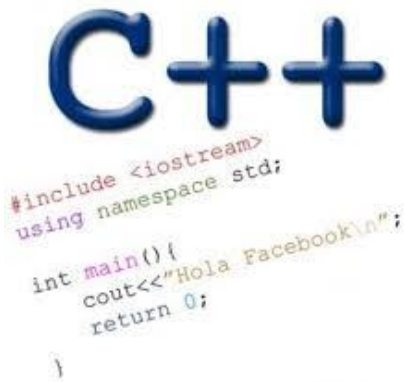
POINTER ARITHMETIC AND MIDTERM REVIEW

Problem Solving with Computers-I

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

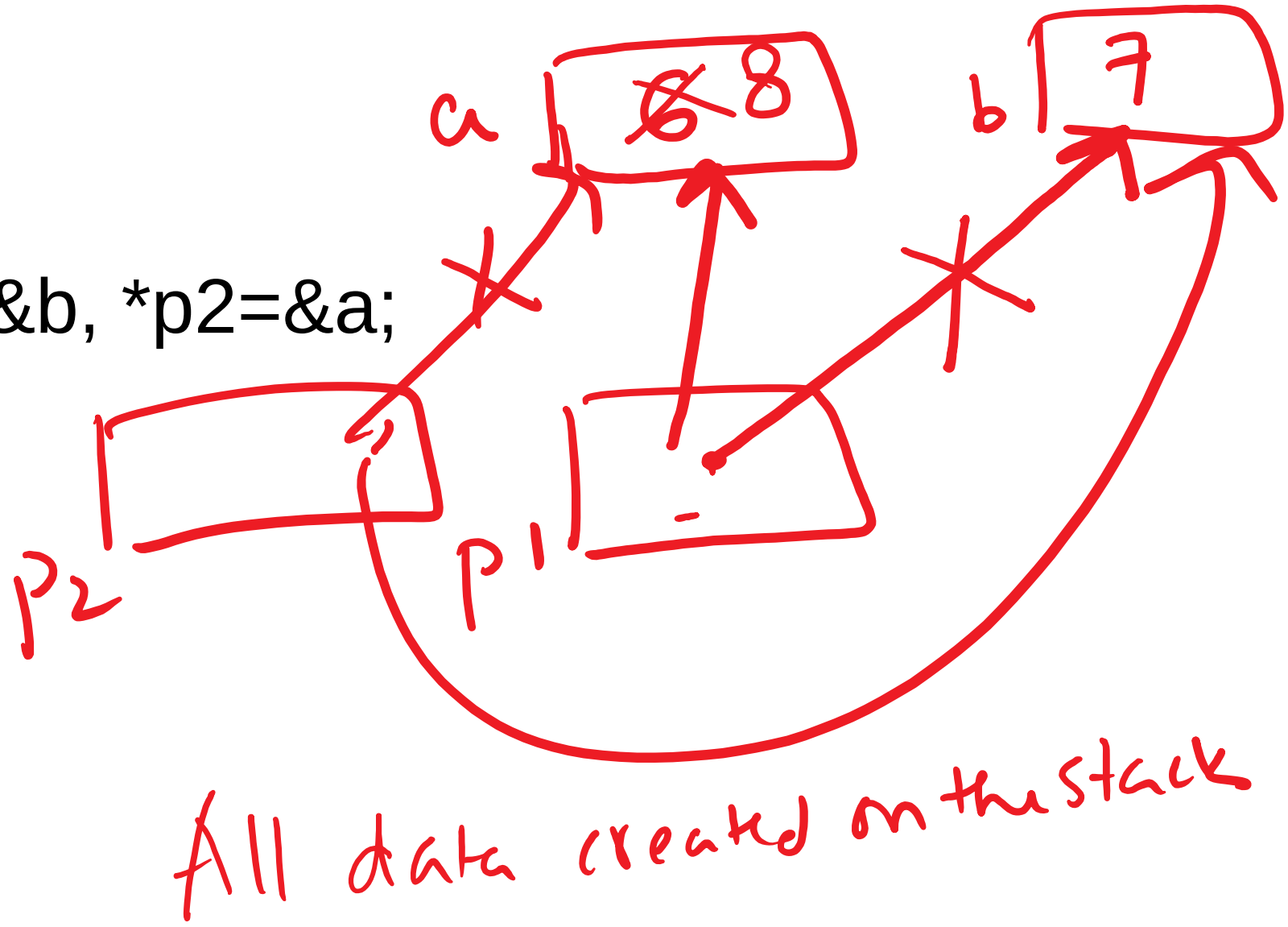


How to study for the midterm?

