Day 17 (Wed 3/2)

- day 17 recap questions
- exercise 17

Announcements/reminders

- HW4 due Friday 3/4 at 11pm
  - written assignment, no late submissions

- Find a midterm project team and register ASAP!
  - See Piazza post 276
  - Contact me ASAP if you need help finding a team

- Midterm exam in class Friday 3/11
  - review materials are posted
  - exam format:
    - 60 minutes
    - computer based
    - access to editor/compiler/web resources

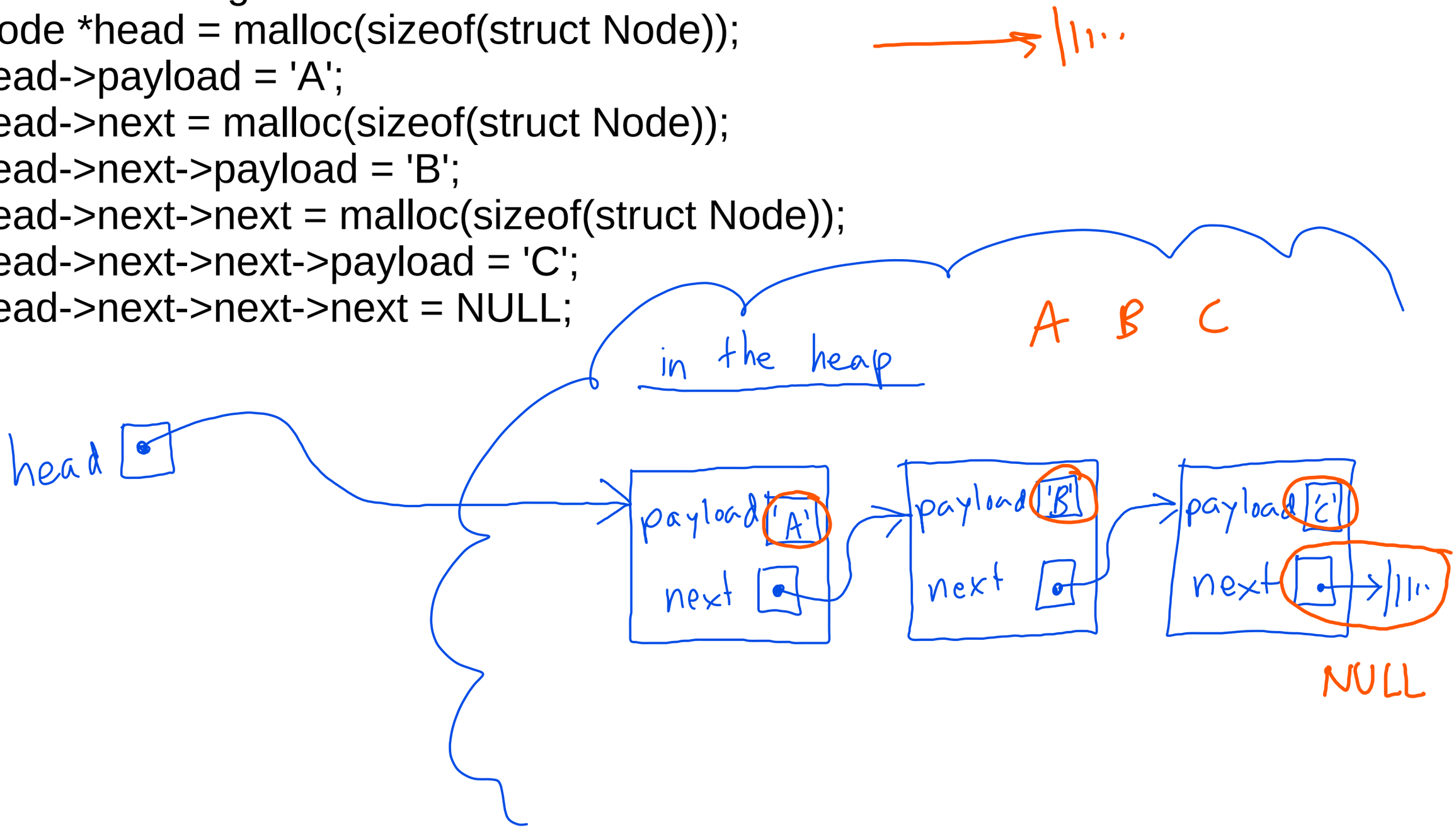
Day 17 recap questions

1. Describe the linked list structure by a diagram.
2. Compare arrays and linked lists. Write down their pros and cons.
3. What is a linked list’s head? How is it different from a node? Explain.
4. How do you calculate length of a linked list?
5. How do you implement add_after on a singly linked list?

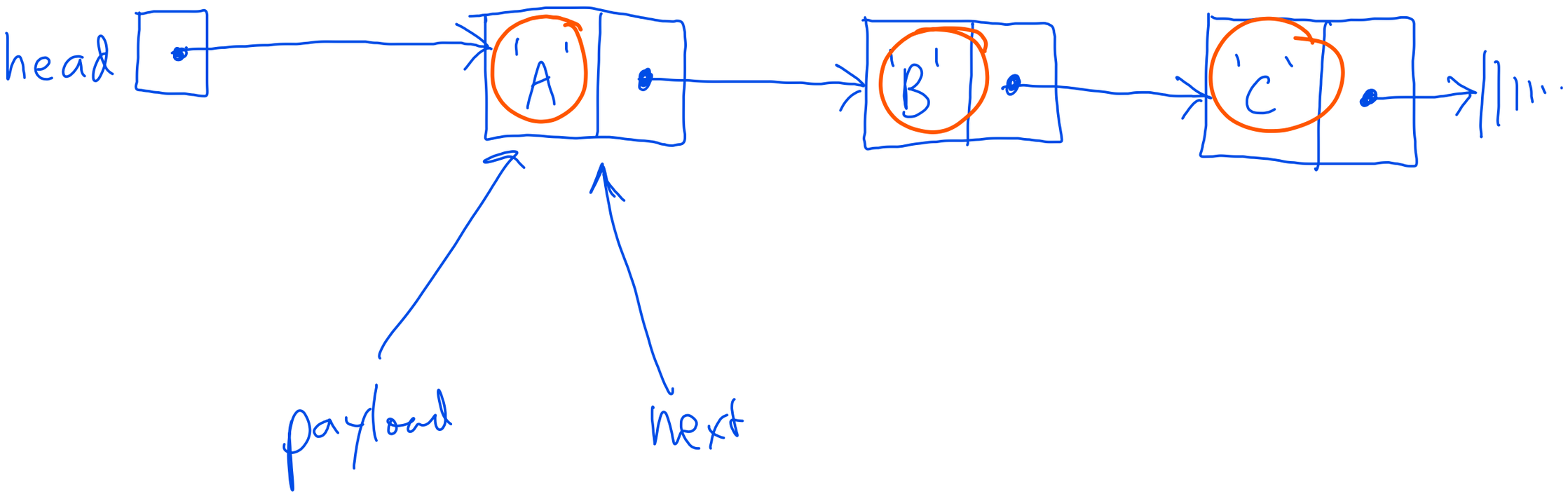
1. Describe the linked list structure by a diagram.

```
struct LLNode {
  char payload; // payload could be any type
  struct LLNode *next;
};
```

```
// code creating a linked list
Node *head = malloc(sizeof(struct Node));
head->payload = 'A';
head->next = malloc(sizeof(struct Node));
head->next->payload = 'B';
head->next->next = malloc(sizeof(struct Node));
head->next->next->payload = 'C';
head->next->next->next = NULL;
```



a more concise representation



2. Compare arrays and linked lists. Write down their pros and cons.

Arrays:

constant time

proportional to # elts

pro: O(1) access to arbitrary element
con: O(N) to insert or remove element at arbitrary position
pro: better locality (fewer cache misses when iterating)
pro: more compact
con: fixed size, to reallocate, must allocate new array and copy existing data

Linked lists:

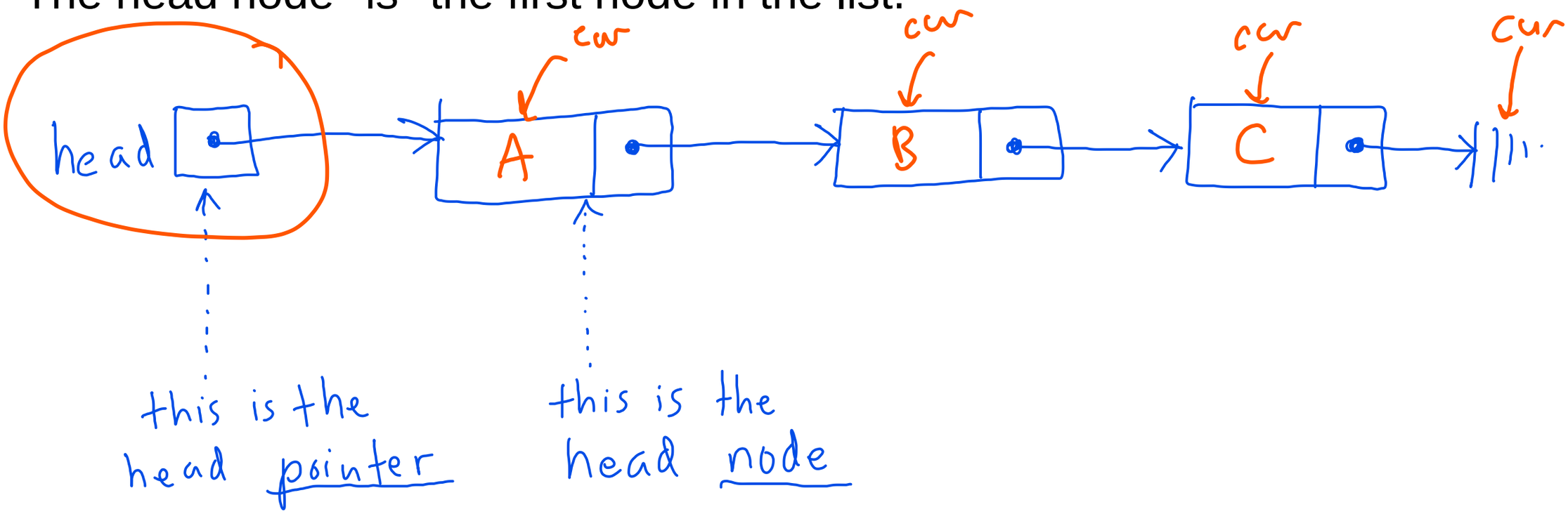
con: O(N) access to arbitrary element
pro: O(1) to remove element at arbitrary position (given a pointer to predecessor)
con: worse locality (more cache misses when iterating)
con: less compact (next pointers require space)
pro: can grow incrementally, nodes are allocated one at a time

3. What is a linked list's head? How is it different from a node? Explain.

Contrast: *head pointer* vs. *head node*.

The head pointer is a pointer to the first node in the list.

The head node *is* the first node in the list.



4. How do you calculate length of a linked list?

A loop is required:

```
struct Node *head = /* points to first node in list */;
int count = 0;

for (struct Node *cur = head; cur != NULL; cur = cur->next) {
  count++;
}
```

this is the way to advance to the next node in the list

loop ends when we reach the NULL pointer marking the end of the list

5. How do you implement add_after on a singly linked list?

```
void add_after(struct Node *p, char value) {
  struct Node *n = malloc(sizeof(struct Node));
  n->payload = value;
  n->next = p->next;
  p->next = n;
}
```

Trace: