DYNAMIC MEMORY ALLOCATION LINKED LISTS

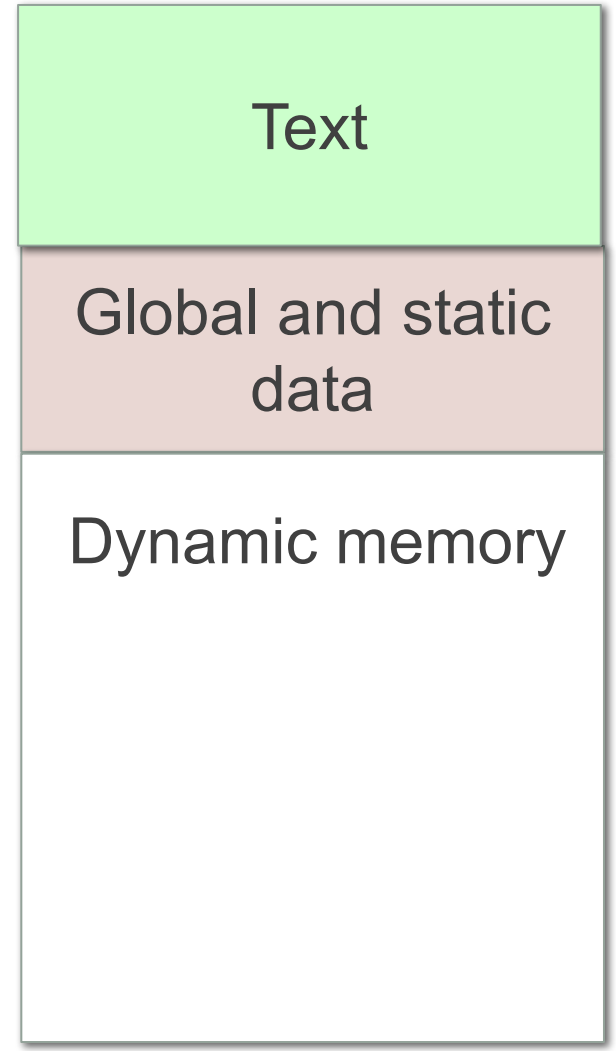
Problem Solving with Computers-I

https://ucsb-cs16-wi17.github.io/

Program layout in memory at runtime

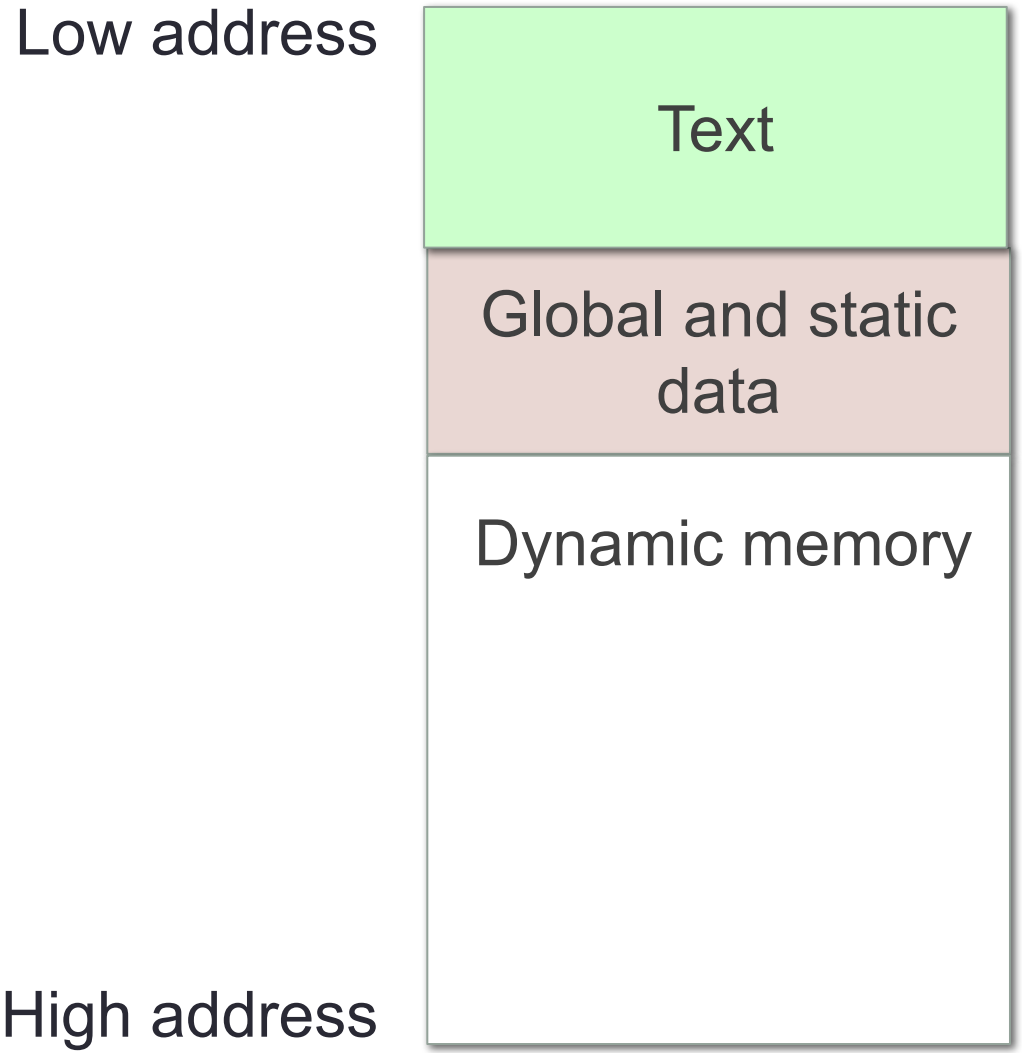
A generic model for memory


```
int foo() {
   int mycourse = 16;
   cout<<“Welcome to CS”<<mycourse;
}
```



