**Number of Questions — 17  
Percent of total test grade — 50**

**Directions:** Determine the answer to each of the following questions or incomplete statements, using the available space for any necessary scratch work. Then decide which is the best of the choices given and fill in the corresponding oval on the answer sheet. No credit will be given for anything written in the examination booklet (these pages). Do not spend too much time on any one problem.

Notes:

* Assume that classes listed in the Quick Reference found in Appendix have been imported where appropriate.
* Assume that declarations of variables and methods appear within the context of an enclosing class.
* Assume that method calls that are not prefixed with an object or class name and are not shown within a complete class definition appear within the context of an enclosing class.

1. What is a characteristic of *binary search* ?  
     
   (A) Numbers in the array are not in any particular order.

(B) The search key is manipulated to indicate exactly where to find the information in the array.

(C) Numbers in the array are sorted into order.

(D) A method examines each element of the array in sequence until it finds the element the user is looking for.

(E) It calls an indexOf method.

1. What is a characteristic of *sequential search* ?  
     
   (A) Numbers in the array are not in any particular order.

(B) The search key is manipulated to indicate exactly where to find the information in the array.

(C) Numbers in the array are sorted into order.

(D) A method examines each element of the array randomly until it finds the element the user is looking for.

(E) It calls an indexOf method.

1. Which of the following is true of *insertion sort*?  
     
   (A) For an array of n elements, the array is sorted after n – 1 passes.

(B) It is a very effective method for sorting large arrays.

(C) The worst-case and best-case scenarios take about the same amount of time to execute.

(D) Insertion sort is not affected by the initial ordering of the elements.

(E) A major disadvantage of this sorting method is that it requires a temporary array that is as large as the original array being sorted.

1. Which of the followings statements is NOT true about subclasses?  
     
   (A) A subclass can override inherited methods

(B) A subclass can directly access private fields of its superclass

(C) A subclass can add new public or private fields

(D) A subclass inherits the non-private fields and methods of its parent class

(E) A subclass is defined using the extends keyword

1. Assume that x and y are variables of type int. The expression  
     
    !(x > y) && !(x < y)  
     
   is equivalent to which of the following?  
     
   (A) true  
   (B) false  
   (C) x == y  
   (D) x != y  
   (E) (x <= y) || (x >= y)
2. The decision to choose a particular sorting algorithm should be made based on:

I Run time efficiency of the sort

II Size of the array

III Space/memory efficiency of the algorithm

(A) I only  
(B) III only  
(C) I and II only  
(D) I and III only  
(E) I, II and III

1. A characteristic of data for a binary search (but **not** a sequential search) is:
2. whether the list is sorted.
3. the length of the list.
4. the type of data sorted in the list.
5. the largest value in the list.
6. the smallest value in the list.

**Questions 8 – 11 draw from the *Elevens* lab you recently completed.**

1. For a single winning game, how many iterations are completed by the inner while loop

in the ElevensSimulation class?

1. 22
2. 23
3. 24
4. 26
5. Different winning games will require differing iteration counts.
6. Which of the following code segments correctly stores in int variables r1 and r2 random unequal integers, each of which can be between 0 and n-1, inclusive?
7. r1 = (int) (Math.random() \* n – 1);

r2 = (int) (Math.random() \* n);

1. r1 = (int) Math.random() \* (n-1));

r2 = (int) Math.random() \* (n-1));

if (r1 == r2){

r2 = (int) (Math.random() \* (n-1));

}

1. r1 = (int) (Math.random() \* n);

r2 = (int) (Math.random() \* n);

if (r1 == r2){

r2 = (int) (Math.random() \* n);

}

1. r1 = (int) Math.random() \* (n-1));

r2 = (int) (Math.random() \* n);

while (r1 ==r2){

r2 = (int) (Math.random() \* n);

}

1. r1 = (int) (Math.random() \* n);

r2 = (int) (Math.random() \* n);

while (r1 ==r2){

r2 = (int) (Math.random() \* n);

}

10. Consider the first line of the ElevensBoard class declaration below:

public class ElevensBoard extends Board

Which of the following methods must be implemented as a result of the way the ElevensBoard class has been declared?

I toSTring

II anotherPlayIsPossible

III isLegal

IV dealMyCards

1. I only
2. I, II, and IV only
3. II and III only
4. I and IV only
5. I, II, II, and IV

11. Consider the following declarations where … is a valid Board constructor parameter list.

I Board board = new Board(…);

II Board board = new ElevensBoard();

III ElevensBoad board = new ElevensBoard();

Which of these declarations is(are) legal?

(A) I only

(B) I and II only

(C) I and III only

(D) II and III only

(E) I, II, and III

12. The binary search algorithm normally finds a value in an array sorted in ascending order.

Suppose that by mistake the algorithm is used on an unsorted array with the following seven elements:

1 3 2 5 13 8 21

Which of the following target values will *not* be found?

(A) 1

(B) 3

(C) 5

(D) 13

(E) 21

13. An array has 4095 = 2 12 -1 elements, arrange in ascending order. Binary search is used to

find the position of a target value. This binary search is implemented iteratively, in such a

way that in each iteration the target is compared to one of the elements of the array. Suppose we know that the target is somewhere in the array. What number of iterations guarantees that the target value is found?

(A) 10

(B) 11

(C) 12

(D) 2047

(E) 4095

14. The following version of Selection Sort is supposed to sort an array in ascending order. For better performance it tries to tackle the array from both ends simultaneously:

public void sort (int[] a){  
     int left = 0, right = a.length - 1;  
     int k;

while (left < right){  
          for (k = left + 1; k < right; k++){  
              if (a[k] < a[left]){  
                  swap(a, k, left);  
              } else if (a[k] > a[right]){  
                  swap(a, k, right);  
 }  
          }  
          left++;  
          right--;  
     }  
}

swap(a, i, j) correctly swaps a[i] and a[j]. This code has a bug, though. Which one of the following changes would assure that the method sorts the array correctly?

I.      Remove else in  
         else if (a[k] > a[right]) ...  
  
II.     Replace  
          for (k = left + 1; k < right; k+)  
         with  
          for (k = left; k <= right; k+)  
  
III.     Add  
               if (a[left] > a[right])  
         swap(a, left, right);  
         at the beginning of the while loop (before the for loop).

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) II and III only

15. Consider the method:

public String mystery(String s)  
{  
     String s1 = s.substring(0,1);  
     String s2 = s.substring(1, s.length() - 1);  
     String s3 = s.substring(s.length() - 1);  
     if (s.length() <= 3)  
          return s3 + s2 + s1;  
     else  
          return s1 + mystery(s2) + s3;  
}

What is the output of

System.out.println(mystery("DELIVER"));

(A) DELIVER

(B) DEVILER

(C) REVILED

(D) RELIVED

(E) DLEIEVR

16. Consider the following code segment:

ArrayList<Integer> list = new ArrayList<Integer>();  
  
list.add(2);  
list.add(1);  
list.add(0);  
  
list.remove(2);  
  
System.out.println(list);

What is printed as a result of executing the code segment?

(A) [2, 1, 0]

(B) [2, 1]

(C) [1, 0]

(D) [2, 0]

(E) none of the above

17. Which of the following statements is true?

(A) A static variable cannot be initialized in a constructor

(B) A static variable must be declared final

(C) An instance variable can’t be declared final

(D) A static method cannot directly access instance variables.

(E) Only a static method can access a static variable

**END OF SECTION I.**