::vector<std::string> zipCodes;
00165                 zipCodes.push_back(record.zipCode); // [0] Easternmost
00166                 zipCodes.push_back(record.zipCode); // [1] Westernmost
00167                 zipCodes.push_back(record.zipCode); // [2] Northernmost
00168                 zipCodes.push_back(record.zipCode); // [3] Southernmost
00169                 stateCodeToZipCodesMap[record.state] = zipCodes;
00170             }
00171             else {
00172                 if (record.longitude < stateCodeToCoordinatesMap[record.state][0]) {
00173                     // New Easternmost (least longitude)
00174                     stateCodeToCoordinatesMap[record.state][0] = record.longitude;
00175                     stateCodeToZipCodesMap[record.state][0] = record.zipCode;
00176                 }
00177                 else if (record.longitude > stateCodeToCoordinatesMap[record.state][1]) {
00178                     // New Westernmost
00179                     stateCodeToCoordinatesMap[record.state][1] = record.longitude;
```

```
00180                     stateCodeToZipCodesMap[record.state][1] = record.zipCode;
00181                 }
00182
00183                 if (record.latitude > stateCodeToCoordinatesMap[record.state][2]) {
00184                     // New Northernmost (greatest latitude)
00185                     stateCodeToCoordinatesMap[record.state][2] = record.latitude;
00186                     stateCodeToZipCodesMap[record.state][2] = record.zipCode;
00187                 }
00188                 else if (record.latitude < stateCodeToCoordinatesMap[record.state][3]) {
00189                     // New Southernmost
00190                     stateCodeToCoordinatesMap[record.state][3] = record.latitude;
00191                     stateCodeToZipCodesMap[record.state][3] = record.zipCode;
00192                 }
00193             }
00194         }
00195
00196         // Display the table column headers
00197         std::cout « std::left « std::setw(8) « "State"
00198                   « std::left « std::setw(8) « "East"
00199                   « std::left « std::setw(8) « "West"
00200                   « std::left « std::setw(8) « "North"
00201                   « std::left « std::setw(8) « "South" « std::endl;
00202         // Display the spacers below the table column headers
00203         for (size_t i = 0; i < 5; i++)
00204         {
00205             std::cout « std::left « std::setw(8) « "-----";
00206         }
00207         std::cout « std::endl;
00208
00209         // Display the records in the table sorted alphabetically by state name.
00210         // Displays State, Easternmost ZIP Code, Westernmost ZIP Code, Northernmost ZIP Code, and
    Southernmost ZIP Code per row
00211         for (const std::string& stateCode : stateCodes) {
00212
00213             std::cout « std::left « std::setw(8) « stateCode;
00214             for (const std::string& zipCode : stateCodeToZipCodesMap[stateCode]) {
00215                 std::cout « std::setw(8) « zipCode;
00216             }
00217             std::cout « std::endl;
00218         }
00219     }
00220     else
00221     {
00222         // If command line parameters were given, do a search.
