Version 1

**Instructions**

- **Write your name and version number on the top of the yellow paper.**
- **Answer all questions on the yellow paper.**
- **One question per page.**
- **Use only one side of the yellow paper.**

1. (16 Points) Multiple Choice:

A. (2 Points) Which of the following loop headers will arrange for the loop body to execute exactly 10 times?

```
a. for (int i = 1; i < 10; ++i)
b. for (int i = 0; i <= 10; ++i)
c. for (int i = –5; i < 5; ++i)
d. for (int i = 2; i < 20; ++i)
```

B. (2 Points) Which access modifier, used when defining a method, indicates that only one such method is available for all instances of the class?

```
a. final
b. private
c. protected
d. static
```

C. (2 Points) Which of the following is an example of a syntax error?

```
a. a program encounters an
   instruction to divide by zero
b. an array subscript in a program
   goes out of range
c. the beginning of a while loop is
   written as “whille” instead of
   “while”
d. an algorithm that calculates the
   monthly payment of a loan
   displays incorrect results
```

D. (2 Points) Data structures are part of an ADT's _____.

```
a. definition
b. implementation
c. specifications
d. usage
```

E. (2 Points) In the following list:
`John,Kate, Fred, Mark, Jon, Adam, Drew`
which element does not have a predecessor?

```
a. John
b. Mark
c. Drew
d. Adam
```

F. (2 Points) If the array: {6, 2, 7, 13, 5, 4} is added to a stack, in the order given, which number will be the first number to be removed from the stack?

```
a. 6
b. 2
c. 5
d. 4
```

G. (2 Points) The last node of a linear linked list _____.

```
a. has the value null
b. has a next reference whose value
   is null
c. has a next reference which
   references the first node of the
   list
d. cannot store any data
```

H. (2 Points) Which of the following statements deletes the node that curr references?

```
a. prev.setNext(curr);
b. curr.setNext(prev);
c. curr.setNext(curr.getNext());
d. prev.setNext(curr.getNext());
```

Version 1

2. (20 Points) Given the following generic MyArray class that contains syntax and logical errors:

```
public class MyArray<I> {

    private I[] array = new Object[100];
    private int currentLocation;

    public void addElement(I element) {
       array[currentLocation] = element;
    }

    public void replaceElement(I newElement, index) {
       if ((index <= currentLocation) ||
            ((index < 0) || (index < array.length))) {
          System.out.println("Error");
       }

       array[index] = newElement;
    }

    public void removeElement(int index) {
       if (((index <= currentLocation) && (index < array.length)) ||
            ((index < 0) || (index < array.length))) {
          System.println("Error");
       }

       for ( int i = index  ; i < currentLocation ; i++ ) {
          array[i-1] = array[i+1];
       }
       array[--currentLocation] = null;
    }

    public void clear() {
       for ( int i = 0 ; i < array.length ; i-- ) {
          array[i] = null;
       }
       currentLocation = 0;
    }

    public int numberOfElements() {
       return currentLocation;
    }
}
```

Re-write the MyArray class and fix the 10 syntax and logical errors.