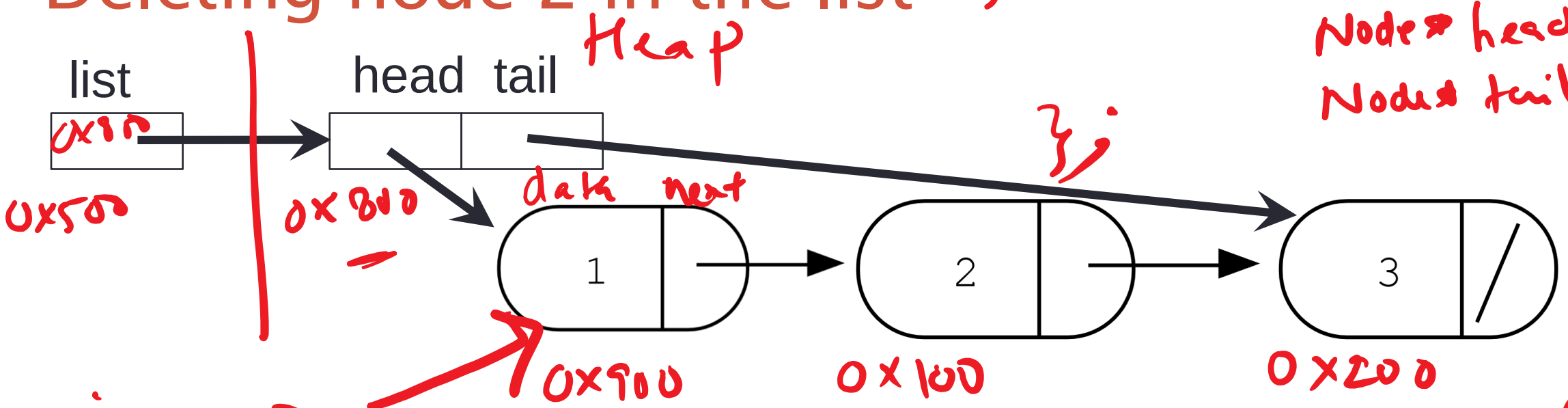
- Go to the site for midterm 2: https://ucsb-cs16-wi17.github.io/exam/e02/
- Review hws, labs and lectures
- Create your own notes and contribute to the collaborative notes document: https://docs.google.com/document/d/1ctpQAlAiTz5L8m8m9ibGlQG9Jcir4xmIUFiknvRR0wk/edit?usp=sharing
- Solve the problems in our concept inventory: https://drive.google.com/drive/folders/0B1z9k2M7uTvJaE9rR0F0OVV5ZWs?usp=sharing
- Ask questions!
- Midterm review sessions: Today 6pm to 8pm HFH 1152, Wednesday (during your section), Thursday morning 9am to 11am (during Diba's office hours)

Pointer diagram;

```
int a=6, b=7, *p1=&b, *p2=&a;
p1 = p2;
*p1 = 8;
p2 = &b;
```



Deleting node 2 in the list



struct LinkedList {
Node* head;
Node* tail;
};

