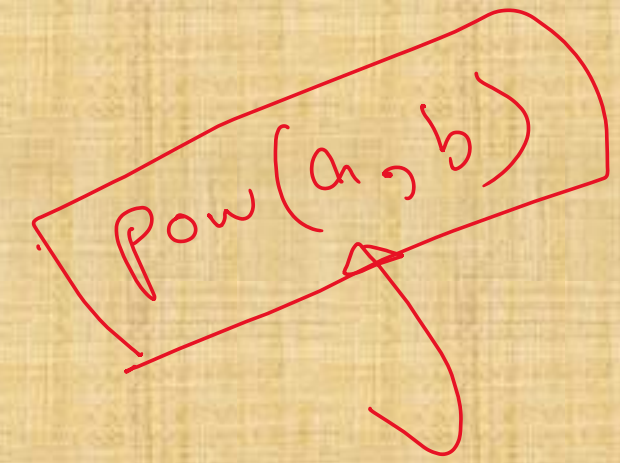
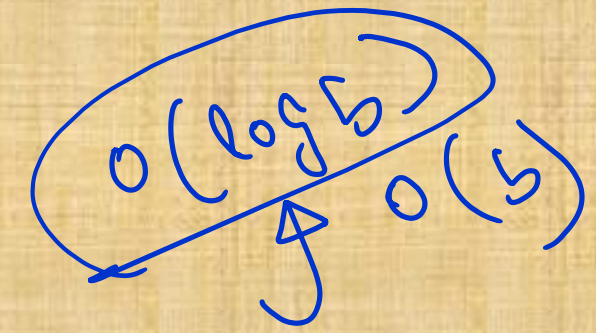
Recursion Problem Solving

