

Northern Michigan University (Marquette Co, MI)

CS422-01-25W: Algorithms (Andrew A. Poe)
Practice Endterm Examination (Exam 2)

Name: _____
Monday 21 April 2025 9:00 A.M. EST

Time: 50 minutes

1. Write the code for the following method

```
public String BinaryFileSearch (RandomAccessFile f, int reclen, String s)
{ ... }
```

`f` is a random access file that is already open. You don't have to open or close it. `reclen` is the length of each individual record. The records are in sorted order. Use binary search to search the file for a record *beginning with* `s`. For example, if the record length is 50, and the search string is DOG, you are not looking for the string DOG, you are looking for a record beginning with DOG. If such a record exists, return the entire record. If more than one such record exists, just return the first one you find. If no such record exists, return null.

2 Consider the following sequence: $f(0)=0$, $f(1)=1$, $f(2)=1$, $f(3)=3$, $f(4)=5$, $f(5)=11$, $f(6)=21$, etc. Each number in the sequence can be built from the two previous using a simple formula.

Write the code for `BigInteger f (int n) { ... }` which uses recursion and a `HashMap` to efficiently compute the value of `f` for a given nonnegative integer. It doesn't take long for the answers to get huge, so you'll have to use `BigInteger`.

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3. Using the Radix Sort as described in class, sort the following array of five strings. Show all steps.

AAA , A , AAAAA , AAAA , AA

4. Given a trie of strings of capital letters, describe a recursive algorithm that given an input string, prints all strings in the trie that END with the input string. For example, if the input string is DOG, the strings DOG , HOUNDDOG , BULLDOG , MADD OG would all be printed if they are in the trie. Your algorithm should move down the tree, never up. As you move through recursion, you should remove the first letter of the input string as needed, but you should only examine the first letter at any given point. You don't have to provide code. A description in English is perfectly acceptable. Be sure to list all base cases and all recursive cases.