CS61B Midterm Review

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Agenda

1. Static vs. Dynamic
2. Box and pointer diagrams
3. Code Questions and examples
4. Bit representation
5. Algorithmic Analysis
6. Access rights
7. Quickie questions

Static vs. Dynamic

- What happens? Assume we have defined:

```
Homer h = new Homer();
Bart b = new Bart();

    Homer h1 = b;
    h1.talk2();
```

Answer: Homer, Bart: dude

Static vs. Dynamic cont.

- What happens? Assume the same definitions

```
Bart b1 = b;
b1.talk2();
```

Answer: Homer, Bart: dude

```
Cartoon c1 = h;
((Homer)c1).talk4();
```

Answer: Homer, Homer: doh!

Static vs. Dynamic cont.

- What happens?

```
Cartoon c2 = b;
((Bart)c2).whoa();
```

Answer: dude

```
Lumpy l2 = b;
((Homer)l2).talk4();
```

Answer: Bart: dude

Static vs. Dynamic cont.

- For calls with an object of interest (i.e. h.f()), static methods are called based on static type, non-static methods are based on dynamic type
- For calls involving “this”, things get a little trickier. Static calls “stay” in the same class, dynamic calls are based on the dynamic set.

Box and Pointer diagrams

- Draw the diagrams that result from this code:

```
int [] x = new int[3];
int [] y = new int[0];
int [][] z = new int[3][2];
```

Box and Pointer diagrams

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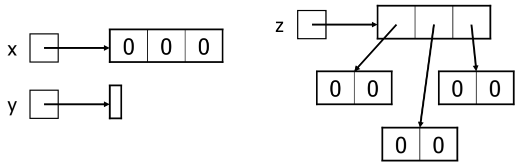

Box and Pointer diagrams cont.

- Modify the box and pointer diagram according to this code:

```
z[1] = z[2];
```

Box and Pointer diagrams cont.

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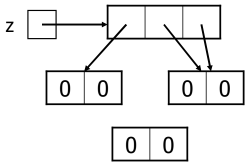
```
z[1] = z[2];
```



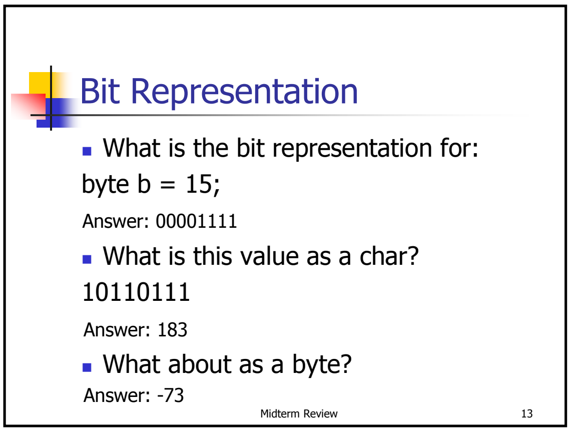
Coding Question

- Finish this method:

```
/* Given an IntList, it will reverse it
   destructively and return the new list */
public IntList reverse(IntList l) {
        …
}
```

Coding Question Solution

```
public IntList reverse(IntList l) {
    IntList prev = null;
    IntList next = l.tail;
    while (l != null) {
          next = l.tail;
          l.tail = prev;
          prev = l;
          l = next;
    }
    return prev; //once we are done reversing all the pointers
                     //we need to set l's head to the new head
}
```



Bit Representation

- What is the bit representation for:

byte b = 15;

Answer: 00001111

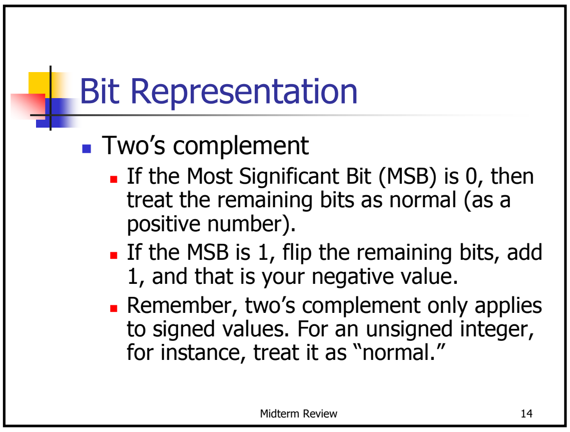
- What is this value as a char?

10110111

Answer: 183

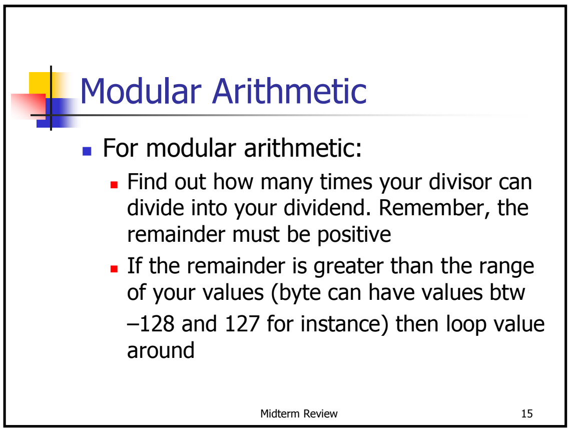
- What about as a byte?

