**Due** Mar 27 at 11:59pm

Points 100

**Questions** 30

**Available** Mar 22 at 12:01am - Mar 27 at 11:59pm 6 days

Time Limit 240 Minutes

# **Instructions**

# Midterm Exam



## Instructions

You have four hours to complete the exam. You must complete the test in one sitting.

This test is open-note/open-book/open-web, but **must be completed individually**. Communicating (in person or online) with anyone other than me is considered cheating and will result in a failing grade and disciplinary procedures.

Note: I recommend completing the exam questions in your own IDE and then pasting the answers into Canvas when you are ready to submit. You can review the **Posting Code to Canvas** if needed.

# \* Canvas Resources

- How do I take a quiz? (https://community.canvaslms.com/docs/DOC-10645-421241977)
- How do I submit a quiz? (https://community.canvaslms.com/docs/DOC-10583-421250759)

This quiz was locked Mar 27 at 11:59pm.

# **Attempt History**

	Attempt	Time	Score
LATEST	Attempt 1	240 minutes	84.5 out of 100

Score for this quiz: **84.5** out of 100

Submitted Mar 24 at 12:05am This attempt took 240 minutes.

## Question 1 0 / 0 pts

I understand that I must complete this test **on my own**.

The following activities are considered plagiarism/cheating and will result in a grade of 0 for the exam and possible disciplinary action:

- Discussing the test with anyone else, including students and tutors (in person or online)
- Communicating with others in person or online
- Posting code from the exam to study/question/discussion sites
- Submitting code that you did not write
- Copying code from a website or from another person

Note: You are allowed to discuss the test with the instructor, although there is no guarantee that she will be online while you am taking the exam.

If you have questions about this, stop immediately and contact Prof. Masters.

#### Correct!

I understand and agree to all of the above.

# Question 2 0 / 0 pts

I understand that I must take the midterm exam in a single sitting- all at once.

If you have questions about this, stop immediately and contact Prof. Masters.

#### Correct!

I understand

# **Section 1: Coding Questions**

# **Provided Files**

I've provided files for the coding questions. Use the tester program to see examples of how the code should work and to test your code.

### Pay close attention to:

- whether you are writing from the implementation perspective or client perspective
- what data structure you are asked to use
- whether efficiency (big-o) is part of the score

## For all coding questions, for full credit:

- account for all possible times when the method could be invokedyour code should not crash or throw a runtime exception for things like empty and singleton datasets
- do not invoke the toArray() method
- do **not** use a data structure different from the one asked about in the question
- follow general best practice of coding (e.g., reduce duplicated code, follow naming conventions, etc.)
- ensure your answers are correct both for syntax (i.e., the code compiles) and semantics (i.e., the code accomplishes the task)

Write a complete method from the implementation perspective that is O(n). This method will go inside the LinkedBag class. The method header is:

```
public void duplicateTheBag()
```

The method duplicates the contents of the bag. For example, if the bag contained (1, 2, 3), then after invoking the method, the bag would contain (1, 2, 3, 1, 2, 3) (in any order). See the tester program for more examples.

#### Notes:

- You can call other methods in LinkedBag.
- Having a linear O(n) solution is worth 5 out of the 15 points.
  - Note: the driver program does not test for efficiency.

Question 3 14 / 15 pts

Paste your complete duplicateTheBag() method here.

#### Your Answer:

```
public void duplicateTheBag() {
   Node currentNode = firstNode;
   LinkedBag<T> tempBag = new LinkedBag<T>();

   // get the lastNode
   while (currentNode != null) {
       tempBag.add(currentNode.data);
       tempBag.add(currentNode.data);
       currentNode = currentNode.next;
   }

   this.firstNode = tempBag.firstNode;
}
```

-1 the code does not update numberOfEntries

Write a complete method from the client perspective that duplicates each element in place in a ListInterface object. For example, if the list contained (1, 2, 3), after invoking the method, the list would contains (1, 1, 2, 2, 3, 3). See the tester program for more examples.

#### Notes:

- For full credit, do not create another list (or any data structure) inside the method.
  - Only modify the parameter list.
  - Not creating another data structure is worth 10 out of the 20 points.
- This question will not be scored based on efficiency (big-O).

The method header is:

```
public static void addDuplicateNeighbors(ListInterface
<String> list)
```

Question 4 13 / 20 pts

Paste your complete addDuplicateNeighbors(...) method here.

#### Your Answer:

```
public static void addDuplicateNeighbors(ListInterface<String> list) {
   int size = list.getLength();

   for (int i = 1; i <= size; i++) {
        list.add(i, list.getEntry(i));
   }
}</pre>
```

-7 the code does not add the correct duplicates; iterate from 1 to size\*2 and then increment i=i+2

Write a complete method from the implementation perspective. This method will go **inside** the AList class. The method header is:

```
public void addToFront(ANode<T> first)
```

The method takes in a linked chain of values and adds them **in order** to the **front** of the AList. See the tester program for examples. Pay close attention to the order of the chain elements!