Version 1

3. (40 Points) Given the following definitions for Node<I> and QueueInterface<I>

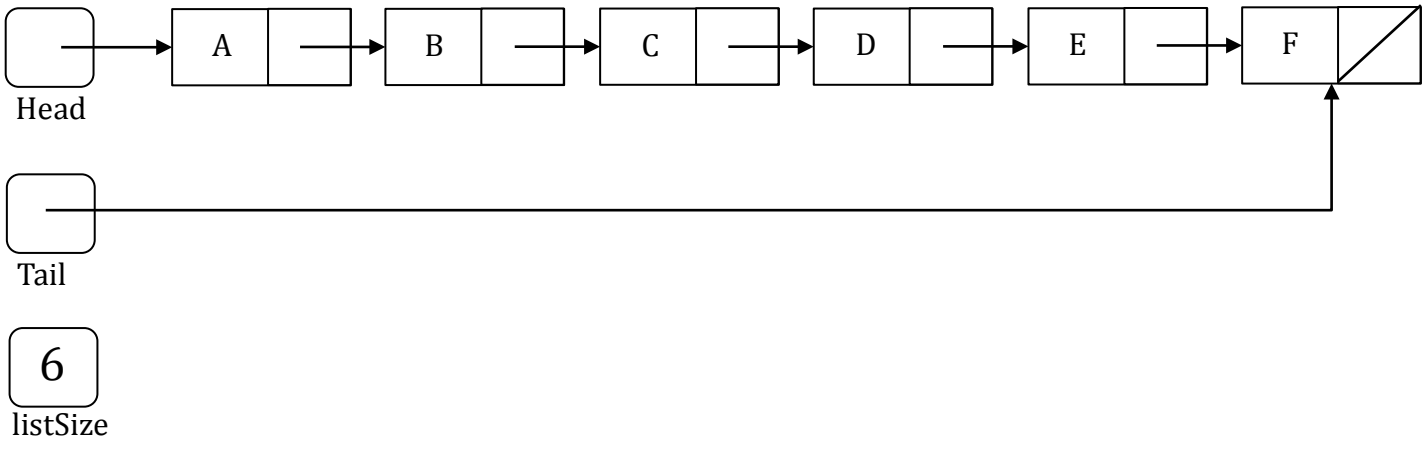
```java
public class Node<I> {

   private I element;
   private Node<I> next;

   public Node() {
         this.element = null;
         this.next = null;
   }

   public Node(I element) {
         this.element = element;
         this.next = null;
   }

   public I getElement() {
         return element;
   }

   public void setElement(I element) {
         this.element = element;
   }

   public Node<I> getNext() {
         return next;
   }

   public void setNext(Node<I> next) {
         this.next = next;
   }
```

```java
import java.util.Vector;

public interface QueueInterface<I> {
   // returns true if Queue is empty
   // returns false otherwise
   public boolean isEmpty();

   // returns the size of the Queue
   public int size();

   // adds the specified element
   // to the Queue
   public void enqueue(I element);

   // removes and returns the front
   // of the Queue
   public I dequeue();

   // tests if this Queue is equal to the
   // Queue specified by oQueue
   // Two Queues are equal if they have
   // the same size and all their elements
   // are equal
   public boolean equals(Object oQueue);

   // returns a Vector containing all the
   // elements in the Queue
   public Vector<I> peekAll();
}
```

Write the complete Java class for the linked-based LinkedQueue that implements the given QueueInterface.

Version 1

4. (30 Points) Given the following list:




And the following method:

```
public void doStuff1() {
   Node[] nodes = new Node[listSize];

   Node node = head;
   int i = 0;
   while (node != null) {
      nodes[i++] = node;
      node = node.getNext();
   }

   for ( i = (listSize - 1) ; i > 0 ; i-- ) {
      nodes[i].setNext(nodes[i-1]);
   }

   head = nodes[listSize - 1];
   tail = nodes[0];
   tail.setNext(null);
}
```

Draw the list after `doStuff1()` has finished executing.

Version 2

**Instructions**

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1. (16 Points) Multiple Choice:

A. (2 Points) The Java expression 9 / 5 + 9 % 5 equals _____.

a. 0
b. 1
c. 3
d. 5
e. 6

B. (2 Points) Consider the following code that appears in a test class.

```
A a = new A();
int c = a.b;
```

In order for this code to work, which statement must be true?

a. a must be declared public inside class A
b. b must be declared public inside class A
c. c must be declared public inside class A
d. Method b( ) must return int

C. (2 Points) The syntax errors of a program are removed during the _____ phase of the program's life cycle

a. verification
b. coding
c. testing
d. refining
e. maintenance

D. (2 Points) An ADT's _____ govern(s) what its operations are and what they do.

a. specifications
b. implementation
c. documentation
d. data structure

E. (2 Points) In the following list:
`John,Kate, Fred, Mark, Jon, Adam, Drew`
which element does not have a successor?

a. John
b. Mark
c. Drew
d. Adam

F. (2 Points) If the array: {6, 21, 35, 3, 6, 2, 13} is added to a stack, in the order given, which of the following is the top of the stack?

a. 2
b. 6
c. 3
d. 13
e. 35

G. (2 Points) Which of the following will be true when the reference variable curr references the last node in a linear linked list?

a. curr == null
b. head == null
c. curr.getNext() == null
d. head.getNext() == null

H. (2 Points) Which of the following statements deletes the first node of a linear linked list that has 10 nodes?

a. head.setNext(curr.getNext());
b. prev.setNext(curr.getNext());
c. head = head.getNext();
d. head = null;

Version 2

2. (20 Points) Given the following generic MyArray class that contains syntax and logical errors:

```
public class MyArray<I> {

    private I[] array = (I[]) new Object[];
    private int currentLocation;

    public void addElement(Object element) {
       array[currentLocation++] = element;
    }

    public void replaceElement(I newElement, int index) {
       if ((index >= currentLocation) ||
            ((index > 0) && (index > array.length))) {
          System.println("Error");
       }

       array[index] = newElement;
    }

    public void removeElement(int index) {
       if (((index >= currentLocation) && (index > array.length)) ||
            ((index < 0) || (index > array.length))) {
          System.out.println("Error");
       }

       for ( int i = index - 1 ; i < currentLocation ; i-- ) {
          array[i-1] = array[i];
       }
       array[--currentLocation] = null;
    }

    public void clear() {
       for ( int i = 0 ; i >= array.length ; i++ ) {
          array[i-1] = null;
       }
       currentLocation = 0;
    }

    public int numberOfElements() {
       return currentLocation;
    }
}
```

Re-write the MyArray class and fix the 10 syntax and logical errors.