00223
00224         if (fileType != 'B') {
00225             // Generate an index
00226             std::ifstream searchFile(fileName);
00227             ZipCodeIndexer index(searchFile, fileType, fileName + "_index.txt", headerBuffer);
00228             index.createIndex();
00229             index.writeIndexToFile();
00230
00231             const std::string COMMAND_NAME = std::string(argv[0]);
00232             // If no flags are used, display the default message
00233             if (argc == 1) {
00234                 defaultMessage(COMMAND_NAME);
00235                 return 0;
00236             } // If a help flag is used, display usage information
00237             else if (std::string(argv[1]) == "-h" || std::string(argv[1]) == "--help") {
00238                 displayHelp(COMMAND_NAME);
00239                 return 0;
00240             }
00241             else {
00242                 std::string flag = "";
00243                 for (int i = 1; i < argc; i++) {
00244                     if (flag == "") {
00245                         flag = std::string(argv[i]);
00246                     }
00247                     else if ((flag == "-Z" || flag == "-z" || flag == "--zipcode") &&
    isNumber(argv[i])) {
00248                         searchHelper(fileName, fileType, argv[i]);
00249                         flag = "";
00250                     }
00251                     else {
00252                         std::cerr « "INVALID ARGUMENT" « std::endl;
00253                         defaultMessage(COMMAND_NAME);
00254                         return 1;
00255                     }
00256                 }
00257             }
00258         }
00259         else // else fileType == B
00260         {
00261             // Run blocked file search
00262
00263             for (int i = 1; i < argc; ++i) {
00264                 string arg = argv[i];
```

```
00265
00266                 // Check if argument starts with -z or -Z
00267                 if (arg.size() > 2 && (arg[0] == '-' && (arg[1] == 'z' || arg[1] == 'Z'))) {
00268                     string zipcodeStr = arg.substr(2);  // Extract the zipcode part
00269                     int zipcode;
00270
00271                     try {
00272                         BlockSearch searcher;
00273                         zipcode = stoi(zipcodeStr);
00274                         string result = searcher.searchForRecord(zipcode);
00275
00276                         if (result != "-1") {
00277                             cout << "Information for zipcode " << zipcode << ":\n";
00278                             searcher.displayRecord(result);
00279                         } else {
00280                             cout << "Zipcode " << zipcode << " not found." << "\n\n";
00281                         }
00282                     } catch (const invalid_argument& ia) {
00283                         cerr << "Invalid zipcode format: " << zipcodeStr << endl;
00284                     }
00285                 } else {
00286                     // Invalid argument format
00287                     cout << "Invalid argument: " << arg << endl;
00288                     cout << "Please use the format: -z<zipcode> or -Z<zipcode>" << endl;
00289                 }
00290             }
00291         }
00292     }
00293
00294     file.close();
00295     return 0;
00296 }
```

Here is the call graph for this function:




## 4.38 ZipCodeTableViewer.cpp

Go to the documentation of this file.

```
00001 // ------------------------------------------------------------------------
00012 // ------------------------------------------------------------------------
00047 // ------------------------------------------------------------------------
00048
00049 #include <iostream>
00050 #include <fstream>
00051 #include <sstream>
00052 #include <string>
00053 #include <map>
00054 #include <vector>
00055 #include <set>
00056 #include <iomanip>
00057 #include "ZipCodeBuffer.h"
00058 #include "ZipCodeRecordSearch.h"
00059 #include "ZipCodeIndexer.h"
00060 #include "HeaderBuffer.h"
00061 #include "BlockSearch.h"
00062 #include "Dump.h"
00063
00064
00065
00066 int main(int argc, char* argv[]) {
00067
```

```
00068     std::ifstream file;
00069     std::string fileName;
00070     char fileType = 'L'; // Default to length-indicated file type
00071 
00072     // Loop until a valid file name is provided by the user
00073     while (true) {
00074         // Prompt the user for a file name until a valid one is given
00075 
00076         std::cout << "Enter the file name to open: ";
00077         std::cin >> fileName;
00078 
00079         // Attempt to open the file
00080         file.open(fileName);
00081 
00082         if (file.is_open()) {
00083             std::cout << "File successfully opened." << std::endl;
00084             break;  // Exit the loop when a valid file is provided
00085         }
00086         else {
00087             std::cerr << "Failed to open the file. Please enter a valid file name." << std::endl;
00088         }
00089     }
00090 
00091 
00092     HeaderBuffer headerBuffer(fileName);
00093 
00094     if (fileName.find(".csv") != std::string::npos)
00095     {
00096         fileType = 'C';
00097     }
00098     else
00099     {
00100         // If not a CSV, then it is either a length-indicated or blocked file with a metadata record,
      so read metadata
00101         headerBuffer.readHeader();
00102         if (headerBuffer.getBlockSize() == 0)
00103         {
00104             // The file does not use blocks, so it is length-indicated
00105 
00106             fileType = 'L';
00107         }
00108         else
00109         {
00110             // The file uses blocks
00111             fileType = 'B';
00112         }
00113 
00114     }
00115 
00116 
00117     // Create a ZipCodeBuffer for accessing the records in the file
00118     ZipCodeBuffer recordBuffer(file, fileType, headerBuffer);
00119     ZipCodeRecord record;
00120 
00121 
00122     // Test code for the dumps
00123     /*
00124     ifstream dumpInputFile(fileName);
00125     ZipCodeBuffer dumpRecordBuffer(dumpInputFile, fileType, HeaderBuffer(fileName));
00126     Dump dump(dumpRecordBuffer);
00127     dump.dumpPhysicalOrder();
00128     dump.dumpBlockIndex("blocked_Index.txt");
00129     */
00130 
00131 
00132     // If the program is given no arguments, display the table
00133     if (argc == 1) {
00134 
00135         // Make a set and maps to store the state code and ZIP code coordinate extrema
00136         std::set<std::string> stateCodes;
00137         std::map<std::string, std::vector<double>> stateCodeToCoordinatesMap;
00138         std::map<std::string, std::vector<std::string>> stateCodeToZipCodesMap;
00139 
00140         // Iterate through records until the terminal string "" is returned from the buffer
00141         while (true)
00142         {
00143             ZipCodeRecord record = recordBuffer.readNextRecord();
00144             if (record.zipCode == "") {
00145                 // Exit the loop if the terminal string "" was returned from the buffer
00146                 break;
00147             }
00148 
00149             // Try to add the state initial to the set and save the boolean result of whether it
      succeeded
00150             std::pair<std::set<std::string>::iterator, bool> result = stateCodes.insert(record.state);
00151 
00152             if (result.second) {
```

```
00153                 // The initial was not already present in the set, so add it to the maps too
00154
00155                 // Create a vector with the current longitude and latitude values in all four extrema
00156                 std::vector<double> coordinates;
00157                 coordinates.push_back(record.longitude); // [0] Easternmost
00158                 coordinates.push_back(record.longitude); // [1] Westernmost
00159                 coordinates.push_back(record.latitude);  // [2] Northernmost
00160                 coordinates.push_back(record.latitude);  // [3] Southernmost
00161                 stateCodeToCoordinatesMap[record.state] = coordinates;
00162
00163                 // Create a vector with the current ZIP code in all four extrema
00164                 std::vector<std::string> zipCodes;
00165                 zipCodes.push_back(record.zipCode); // [0] Easternmost
00166                 zipCodes.push_back(record.zipCode); // [1] Westernmost
00167                 zipCodes.push_back(record.zipCode); // [2] Northernmost
00168                 zipCodes.push_back(record.zipCode); // [3] Southernmost
00169                 stateCodeToZipCodesMap[record.state] = zipCodes;
00170             }
00171             else {
00172                 if (record.longitude < stateCodeToCoordinatesMap[record.state][0]) {
00173                     // New Easternmost (least longitude)
00174                     stateCodeToCoordinatesMap[record.state][0] = record.longitude;
00175                     stateCodeToZipCodesMap[record.state][0] = record.zipCode;
00176                 }
00177                 else if (record.longitude > stateCodeToCoordinatesMap[record.state][1]) {
00178                     // New Westernmost
00179                     stateCodeToCoordinatesMap[record.state][1] = record.longitude;
00180                     stateCodeToZipCodesMap[record.state][1] = record.zipCode;
00181                 }
00182
00183                 if (record.latitude > stateCodeToCoordinatesMap[record.state][2]) {
00184                     // New Northernmost (greatest latitude)
00185                     stateCodeToCoordinatesMap[record.state][2] = record.latitude;
00186                     stateCodeToZipCodesMap[record.state][2] = record.zipCode;
00187                 }
00188                 else if (record.latitude < stateCodeToCoordinatesMap[record.state][3]) {
00189                     // New Southernmost
00190                     stateCodeToCoordinatesMap[record.state][3] = record.latitude;
00191                     stateCodeToZipCodesMap[record.state][3] = record.zipCode;
00192                 }
00193             }
00194         }
00195
00196         // Display the table column headers
00197         std::cout « std::left « std::setw(8) « "State"
00198                   « std::left « std::setw(8) « "East"
00199                   « std::left « std::setw(8) « "West"
00200                   « std::left « std::setw(8) « "North"
00201                   « std::left « std::setw(8) « "South" « std::endl;
00202         // Display the spacers below the table column headers
00203         for (size_t i = 0; i < 5; i++)
00204         {
00205             std::cout « std::left « std::setw(8) « "-----";
00206         }
00207         std::cout « std::endl;
00208
00209         // Display the records in the table sorted alphabetically by state name.