For full credit, write a method that is O(n).

#### Notes:

- The ANode class is provided. This class is exactly the same as a regular Node. I created a class with a different name so that it doesn't interfere with LinkedBag or LList.
- To create a local variable inside the method, declare it as type ANode<T>.
- Having a linear solution is worth 3 of the 20 points.
  - Note: the driver program does not test for efficiency.

Question 5 17 / 20 pts

Paste your complete addToFront(...) method here.

#### Your Answer:

```
public void addToFront(ANode<T> first) {
    ANode<T> currentNode = first;

int counter = 1;
    while (currentNode != null) {
        this.add(counter, currentNode.data);
        counter++;
        currentNode = currentNode.next;
    }
}
```

-3 repeatedly invoking add(int,T) makes this method  $O(n^2)$  instead of O(n); figure out the size of the chain that needs to be added and do a single shift of elements and then insert into the array

# Section 2: Lists and Bags (From the Client Perspective)

Question 6	2 / 2 pts
myBag is an object of type <b>BagInterface</b> <strir contains="" strings:<="" td="" the=""><td>g&gt;. myBag currently</td></strir>	g>. myBag currently
snoopy	
woodstock	
charlie	
lucy	
lucy What will be printed after the following is exec	uted?
•	
What will be printed after the following is exec	
What will be printed after the following is exec	
What will be printed after the following is executed System.out.println(myBag.remove())	

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	○ woodstock
	O null
Correct!	you cannot tell from the provided code

Question 7	2 / 2 pts

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	list is an object of type <b>ListInterface</b> <string> that contains the Strings in the order listed:</string>
	cat
	dog
	zebra
	mouse
	Which of the following statements will result in list containing:
	cat
	zebra
	mouse
	O none of these is correct
	O list.remove(0);
	O list.remove(4);
Correct!	list.remove(2);
	O list.remove(3);
	O list.remove(1);

Question 8

2 / 2 pts

myList is an object of type ListInterface<String>. myList currently contains the Strings in the order listed:

boat

	car
	bike
	plane
	What will be printed after the following is executed?
	<pre>System.out.println(myList.getEntry(1));</pre>
	O none of these is correct
	O null
	O bike
Correct!	boat
	O plane
	O you cannot tell from the provided code
	O car

# myList is an object of type ListInterface<String>. myList currently contains the Strings in the order listed: delaware california iowa montana What will the list contain after the following is executed?

Correct!	<pre>myList.add(2, "maine");</pre>
	none of these is correct
	delaware maine california iowa montana
	maine delaware california iowa montana
	O delaware california maine montana
	O delaware maine iowa montana
	O delaware california maine iowa montana

# 2 / 2 pts **Question 10** myJavaList is an object of type List<String>. Note: this is the Java interface from the standard library. myJavaList currently contains the Strings in the order listed: delaware california iowa montana What will the list contain after the following is executed? myJavaList.add(2, "maine"); delaware california iowa montana none of these is correct

	O delaware california iowa maine montana
	O delaware california iowa montana maine
	maine delaware california iowa montana
Correct!	delaware california maine iowa montana
	O delaware maine california iowa montana

# Section 3: Array-Based Bags and Lists

# Question 11 2 / 2 pts

The private data for an ArrayBag object called aBag is below:

number0	OfEntries				
6	6				
bag[0]	bag[1]	bag[2]	bag[3]	bag[4]	bag[5]
17	31	29	42	16	58

What will be the contents of the ArrayBag object's array (called bag) after executing aBag.remove(42);

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Correct!

	17 31 29 16 58 null
	none of these is correct
(	null 31 29 17 16 58
	O 17 31 29 null 16 58
	31 29 17 16 58 null
	17 31 29 58 16 null

# 2 / 2 pts **Question 12** The private data for an **AList** object called aList is below: numberOfEntries 5 list[0] list[1] list[2] list[3] list[4] list[5] list[6] 42 32 36 61 24 What will be the contents of the AList object's array (called list) after executing aList.add(2,92); none of these is correct 92 42 32 36 61 24 0 42 32 36 92 61 24

	O 42 32 92 36 61 24
Correct!	<ul><li>42 92 32 36 61 24</li></ul>
	Question 13 0 / 1 pts
	In the AList implementation, when the list is empty, the list array is null (meaning this.list==null).
ou Answered	True
orrect Answei	O False
	Question 14 1 / 1 pts
	In the AList implementation, when the list is empty, list.length is equal to 0.
	O True
Correct!	False

# Question 15 1 / 1 pts

In the AList implementation, when the list is empty, numberOfEntries is equal to 0.

