COP3502 11/27/23

0. Exams Returned in Recitation
1. Schedule Adjustment
   - A- but I'll curve one quick backtracker curved.
2. Bitwise Operators

```
int x = 2^exp;
```

→ think this means exponentiation, but it doesn't.

We'll learn what this ACTUALLY means!

We're usually using 2's complement.

unsigned binary 74 000... 1001010

```
2|74
2|37 R0
2|18 R1
 2|9 R0
 2|4 R1
 2|2 R0
   1 R0
```

2's complement 32 bit #

[1][1] 0 . . . . 0 [1][0][1]

-2^{31} 2^{30} 2^2 2^1 2^0

$-2^{31}+2^{30}+2^2+2^0$

$[-2^{31}, 2^{31}-1]$ range of int

range of unsigned $[0, 2^{32}-1]$

examples & bits

$x = 47$
$y = 29$

$x \,\&\, y$ bitwise and (like set intersection)

```
  00101111
& 00011101
----------
  00001101  = 13
```

$x \mid y$ bitwise or (like set union)

```
  00101111
| 00011101
----------
  00111111  = 63
```

$x \wedge y$ bitwise xor (like set symmetric difference)

```
  00101111
^ 00011101
----------
  00110010  = 50
```

$x >> k$ right shift

$00101111 >> 2$
$= 001011 = 11$
(chops off the last k bits)

$x << k$

$00101111 << 3$ (3 bits)
00101111000 mult 2^3

```
int numonebits(int n) {
    int res = 0; ~~cur=1;~~
    for (int i=0; i<32; i++)
        if ((n & (1<<i)) != 0)
            res++;
    return res;
}
// assume n>0
int mostsigbit(int n) {
    int res = -1;
    for (int i=0; i<32; i++)
        if ((n & (1<<i)) != 0)
            res = i;
    return res;
}
```

0100110 1001

0001 i=0

0010

0 0 0 0

Knapsack

	W	V
0)	10	35
1)	17	52
2)	13	40
3)	16	50
4)	6	10
5)	8	20

n=6

items to take

```
000000
000001   take item 0
000010   = item 1
000011   take items 0,1
  :
111111
```

```
for (int mask=0; mask<(1<<n); mask++){
    int curV=0, curW=0;
    for (int i=0; i<n; i++) {
        if (mask & (1<<i)) {
            curV += V[i];
            curW += W[i];
        }
    // UPDATE IF NECESSARY
```

Grading a TF exam via bitwise ops

key 0110 1111 0010 0111

student ^ 1111 0111 1111 1001

1001 1000 1101 1110

if bitwise XOR == 1 ⟹ WRONG

$$\text{Score} = \underbrace{\text{NUMQ}}_{\text{all}} - \underbrace{\text{numonebits}(\text{key} \wedge \text{student})}_{\text{wrong}}$$