Answer: -73



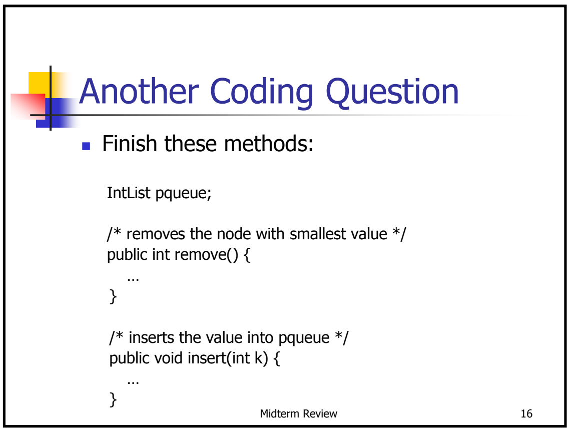
Bit Representation

- Two's complement
  - If the Most Significant Bit (MSB) is 0, then treat the remaining bits as normal (as a positive number).
  - If the MSB is 1, flip the remaining bits, add 1, and that is your negative value.
  - Remember, two's complement only applies to signed values. For an unsigned integer, for instance, treat it as "normal."



Modular Arithmetic

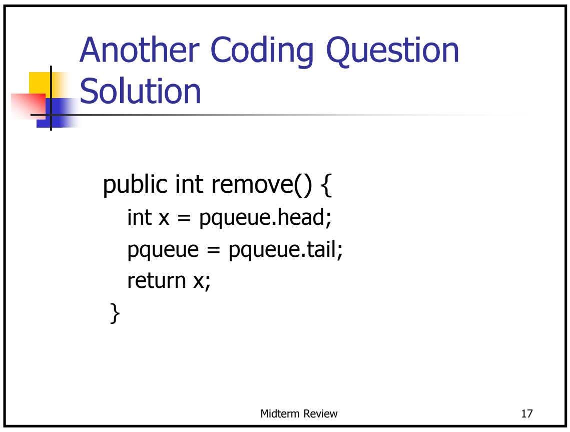
- For modular arithmetic:
  - Find out how many times your divisor can divide into your dividend. Remember, the remainder must be positive
  - If the remainder is greater than the range of your values (byte can have values btw –128 and 127 for instance) then loop value around



Another Coding Question

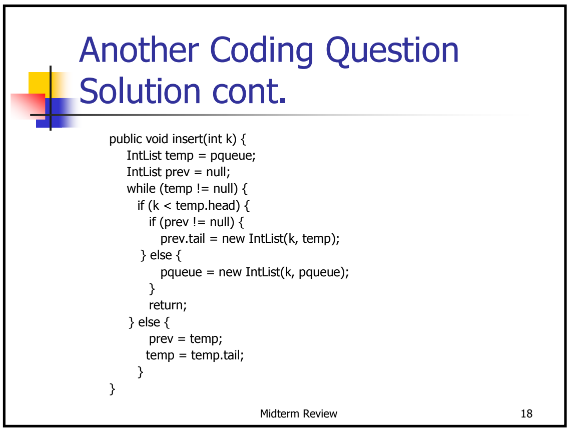
- Finish these methods:

```
IntList pqueue;

/* removes the node with smallest value */
public int remove() {
    …
}

/* inserts the value into pqueue */
public void insert(int k) {
    …
}
```



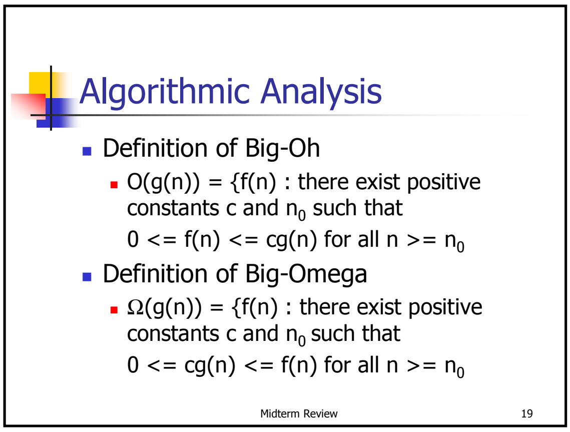
Another Coding Question Solution

```
public int remove() {
    int x = pqueue.head;
    pqueue = pqueue.tail;
    return x;
}
```