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# Correct! True False

# Section 4: Nodes and Linked-Based Implemementations

	Question 16 1 / 1 pts	S
	In the LinkedBag implementation, when the bag is empty, firstNode is null (meaning firstNode==null).	
Correct!	True	
	O False	

,	Question 17 1 pts	
	In the LinkedBag implementation, when the bag is empty, firstNode.data is null (meaning firstNode.data==null).	
	O True	
Correct!	False	

#### **Question 18**

0 / 2 pts

firstNode is the first node of the chain below.

What will be output by passing firstNode to the following method? (Ignore spacing in the output.)

```
public void mystery(Node first) {
   Node current = first;
   while(current.next!=null) {
      System.out.print(current.data);
      current = current.next;
   }
}
```

#### orrect Answer

- 0 14 26 37
- 14 26 37 65
- 0 14 26
- none of these is correct

#### ou Answered

the code will crash (an exception or error will be thrown)

## **Question 19**

2 / 2 pts

Refer to the following lists and code for the question below:

```
list1: 20 -> 37 -> 45
```

list2: 13 -> 29

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```
public void mystery(Node nodeA, Node nodeB) {
   nodeB.next = nodeA.next;
   nodeA.next = nodeB;
}
```

What will **list1** contain after calling mystery(list1.firstNode, list2.firstNode);?

O 29 -> 20 -> 37 -> 45

#### Correct!

20 -> 13 -> 37 -> 45

O 29 -> 37 -> 45

O 29 -> 20 -> 13 -> 37 -> 45

0 20 -> 13 -> 29

0 20 -> 37 -> 45

0 20 -> 29 -> 13 -> 37 -> 45

0 20 -> 29 -> 37 -> 45

none of these is correct

0 13 -> 20 -> 29

Question 20 2 / 2 pts

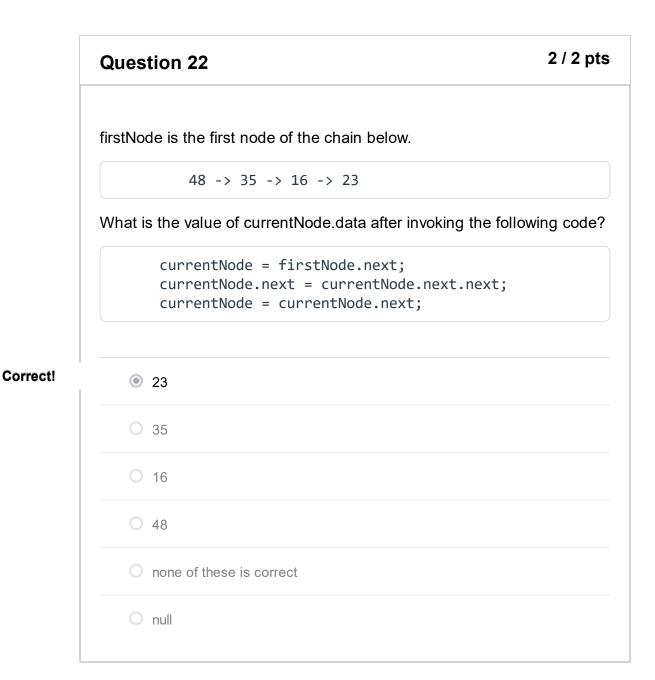
firstNode is the first node of the chain below.

14 -> 42 -> 19

What is the value of currentNode.data after invoking the following code?

	<pre>currentNode = firstNode; currentNode = currentNode.next;</pre>
	O null
	O 14
	O none of these is correct
Correct!	<ul><li>19</li><li>42</li></ul>
	<ul><li>42</li></ul>

	Question 21	2 / 2 pts
Correct!	After the above code, what is the contents of the chain headed by firstNode?	ру
	O 14 -> 19	
	O 42	
	<ul><li>14 -&gt; 42 -&gt; 19</li></ul>	
	O none of these is correct	
	O 14	
	O 42 -> 19	
	O 14 -> 42	
	O 19	

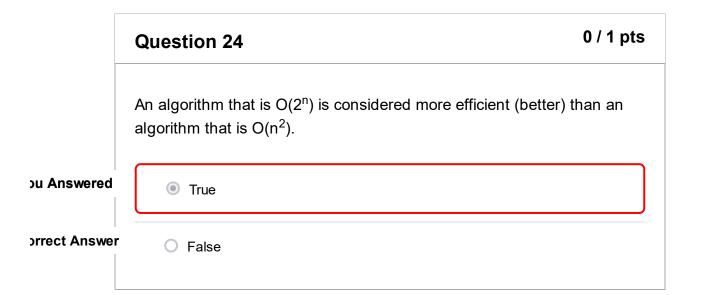


# After the above code, what is the contents of the chain headed by firstNode? 16 -> 23 48 -> 35 -> 16 -> 23



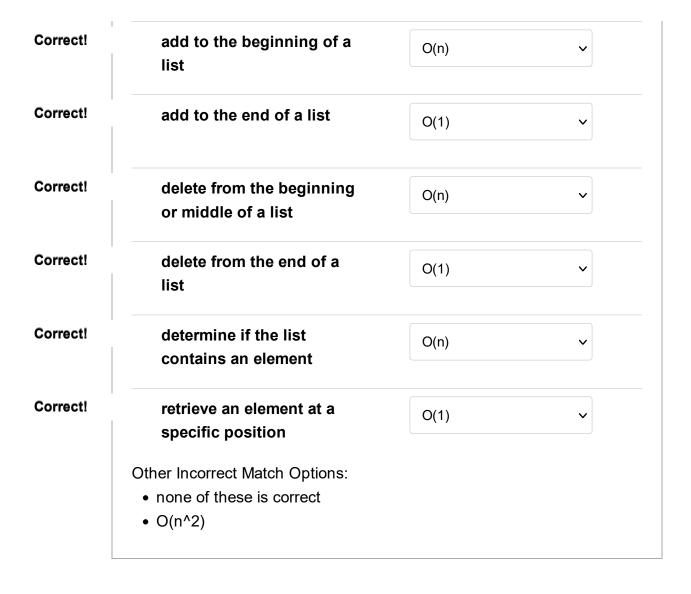
48 -> 35 -> 23
 35 -> 16 -> 23
 none of these is correct
 48 -> 35 -> 16
 35 -> 16
 48 -> 35

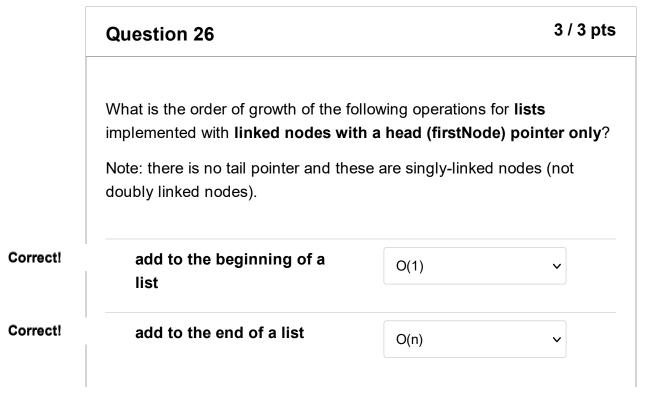
# **Section 5: Timing and Efficiency**



Question 25

What is the order of growth of the following operations for lists implemented with arrays?





Correct!	delete from the beginning of a list	O(1)	~
Correct!	delete from the end of a list	O(n)	~
Correct!	determine if the list contains an element	O(n)	•
Correct!	retrieve an element at a specific position	O(n)	~
	Other Incorrect Match Options:  • none of these is correct  • O(n^2)		

Question 27	0.5 / 1 pts

What is the order of growth of the following operations for **lists** implemented with linked nodes with a head (firstNode) and a tail (lastNode) pointer? Note: these are singly-linked nodes (not doubly linked nodes). Correct! add to the end of a list O(1) ou Answered delete from the end of a O(1) list **Correct Answer** O(n)Other Incorrect Match Options: • O(n^2) • none of these is correct

# Question 28 2 / 2 pts

Select the order of growth for the following algorithm. myArrayList is of type **ArrayList**<Integer>. Note: this is the Java class from the standard library.