Creating data on the heap: new and delete

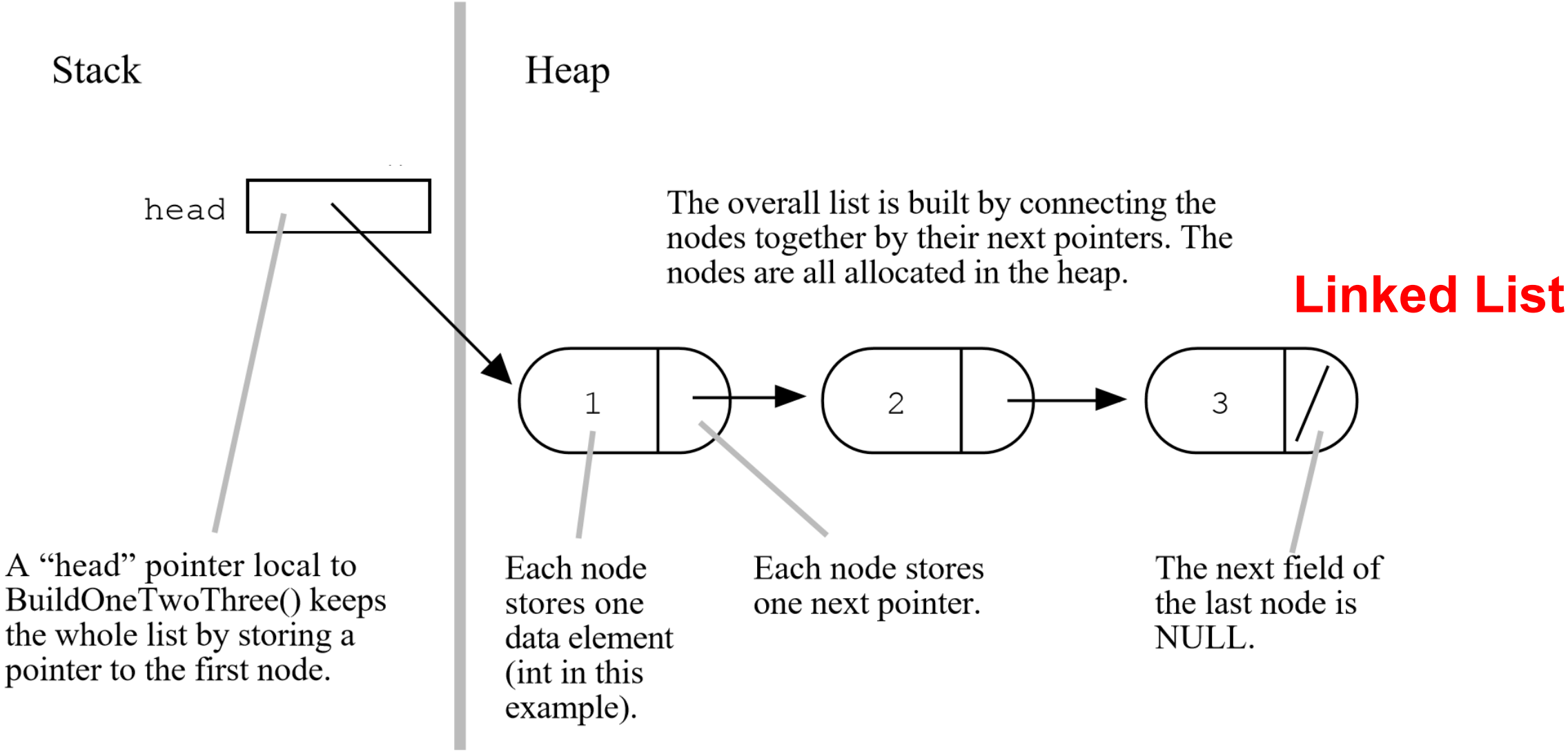
```
int foo() {
  int mycourse = 16;
  cout<<“Welcome to CS”<<mycourse;
}
```



Linked Lists

The Drawing Of List {1, 2, 3}

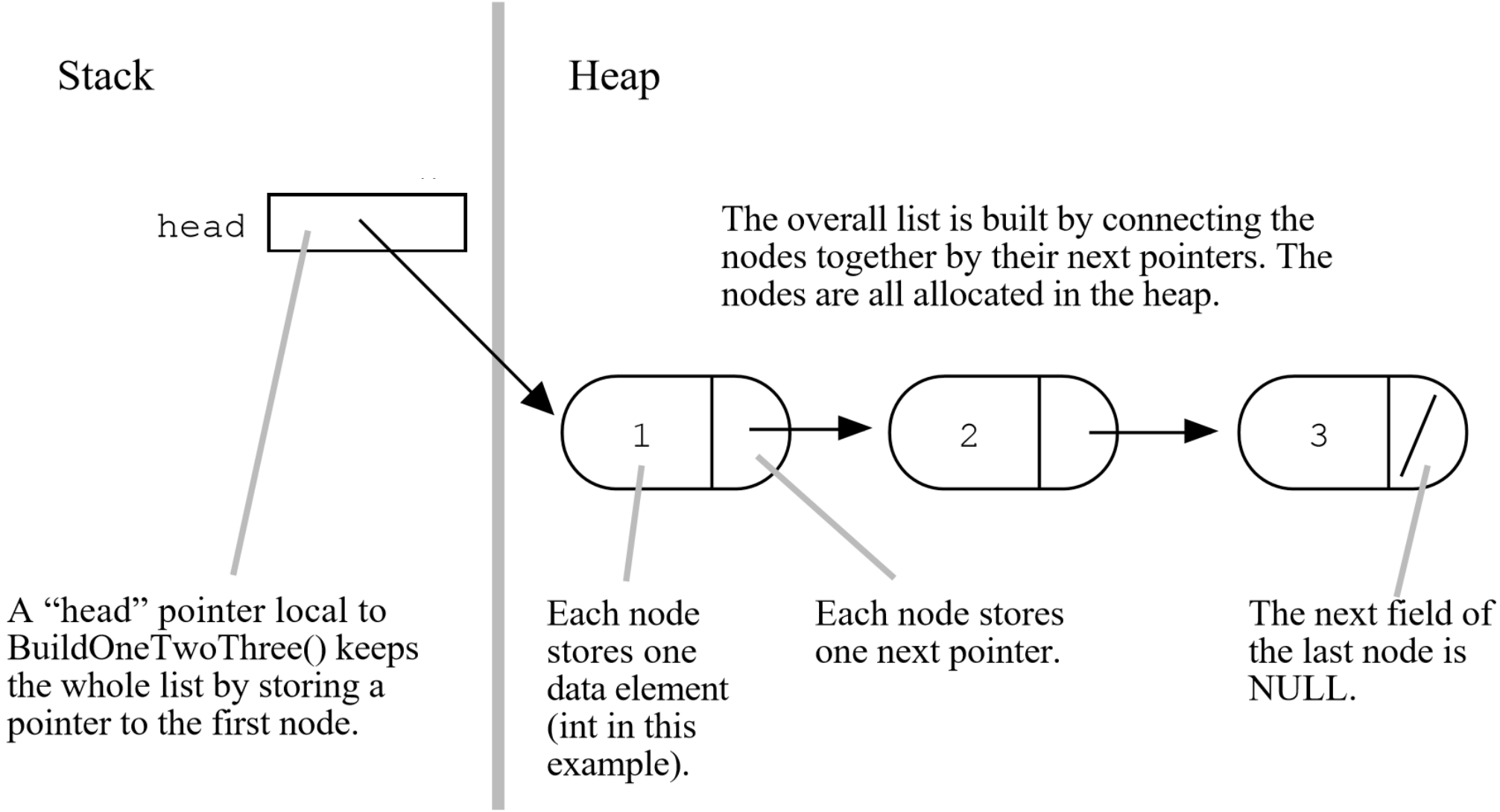
Array List



Linked List

Declaring a node in the list

The Drawing Of List {1, 2, 3}



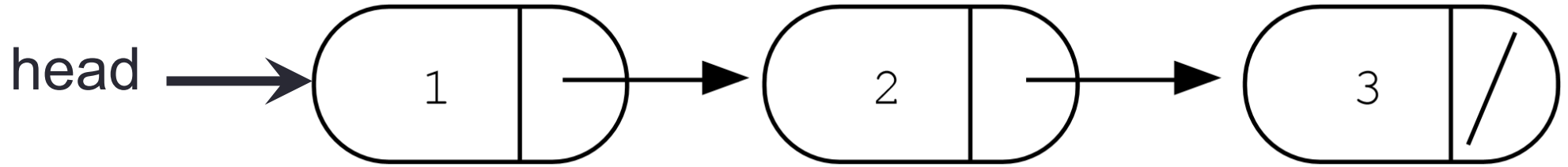
Creating a small list

- Define an empty list
- Add a node to the list

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

Accessing elements of a list

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



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

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

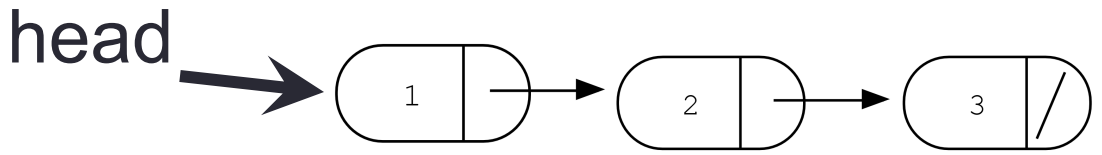
A. 1
B. 2
C. 3
D. NULL
E. Run time error

Building a list from an array

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

a

Iterating through the list




```
int length(Node* head) {
    /* Find the number of elements in the list */




}
```

Complex declarations in C/C++

How do we decipher declarations of this sort?

```
int **arr[];
```

Read

* as “pointer to” (always on the left of identifier)

[] as “array of” (always to the right of identifier)

( ) as “function returning” (always to the right …)

For more info see:
http://ieng9.ucsd.edu/~cs30x/rt_lt.rule.html

Complex declarations in C/C++

Right-Left Rule

int **arr [];

Illegal combinations include:

[]() - cannot have an array of functions
()() - cannot have a function that returns a function
()[] - cannot have a function that returns an array

Step 1: Find the identifier

Step 2: Look at the symbols to the right of the identifier. Continue right until you run out of symbols *OR* hit a *right* parenthesis ")"

Step 3: Look at the symbol to the left of the identifier. If it is not one of the symbols '*', '(), '[]' just say it. Otherwise, translate it into English using the table in the previous slide. Keep going left until you run out of symbols *OR* hit a *left* parenthesis "(".

Repeat steps 2 and 3 until you've formed your declaration.

Complex declarations in C/C++

```
int i;
int *i;
int  a[10];
int f( );
int **p;
int (*p)[];
int (*fp) ( );
int *p[];
int af[]( );
int *f();
int fa()[];
int ff()();
int (**ppa)[];
int (*apa[ ])[ ] ;
```

Next time

- Dynamic arrays
- Pointer arithmetic
- Dynamic memory pitfall