AP Computer Science

Searching Algorithms

We will look at two searching algorithms in this course. One is sequential search (linear search) and the other is binary search. Here are the algorithms for each:

SEQUENTIAL SEARCH

```
public int find(int[] A, int num) {
  for( int k=0; k<A.length; k++)
     if (A[k] == num)
         return(k);
  return(-1);
}
```

BINARY SEARCH

```
public int binarySearch(int[] A, int num){
       int low = 0;
       int high = A.length - 1;

       while(high >= low) {
             int mid = (low + high) / 2;
             if(A[mid] == num) {
                 return(mid);
             }
             if(A[mid] < num) {
                 low = mid + 1;
             }
             if(A[mid] > num) {
                 high = mid - 1;
             }
       }
      return(-1);
}
```

1. Are there any requirements for an array to be searched with sequential search?
2. Are there any requirements for an array to be searched with binary search?

3. You want to search a list of 1000 unsorted numbers with sequential search. On average, what will be the value of 'k' when your number is found?

4. You want to search a list of 1000 sorted numbers with binary search. On average, how many times will the 'while loop' loop?

5. If you double the size of a list, how will the time taken for sequential search change?
6. If you double the size of a list, how will the time taken for binary search change?

7. “Binary search is always faster than sequential search”. Comment.

8. A list contains the numbers 0,1,2, ... , 29,30,31 . Using the binary search code above you look for the number 24. List how the values of 'high' and 'low' changed throughout the search.

9. Qualitatively discuss the difference in 'work' between the role of finding 10 numbers in a list of a 1000 random values randomly placed in a list:

   Student A says we are only going to do 10 searchs so lets leave the list randomly ordered and just use sequential search 10 times.
   Student B says it is worth sorting the list with insert sort so that binary search can do 10 really efficient searches.

10. How many searches would make Student A and Student B's plan similar in the total amount of work for the computer (approximatey) ? Explain.