00210         // Displays State, Easternmost ZIP Code, Westernmost ZIP Code, Northernmost ZIP Code, and
    Southernmost ZIP Code per row
00211         for (const std::string& stateCode : stateCodes) {
00212
00213             std::cout « std::left « std::setw(8) « stateCode;
00214             for (const std::string& zipCode : stateCodeToZipCodesMap[stateCode]) {
00215                 std::cout « std::setw(8) « zipCode;
00216             }
00217             std::cout « std::endl;
00218         }
00219     }
00220     else
00221     {
00222         // If command line parameters were given, do a search.
00223
00224         if (fileType != 'B') {
00225             // Generate an index
00226             std::ifstream searchFile(fileName);
00227             ZipCodeIndexer index(searchFile, fileType, fileName + "_index.txt", headerBuffer);
00228             index.createIndex();
00229             index.writeIndexToFile();
00230
00231             const std::string COMMAND_NAME = std::string(argv[0]);
00232             // If no flags are used, display the default message
00233             if (argc == 1) {
00234                 defaultMessage(COMMAND_NAME);
00235                 return 0;
00236             } // If a help flag is used, display usage information
00237             else if (std::string(argv[1]) == "-h" || std::string(argv[1]) == "--help") {
00238                 displayHelp(COMMAND_NAME);
```

```
00239                 return 0;
00240             }
00241             else {
00242                 std::string flag = "";
00243                 for (int i = 1; i < argc; i++) {
00244                     if (flag == "") {
00245                         flag = std::string(argv[i]);
00246                     }
00247                     else if ((flag == "-Z" || flag == "-z" || flag == "--zipcode") &&
      isNumber(argv[i])) {
00248                         searchHelper(fileName, fileType, argv[i]);
00249                         flag = "";
00250                     }
00251                     else {
00252                         std::cerr « "INVALID ARGUMENT" « std::endl;
00253                         defaultMessage(COMMAND_NAME);
00254                         return 1;
00255                     }
00256                 }
00257             }
00258         }
00259         else // else fileType == B
00260         {
00261             // Run blocked file search
00262 
00263             for (int i = 1; i < argc; ++i) {
00264                 string arg = argv[i];
00265 
00266                 // Check if argument starts with -z or -Z
00267                 if (arg.size() > 2 && (arg[0] == '-' && (arg[1] == 'z' || arg[1] == 'Z'))) {
00268                     string zipcodeStr = arg.substr(2);  // Extract the zipcode part
00269                     int zipcode;
00270 
00271                     try {
00272                         BlockSearch searcher;
00273                         zipcode = stoi(zipcodeStr);
00274                         string result = searcher.searchForRecord(zipcode);
00275 
00276                         if (result != "-1") {
00277                             cout « "Information for zipcode " « zipcode « ":\n";
00278                             searcher.displayRecord(result);
00279                         } else {
00280                             cout « "Zipcode " « zipcode « " not found." « "\n\n";
00281                         }
00282                     } catch (const invalid_argument& ia) {
00283                         cerr « "Invalid zipcode format: " « zipcodeStr « endl;
00284                     }
00285                 } else {
00286                     // Invalid argument format
00287                     cout « "Invalid argument: " « arg « endl;
00288                     cout « "Please use the format: -z<zipcode> or -Z<zipcode>" « endl;
00289                 }
00290             }
00291         }
00292     }
00293 
00294     file.close();
00295     return 0;
00296 }
```