

Puzzle 1: Detecting a Cycle

Clues: You have a singly linked list where the nodes are connected as follows:

```
mathematica
Copy code
A → B → C → D → E
          ↑     ↓
          └─────┘
```

Question:

Is there a cycle in this linked list? If so, at which node does the cycle begin?

Answer Key:

Yes, there is a cycle. The cycle begins at node **C**.

Puzzle 2: Reversing the Linked List

Clues: Given the following singly linked list:

```
arduino
Copy code
1 → 2 → 3 → 4 → 5 → NULL
```

Question:

Reverse the linked list and provide the new order of nodes.

Answer Key:

After reversal, the linked list becomes:

```
arduino
Copy code
5 → 4 → 3 → 2 → 1 → NULL
```

Puzzle 3: Merging Two Sorted Lists

Clues: You have two sorted linked lists:

- **List 1:** 1 → 3 → 5 → NULL
- **List 2:** 2 → 4 → 6 → NULL

Question:

Merge these two lists into a single sorted linked list.

Answer Key:

The merged sorted linked list is:

```
arduino  
Copy code  
1 → 2 → 3 → 4 → 5 → 6 → NULL
```

Puzzle 4: Finding the Middle Element

Clues: Given the linked list:

```
mathematica  
Copy code  
A → B → C → D → E → NULL
```

Question:

Identify the middle element of the linked list.

Answer Key:

The middle element is **C**.

Puzzle 5: Removing Duplicates

Clues: Given a linked list with duplicate elements:

```
arduino  
Copy code  
1 → 2 → 2 → 3 → 3 → 4 → 4 → 4 → NULL
```

Question:

Remove all duplicate nodes. What does the linked list look like after removal?

Answer Key:

After removing duplicates, the linked list is:

```
arduino  
Copy code  
1 → 2 → 3 → 4 → NULL
```

Puzzle 6: Intersection of Two Linked Lists

Clues: Two singly linked lists intersect at a node. The lists are:

- **List 1:** X → Y → Z → A → B → C → NULL

- **List 2:** $M \rightarrow N \rightarrow A \rightarrow B \rightarrow C \rightarrow \text{NULL}$

Question:

Identify the intersection node of the two linked lists.

Answer Key:

The intersection starts at node **A**.

Puzzle 7: Nth Node from the End

Clues: Given the linked list:

```
arduino
Copy code
10 → 20 → 30 → 40 → 50 → NULL
```

Question:

Find the 2nd node from the end of the linked list.

Answer Key:

The 2nd node from the end is **40**.

Puzzle 8: Palindrome Linked List

Clues: Determine if the following linked list is a palindrome:

```
css
Copy code
R → A → D → A → R → NULL
```

Question:

Is the linked list a palindrome?

Answer Key:

Yes, the linked list is a palindrome.

Puzzle 9: Copying a Linked List with Random Pointers

Clues: Suppose you have a linked list where each node has an additional random pointer that can point to any node in the list or `NULL`. For example:

```
arduino
Copy code
1 → 2 → 3 → NULL
|   |   |
v   v   v
3   1   2
```

Question:

Describe an algorithm to create a deep copy of this list without using extra space for a hash table.

Answer Key:

One efficient approach is:

- Interleave Copied Nodes:** Insert copied nodes between original nodes.
 - Original: $1 \rightarrow 2 \rightarrow 3 \rightarrow \text{NULL}$
 - After interleaving: $1 \rightarrow 1' \rightarrow 2 \rightarrow 2' \rightarrow 3 \rightarrow 3' \rightarrow \text{NULL}$
- Set Random Pointers:** Assign random pointers for the copied nodes.
 - $1'.\text{random} = 3$
 - $2'.\text{random} = 1$
 - $3'.\text{random} = 2$
- Separate the Lists:** Detach the copied nodes to form the new deep-copied list.
 - Copied List: $1' \rightarrow 2' \rightarrow 3' \rightarrow \text{NULL}$

Puzzle 10: Reordering a Linked List

Clues: Given the linked list:

```
arduino
Copy code
1 → 2 → 3 → 4 → 5 → NULL
```

Question:

Reorder the list to achieve the following sequence:

```
arduino
Copy code
1 → 5 → 2 → 4 → 3 → NULL
```

Answer Key:

Steps to reorder:

- Find the Middle:** The middle node is **3**.
- Reverse the Second Half:** Reverse the second half starting from **4**.
 - Reversed second half: $5 \rightarrow 4 \rightarrow 3 \rightarrow \text{NULL}$
- Merge Alternately:** Merge nodes from the first and reversed second half.
 - Final reordered list: $1 \rightarrow 5 \rightarrow 2 \rightarrow 4 \rightarrow 3 \rightarrow \text{NULL}$

Puzzle 11: Length of a Linked List

Clues: You have a linked list with the nodes:

```
mathematica
Copy code
M → N → O → P → NULL
```

Question:

What is the length of the linked list?

Answer Key:

The length of the linked list is **4**.

Puzzle 12: Loop Removal

Clues: Given a linked list that contains a loop:

```
markdown
Copy code
1 → 2 → 3 → 4 → 5
                ↑
                └──┬──┘
```

Question:

Describe an algorithm to remove the loop from the linked list.

Answer Key:

One approach is:

1. **Detect the Loop:** Use Floyd's Cycle-Finding Algorithm to detect the loop.
2. **Find Loop Start:** Once a cycle is detected, reset one pointer to the head and move both pointers at the same pace to find the loop's starting node.
3. **Remove Loop:** Traverse to the node just before the starting node of the loop and set its next to NULL.

After removal, the linked list becomes:

```
arduino
Copy code
1 → 2 → 3 → 4 → 5 → NULL
```

Puzzle 13: Alternating Split

Clues: Given the linked list:

```
mathematica
Copy code
A → B → C → D → E → F → NULL
```

Question:

Split the linked list into two lists, where the first list contains nodes at odd positions and the second list contains nodes at even positions.

Answer Key:

After splitting:

- **First List (Odd positions):** A → C → E → NULL
 - **Second List (Even positions):** B → D → F → NULL
-

Puzzle 14: Swap Nodes in Pairs

Clues: Given the linked list:

```
arduino
Copy code
1 → 2 → 3 → 4 → NULL
```

Question:

Swap every two adjacent nodes and return its head. What does the linked list look like after swapping?

Answer Key:

After swapping every two adjacent nodes:

```
arduino
Copy code
2 → 1 → 4 → 3 → NULL
```

Puzzle 15: Flattening a Multilevel Linked List

Clues: You have a multilevel linked list where nodes may have a `child` pointer to another linked list:

```
arduino
Copy code
1 → 2 → 3 → NULL
  |
  4 → 5 → NULL
```

Question:

Flatten the linked list so that all nodes appear in a single-level linked list. What does the flattened list look like?

Answer Key:

After flattening:

```
arduino  
Copy code  
1 → 2 → 4 → 5 → 3 → NULL
```

These puzzles cover a wide range of linked list concepts and operations. Solving them will help reinforce your understanding of linked lists and improve your problem-solving skills in data structures. If you need further explanations or additional puzzles, feel free to ask!

ChatGPT

Response 2

Here are some puzzles related to linked lists: