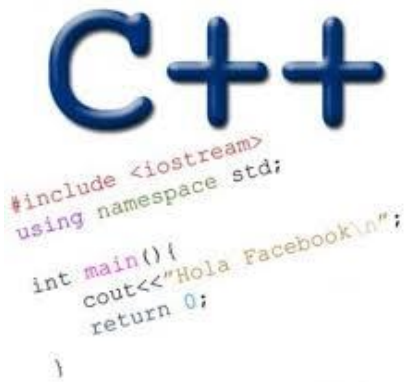
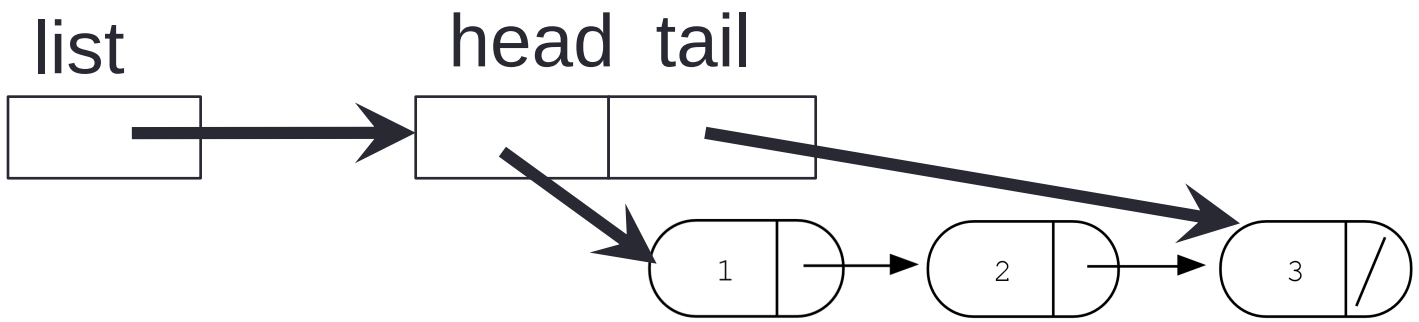
LINKED LISTS (CONTD)
DYNAMIC MEMORY PROBLEMS

Problem Solving with Computers-I

https://ucsb-cs16-sp17.github.io/

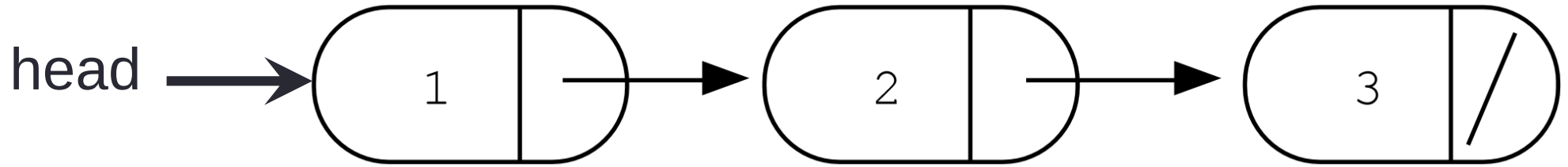


Review:
What are the ‘links’ in a linked-list?



Accessing elements of a list

```
struct Node {
      int data;
      Node *next;
};
```



Assume the linked list has already been created, what do the following expressions evaluate to?

1. head->data
2. head->next->data
3. head->next->next->data
4. head->next->next->next->data

A. 1
B. 2
C. 3
D. NULL
E. Run time error

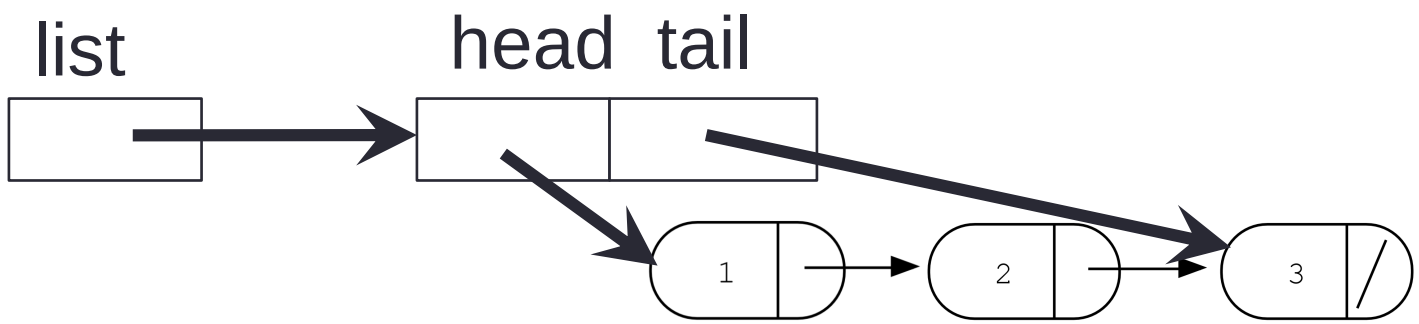
Building a list from an array

LinkedList * arrayToLinkedList(int a[], int size) ;

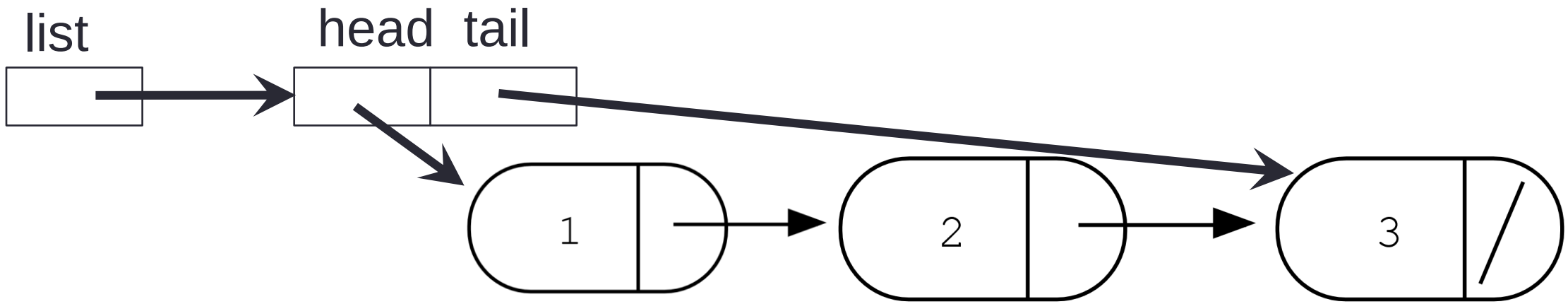
a

Iterating through the list

```
int lengthOfList(LinkedList * list) {
}
```

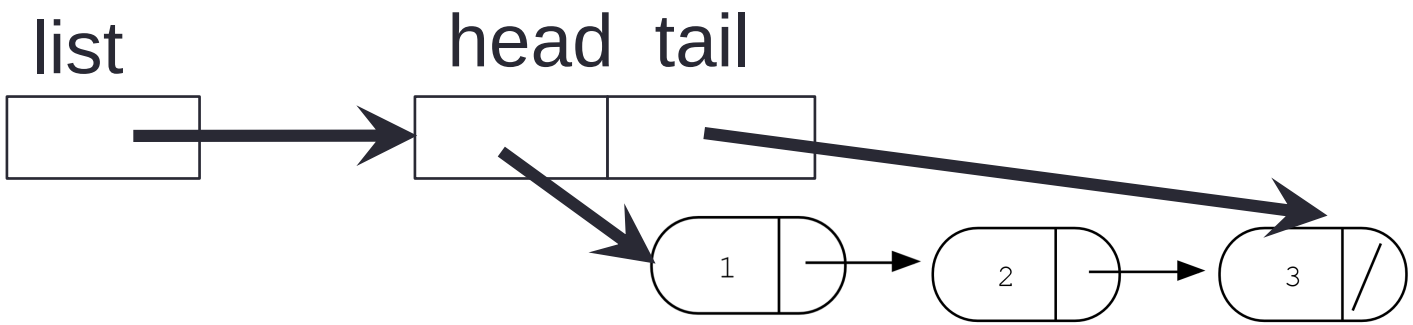


Deleting node 2 in the list



Deleting the list

int freeLinkedList(LinkedList * list);



Dynamic memory allocation

- To allocate memory on the heap use the ‘new’ operator
- To free the memory use delete

```
int *p= new int;
delete p;
```

Dangling pointers and memory leaks

- Dangling pointer: Pointer points to a memory location that no longer exists
- Memory leaks (tardy free)
  - Heap memory not deallocated before the end of program (more strict definition, potential problem)
  - Heap memory that can no longer be accessed (definitely a leak , must be avoided!)

Dynamic memory pitfall: Memory Leaks

- Memory leaks (tardy free)

Does calling foo() result in a memory leak? A. Yes B. No

```
void foo(){
        int * p = new int;

}
```

Q: Which of the following functions results in a dangling pointer?

```
int * f1(int num){
    int *mem1 =new int[num];
    return(mem1);
}
```

```
int * f2(int num){
     int mem2[num];
     return(mem2);
}
```

A. f1

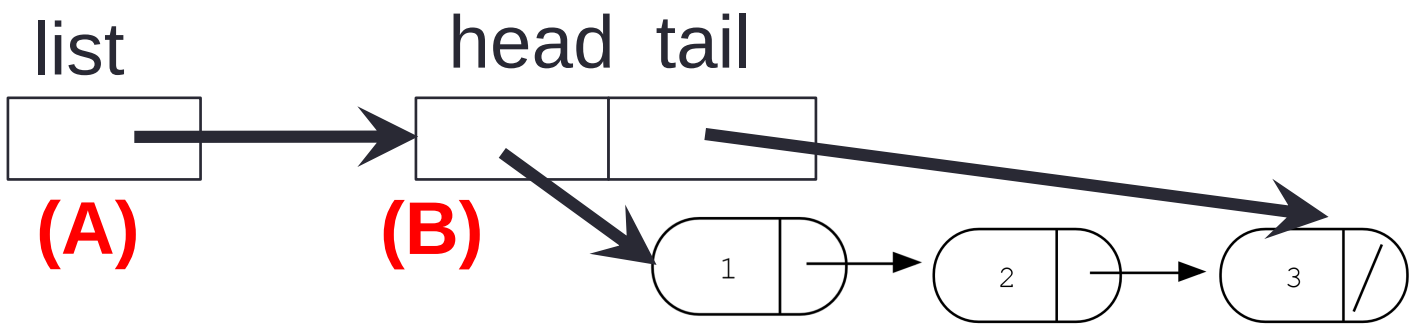
B. f2

C. Both

Deleting the list

int freeLinkedList(LinkedList * list){…}

Which data objects are deleted by the statement: delete list;



(C) All nodes of the linked list

(D) B and C

(E) All of the above

Does this result in a memory leak?

Dynamic arrays

```
int arr[5];
```

```
struct UndergradStudents{
    string firstName;
    string lastName;
    string major;
    double gpa[4];
};
```

Next time

- Recursion
- Strings