Heap

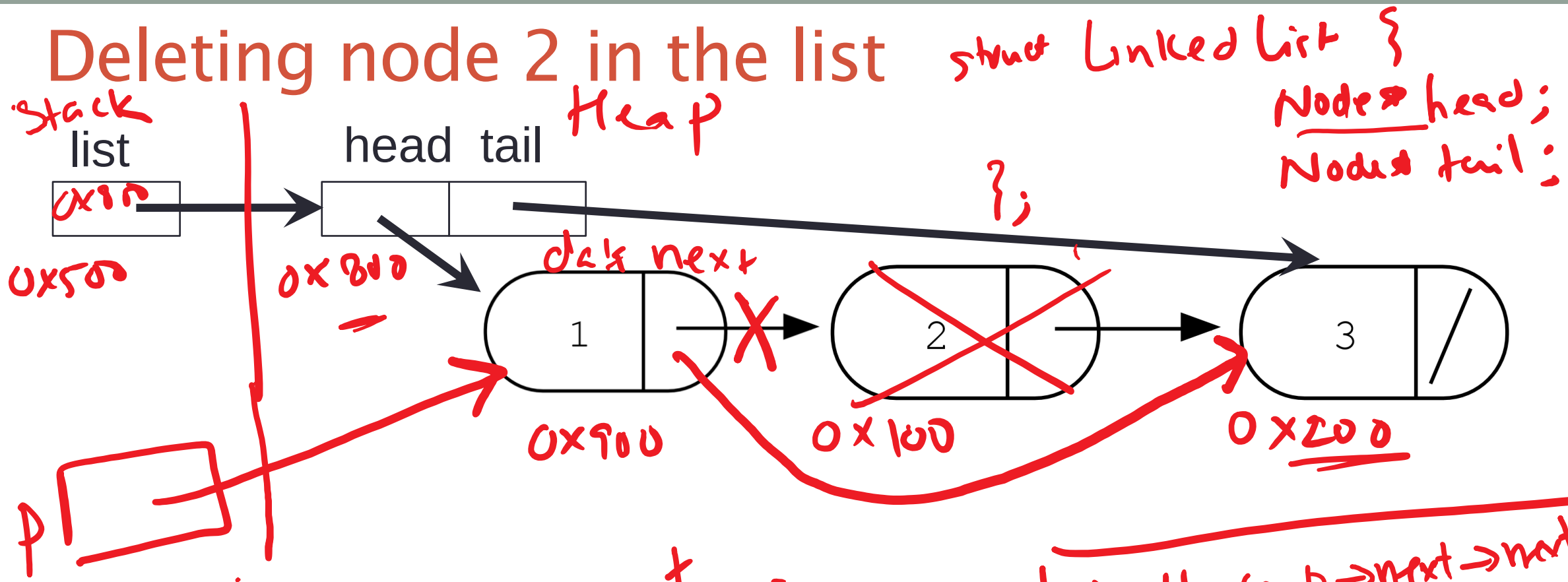
0x500
0x800
0x900
0x100
0x200

p

list (0x800)
list->head (0x900)
list->head->next (0x100)

list->head->data (1)
p->data (1)

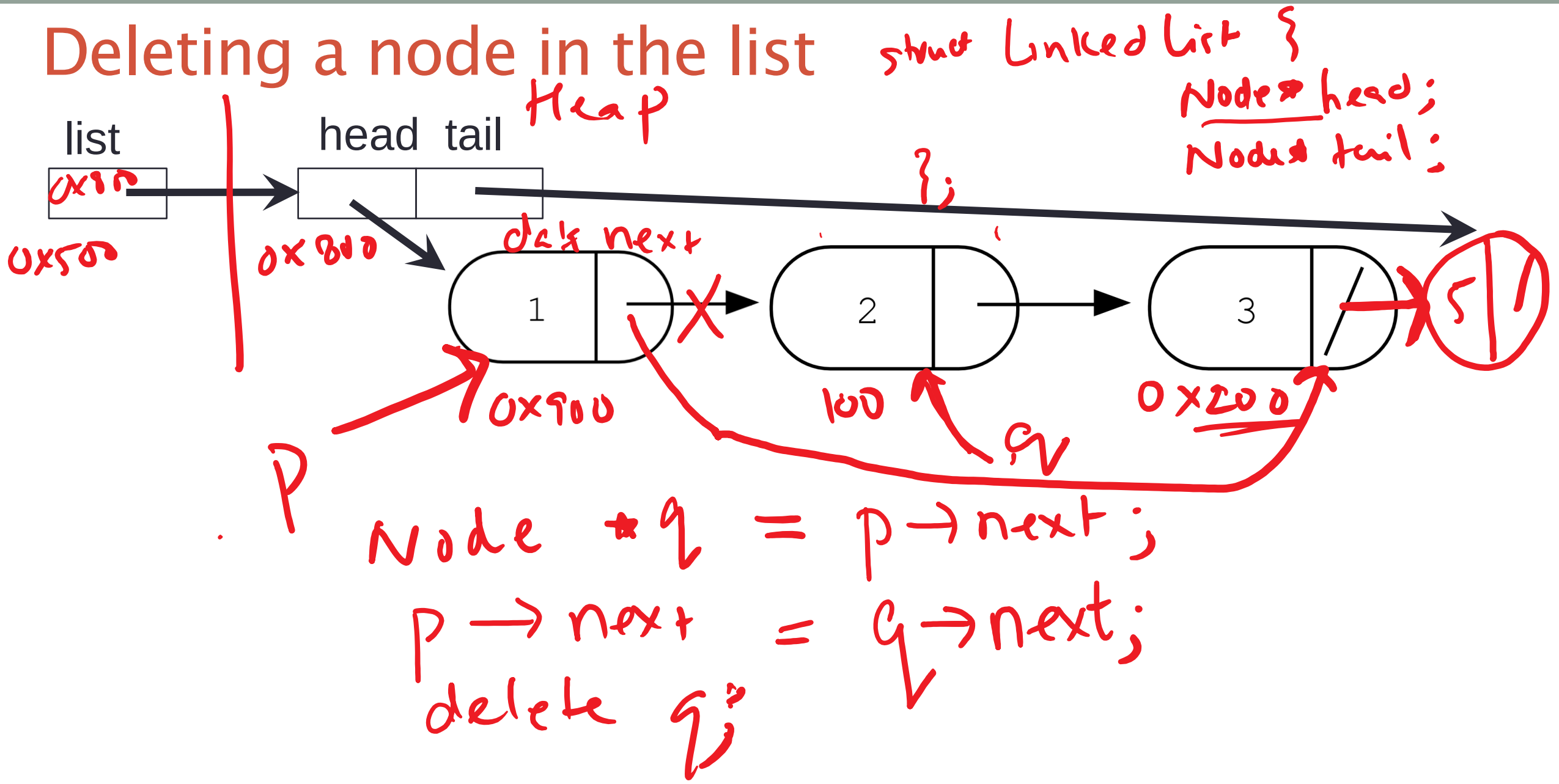
Deleting node 2 in the list




```
delete p->next;
p->next = list->tail;
```