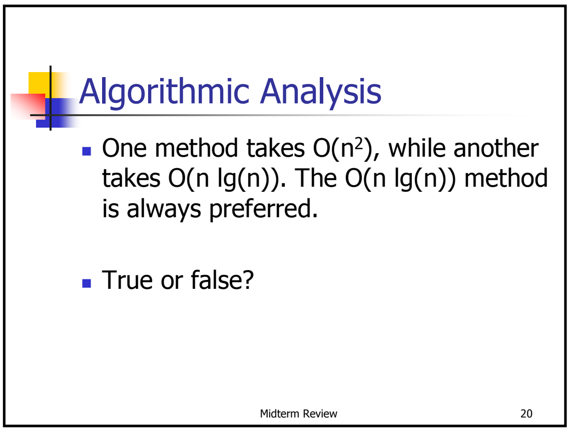
Another Coding Question Solution cont.

```
public void insert(int k) {
    IntList temp = pqueue;
    IntList prev = null;
    while (temp != null) {
      if (k < temp.head) {
        if (prev != null) {
          prev.tail = new IntList(k, temp);
       } else {
          pqueue = new IntList(k, pqueue);
        }
        return;
    } else {
        prev = temp;
       temp = temp.tail;
      }
}
```



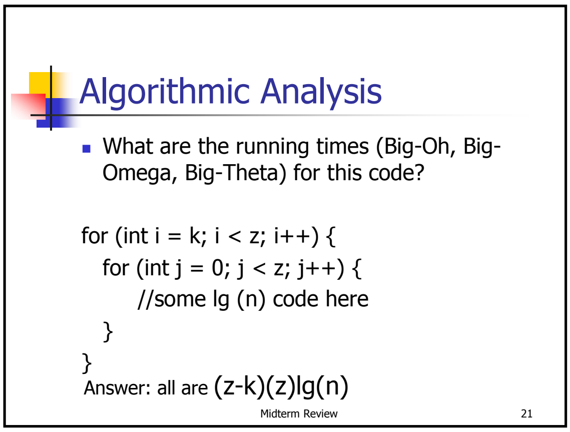
Algorithmic Analysis

- Definition of Big-Oh
  - O(g(n)) = {f(n) : there exist positive constants c and n_0 such that 0 <= f(n) <= cg(n) for all n >= n_0
- Definition of Big-Omega
  - Ω(g(n)) = {f(n) : there exist positive constants c and n_0 such that 0 <= cg(n) <= f(n) for all n >= n_0



Algorithmic Analysis

- One method takes O(n^2), while another takes O(n lg(n)). The O(n lg(n)) method is always preferred.
- True or false?

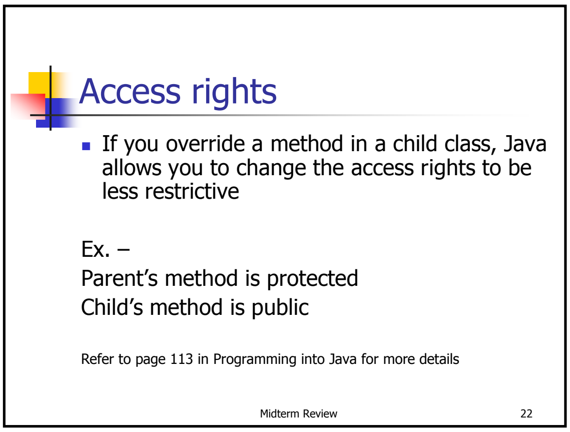


Algorithmic Analysis

- What are the running times (Big-Oh, Big-Omega, Big-Theta) for this code?

```
for (int i = k; i < z; i++) {
   for (int j = 0; j < z; j++) {
        //some lg (n) code here
   }
}
```

Answer: all are (z-k)(z)lg(n)

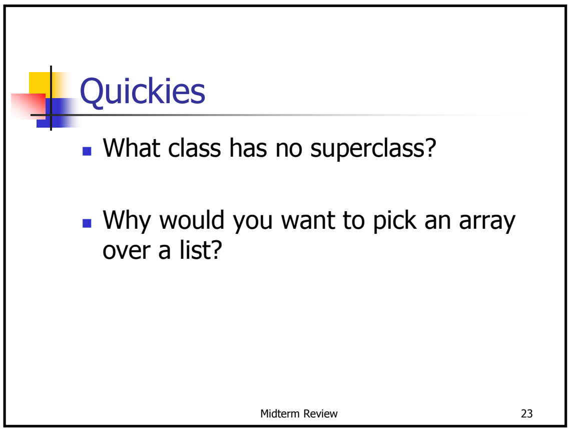


Access rights

- If you override a method in a child class, Java allows you to change the access rights to be less restrictive

Ex. –
Parent’s method is protected
Child’s method is public

Refer to page 113 in Programming into Java for more details



Quickies

- What class has no superclass?
- Why would you want to pick an array over a list?