Version 2

3. (40 Points) Given the following generic definitions for Node and StackInterface

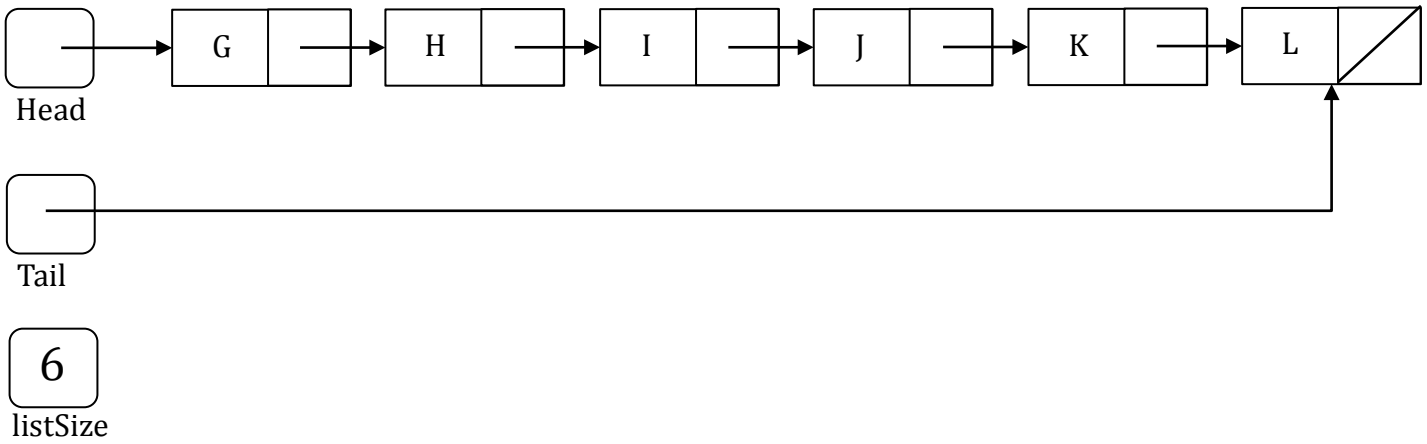
```java
public class Node<I> {

   private I element;
   private Node<I> next;

   public Node() {
         this.element = null;
         this.next = null;
   }

   public Node(I element) {
         this.element = element;
         this.next = null;
   }

   public I getElement() {
         return element;
   }

   public void setElement(I element) {
         this.element = element;
   }

   public Node<I> getNext() {
         return next;
   }

   public void setNext(Node<I> next) {
         this.next = next;
   }
}
```

```java
import java.util.Vector;

public interface StackInterface<I> {
      // returns true if Stack is empty
      // returns false otherwise
      public boolean isEmpty();

      // returns the size of the Stack
      public int size();

      // pushes the specified element
      // onto the stack
      public void push(I element);

      // pops and returns the element
      // at the top of the stack
      public I pop();

      // tests if Stack is equal to the
      // Stack specified by oStack
      // Two Stacks are equal if they have
      // the same size and all their elements
      // are equal
      public boolean equals(Object oStack);

      // returns a Vector containing all the
      // elements in the Stack
      public Vector<I> peekAll();
}
```

Write the complete Java class for the linked-based LinkedStack that implements the given StackInterface.

Version 2

4. (30 Points) Given the following list:




And the following method:

```
public void doStuff2() {
   Node[] nodes = new Node[listSize];

   Node node = head;
   int i = 0;
   while (node != null) {
      nodes[i++] = node;
      node = node.getNext();
   }

   for ( i = 1 ; i < (listSize - 3) ; i++ ) {
      nodes[i].setNext(nodes[i+2]);
   }

   for ( i = (listSize - 1) ; i > 3 ; i-- ) {
      nodes[i].setNext(nodes[i-4]);
   }

   nodes[0].setNext(nodes[listSize - 1]);

   head = nodes[2];
   tail = nodes[3];
   tail.setNext(null);
}
```

Draw the list after `doStuff2()` has finished executing.