Don't use p->next->next because it was deallocated in the previous statement

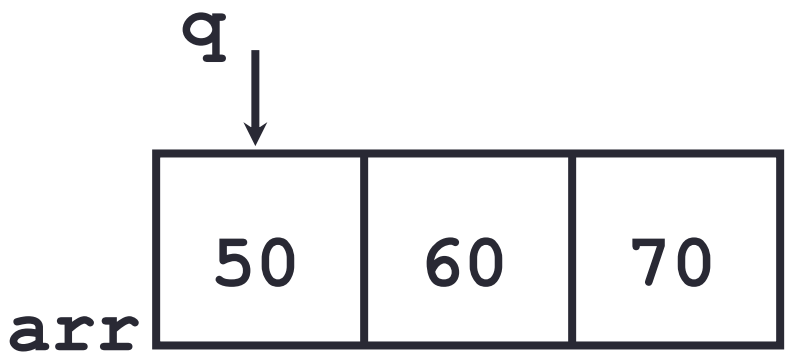
Deleting a node in the list



Pointer Arithmetic

```
int arr[]={50, 60, 70};
int *p;
p = arr;
p = p + 1;
*p = *p + 1;

UndergradStudents records[2];
UndergradStudents *pRec;
pRec = records;
pRec = pRec + 1;
```

```
void IncrementPtr(int *p){
    p =  p + 1;
}

int arr[3] = {50, 60, 70};
int *q = arr;
IncrementPtr(q);
```



Which of the following is true after **`IncrementPtr(q)`** is called in the above code:

A. ‘q’ points to the next element in the array with value 60

B. ‘q’ points to the first element in the array with value 50

How should we implement `IncrementPtr()`, so that ‘q’ points to 60 when the following code executes?

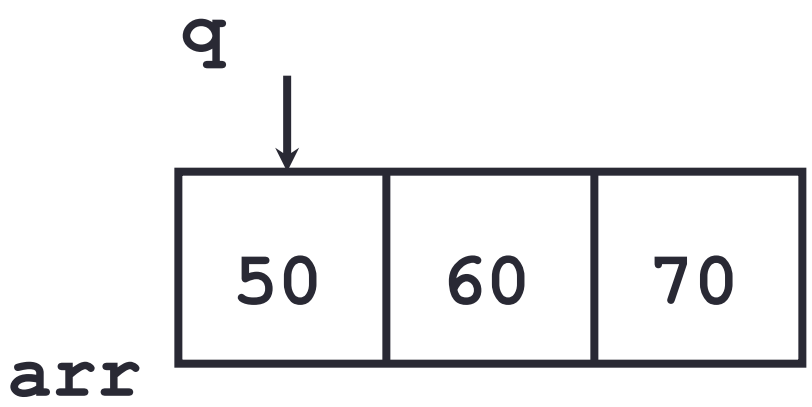
```
void IncrementPtr(int **p){
    p =  p + 1;  }


int arr[3] = {50, 60, 70};
int *q = arr;
IncrementPtr(&q);
```

A. `p =  p + 1;`

B. `&p = &p + 1;`

C. `*p= *p + 1;`

D. `p= &p+1;`



Pointer Arithmetic

- What if we have an array of large structs (objects)?
  - C++ takes care of it: In reality, `ptr+1` doesn't add `1` to the memory address, but rather adds the size of the array element.
  - C++ knows the size of the thing a pointer points to – every addition or subtraction moves that many bytes: 1 byte for a char, 4 bytes for an int, etc.

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

- Recursion