Linked Nodes

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Agenda

• References Review
• Linked Nodes
• Practice w/ ListNode
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Point $p = \text{new Point}(1, 2);$ 
Point $q = p;$

How does the picture change when the second line is executed?
References

• Recall that variables store references
• Don’t store the actual object
• Can think of references as “phone numbers”
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Contiguous vs. Non Contiguous Memory

• **Contiguous**
  • Sequential, implicitly connected together

| 8 | 12 | -3 | 51 |
Contiguous vs. Non Contiguous Memory

• **Contiguous**
  • Sequential, implicitly connected together

```
8  12  -3  51
```

• **Non-contiguous**
  • Disconnected, spread out

```
8   51  -3  12
```
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Linked Nodes Problem 1

• Suppose we had the following ListNodes:

<table>
<thead>
<tr>
<th>data</th>
<th>next</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

• What happens when we execute: `list1.next = list2.next`?
Linked Nodes Problem 2

• What statements turn this picture:

• Into this picture?
Linked Nodes Problem 2

- What statements turn this picture:

```
Answer:
list1.next.next = list2;
list2 = list2.next;
list1.next.next.next = null;
```

- Into this picture?
General Linked Nodes Steps

1. Determine what references need to change
2. Find which references are “safe changes”
   • Set to null
   • Redundant reference
3. Make safe changes
4. Repeat steps 2-3 until all references are updated
Linked Nodes Problem 3

• What statements turn this picture:

  list1
  data: 10  next
  list2
  data: 30  next

• Into this picture:

  list1
  data: 10  next
  list2
  data: 20  next
Linked Nodes Problem 3

• What statements turn this picture:

```
list1 ——— data 10 ——— next
      |                    |
list2 ——— data 30 ——— next
```

• Into this picture?

```
list1 ——— data 10 ——— next
      |                    |
list2 ——— data 20 ——— next
```

(1 Possible) Answer:

```java
ListNode temp = list1.next;
list1.next = list1.next.next;
temp.next = list2;
list2 = temp;
```
General Linked Nodes Steps

1. Determine what references need to change
2. Find which references are “safe changes”
   - Set to null
   - Redundant reference
3. Make safe changes
   - If none exist, introduce temp variable
4. Repeat steps 2-3 until all references are updated