Solution Review: Pairs with Sums

This lesson contains the solution review for the challenge of finding pairs in a doubly linked list which sum up to the given number.

We'll cover the following

Here is an overview of our solution to finding a pair of nodes in a doubly linked list that sums up to a specific number.

Implementation

Here is the coding solution in Python for the previous challenge:

```
1  def pairs_with_sum(self, sum_val):
2    pairs = list()
3    p = self.head
4    q = None
5    while p:
6      q = p.next
7      while q:
8        if p.data + q.data == sum_val:
9          pairs.append("(" + str(p.data) + "," + str(q.data) + ")")
10       q = q.next
11     p = p.next
12   return pairs
```

Explanation

On **line 2**, `pairs` is initialized to an empty Python list. In the next lines (**lines 3-4**), `p` and `q` are set equal to `self.head` and `None` respectively. We will use both these pointers (`p` and `q`) to make pairs out of the doubly linked list by using two `while` loops afterward.

The outer `while` loop on **line 5** will run until `p` becomes equal to `None` while the inner loop on **line 7** will run for every iteration of the outer loop until `q` becomes `None`.

On **line 6**, we set `q` equal to `p.next` as we have to start pairing nodes from the next node of the current node as we would already have checked the pairing with all previous nodes. Then we'll check if the sum of `p.data` and `q.data` equals `sum_value` or not on **line 8**. If it is, then we append `p.data` and `q.data` to the list we declared at the beginning of the `pairs_with_sum` method. If it does not, we move on to the next node of `q` by updating `q` to `q.next` on **line 10**. In each iteration of the inner loop, we pair the data of `p` with all the data of the nodes after `p` using `q` and then check each of these pairs to see if they sum up to `sum_value`. This process is repeated for every node in the linked list as `p` updates to `p.next` on **line 11** in the outer `while` loop. After the outer loop terminates, `pairs` is returned from the method on **line 12**.

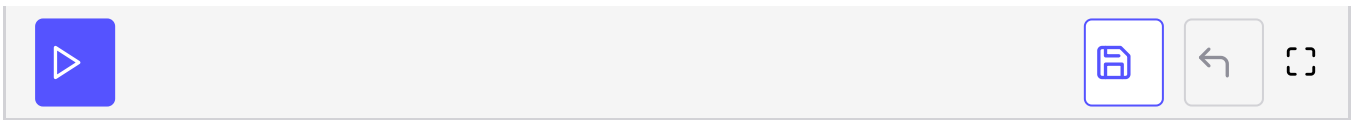
You can play around with all the methods that we have implemented for the `DoublyLinkedList` class in the code widget provided below.

```
class Node:
  def __init__(self, data):
    self.data = data
    self.next = None
    self.prev = None


class DoublyLinkedList:
  def __init__(self):
    self.head = None

  def append(self, data):
    if self.head is None:
      new_node = Node(data)
      new_node.prev = None
      self.head = new_node
    else:
      new_node = Node(data)
      cur = self.head
      while cur.next:
          cur = cur.next
      cur.next = new_node
      new_node.prev = cur
      new_node.next = None

  def prepend(self, data):
    if self.head is None:
      new_node = Node(data)
```

```
    new_node.prev = None
    self.head = new_node
  else:
    new_node = Node(data)
    self.head.prev = new_node
    new_node.next = self.head
    self.head = new_node
    new_node.prev = None

def print_list(self):
  cur = self.head
  while cur:
    print(cur.data)
    cur = cur.next

def add_after_node(self, key, data):
  cur = self.head
  while cur:
    if cur.next is None and cur.data == key:
      self.append(data)
      return
    elif cur.data == key:
      new_node = Node(data)
      nxt = cur.next
      cur.next = new_node
      new_node.next = nxt
      new_node.prev = cur
      nxt.prev = new_node
      return
    cur = cur.next

def add_before_node(self, key, data):
  cur = self.head
  while cur:
    if cur.prev is None and cur.data == key:
      self.prepend(data)
      return
    elif cur.data == key:
      new_node = Node(data)
      prev = cur.prev
      prev.next = new_node
      cur.prev = new_node
      new_node.next = cur
      new_node.prev = prev
      return
    cur = cur.next

def delete(self, key):
  cur = self.head
  while cur:
    if cur.data == key and cur == self.head:
      # Case 1:
      if not cur.next:
        cur = None
        self.head = None
        return

      # Case 2:
      else:
        nxt = cur.next
        cur.next = None
        nxt.prev = None
```

```
            cur = None
            self.head = nxt
            return

        elif cur.data == key:
            # Case 3:
          if cur.next:
              nxt = cur.next
              prev = cur.prev
              prev.next = nxt
              nxt.prev = prev
              cur.next = None
              cur.prev = None
              cur = None
              return

            # Case 4:
          else:
              prev = cur.prev
              prev.next = None
              cur.prev = None
              cur = None
              return
        cur = cur.next

    def delete_node(self, node):
      cur = self.head
      while cur:
        if cur == node and cur == self.head:
          # Case 1:
          if not cur.next:
            cur = None
            self.head = None
            return

          # Case 2:
          else:
            nxt = cur.next
            cur.next = None
            nxt.prev = None
            cur = None
            self.head = nxt
            return

        elif cur == node:
          # Case 3:
          if cur.next:
            nxt = cur.next
            prev = cur.prev
            prev.next = nxt
            nxt.prev = prev
            cur.next = None
            cur.prev = None
            cur = None
            return

          # Case 4:
          else:
            prev = cur.prev
            prev.next = None
            cur.prev = None
            cur = None
```

```
            return
        cur = cur.next

    def reverse(self):
        tmp = None
        cur = self.head
        while cur:
            tmp = cur.prev
            cur.prev = cur.next
            cur.next = tmp
            cur = cur.prev
        if tmp:
            self.head = tmp.prev

    def remove_duplicates(self):
        cur = self.head
        seen = dict()
        while cur:
            if cur.data not in seen:
                seen[cur.data] = 1
                cur = cur.next
            else:
                nxt = cur.next
                self.delete_node(cur)
                cur = nxt

    def pairs_with_sum(self, sum_val):
      pairs = list()
      p = self.head
      q = None
      while p:
        q = p.next
        while q:
          if p.data + q.data == sum_val:
              pairs.append("(" + str(p.data) + "," + str(q.data) + ")")
          q = q.next
        p = p.next
      return pairs


dllist = DoublyLinkedList()
dllist.append(1)
dllist.append(2)
dllist.append(3)
dllist.append(4)
dllist.append(5)

print(dllist.pairs_with_sum(5))
```



Now this lesson marks an end to the content on linked lists. Get ready to solve problems using another data structure in the next chapter!