```
int stop = myArrayList.size() / 2;
for(int i=0; i < stop; i++) {
    if(myArrayList.contains(i)) {
        System.out.println("Match found! " + i);
    }
}</pre>
```

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 $O(n^3)$ 

	O none of the above
	O(n log n)
	O(log n)
	O(n)
Correct!	$\odot$ O(n <sup>2</sup> )

# Question 29 2 / 2 pts

Select the order of growth for the following algorithm. myArrayList is of type **ArrayList**<Integer>. Note: this is the Java class from the standard library.

```
int stop = myArrayList.size();
for(int i=0; i < stop; i++) {
    System.out.println("Item: " + myArrayList.get(i));
}</pre>
```

- $\bigcirc$  O(n<sup>2</sup>)
- O(log n)
- onone of the above
- O(n log n)

#### Correct!

O(n)

 $\bigcirc$  O(n<sup>3</sup>)

# 2 / 2 pts **Question 30** Select the order of growth for the following algorithm. myLList is of type LList<Integer>. int stop = myLList.getLength(); for(int i=0; i < stop; i++) {</pre> System.out.println("Item: " + myLList.getEntry (i)); } none of these is correct $O(n^3)$ O(n) Correct! O(n<sup>2</sup>) O(log n) O(n log n)

Quiz Score: **84.5** out of 100