Exam Sets 30E
AP Computer Science A

Name ____ Period__________

1. The following code fragment does a sequential search to determine whether a given integer `value` is stored in an array `a[0] … a[n - 1]`. What should replace `/* boolean expression */` so that the algorithm works as intended?

```
int i = 0;
while( /* boolean expression */ )
{
     i++;
}
if(i == n)
     return -1;      //value not found
else
     return i;      //value found at location i
```

`i < n && value != a[i]`

2. Refer to the code below to answer the following

```
private int[] a;

/** Does binary search for key in array a[0] … a[a.length-1].
*  sorted in ascending order.
*  @param key the integer value to be found
*  Postcondition:
*  - index has been returned such that a[index] == key
*  - If key not in a, return -1.
*/
public int binSearch(int key){
     int low = 0;
     int high = a.length - 1
     while(low <= high){
          int mid = (low - high) / 2;
          if(a[mid] == key)
               return mid;
          else if(a[mid] < key)
               low = mid + 1;
          else
               high = mid - 1;
     }
     return -1;
}
```

A binary search will be performed on the following list,

a[0]	a[1]	a[2]	a[3]	a[4]	a[5]	a[6]	a[7]
4	7	9	11	20	24	30	41

(a) How many iterations will be required to determine that 27 is not in the list?

3

(b) If the key value searched is 27, what is the search interval (a[?] … a[?]) for each pass through the while loop?

```
a[0] … a[7]
a[4] … a[7]
a[6] … a[7]
```

(c) What will be stored in y after executing the following?

```
      int y = binSearch(4)
```

0

(d) If the test for the while loop is changed to

```
while(low < high)
```

the `binSearch` method does not work as intended. Which value(s) in the given list will not be found?

4

3. For each of the following sets, how many iterations will be required to find a key value using an iterative binary search algorithm, (Note: 10^3 ~2^{10})

(a) 1000 elements

2^{10} - 10 iterations

(b) 2000 elements

2^1 x 2^{10} = 2^{11} - 11 iterations

(c) 30,000 elements

30 x 1000 = 3 x 2 x 5 x 1000 ~ 2^2 x 2^1 x 2^2 x 2^{10} = 2^{15} - 15 iterations

(d) 600 elements

2^{10} - 10 iterations

(e) 1 million elements

2^{20} – 20 iterations

4. An array of integer values is to be searched for a prime number. Once a prime number is found the algorithm will return the value of the prime number. If no prime number is found -1 will be returned.

Consider the examples below,

Array 1:	Array 2:	Array 2:
4 | 6 | 8 | 7	4 | 6 | 3 | 7	4 | 6 | 9 | 2
Returns 7	Returns 3	Returns -1

Write the method findPrimes which accepts a one-dimensional array of integer values and returns the first prime number found or returns -1 if no prime numbers are found.

```
public static int findPrime(int[] a){
        for(int j = 0; j < a.length; j++){

        int num = a[j];
        boolean flag = true;

            for(int i = 2; i <= num/2; ++i)
            {
            // condition for nonprime number
                if(num % i == 0)
                {
                    flag = false;
                    break;
                }
            }

        if (flag)
            return num;

        }
       return -1;
    }
```