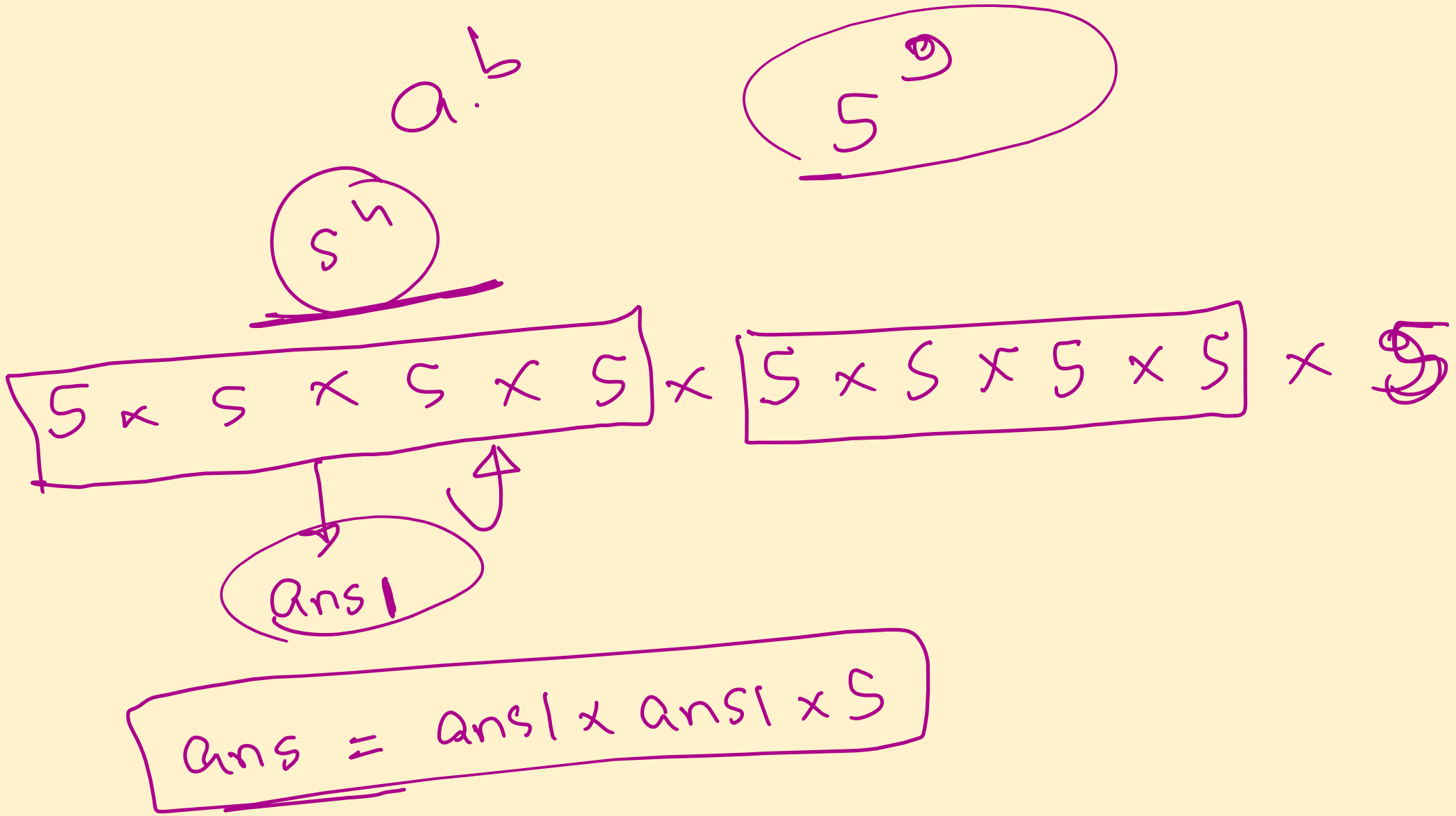
--by Harsh Gupta



Calculate a power b

```
ans = 1
for (int i = 1; i <= b; i++){
    ans *= a;
}
```




a^b
5^9
5^4
5 x 5 x 5 x 5
x
5 x 5 x 5 x 5
x 5
ans1
ans = ans1 x ans1 x 5

$(a^b)\,\%\,mod$

$5 \times 5 \times 5 \times 5 \times 5 \times 5$

ans1

$a^b = a^{b/2} \times a^{b/2}$

ans = ans1 x ans1

$b = 9/2 = 4$

$a^9 = a^4 \times a^4 \times a$

5 6 4

if (a, b/2)

a^b

$b = 6/2$

$a^6 = a^3 \times a^3$ (3)

ans

$a^{b/2}$

ans * = ans

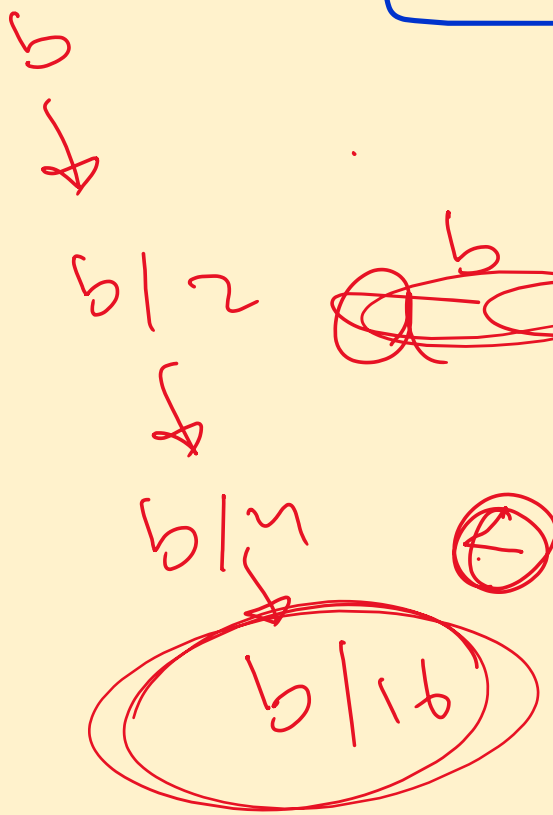
$a^b = a^{b/2} \times a^{b/2} \times a$ } if b is odd

$= a^{b/2} \times a^{b/2}$ } if b is even

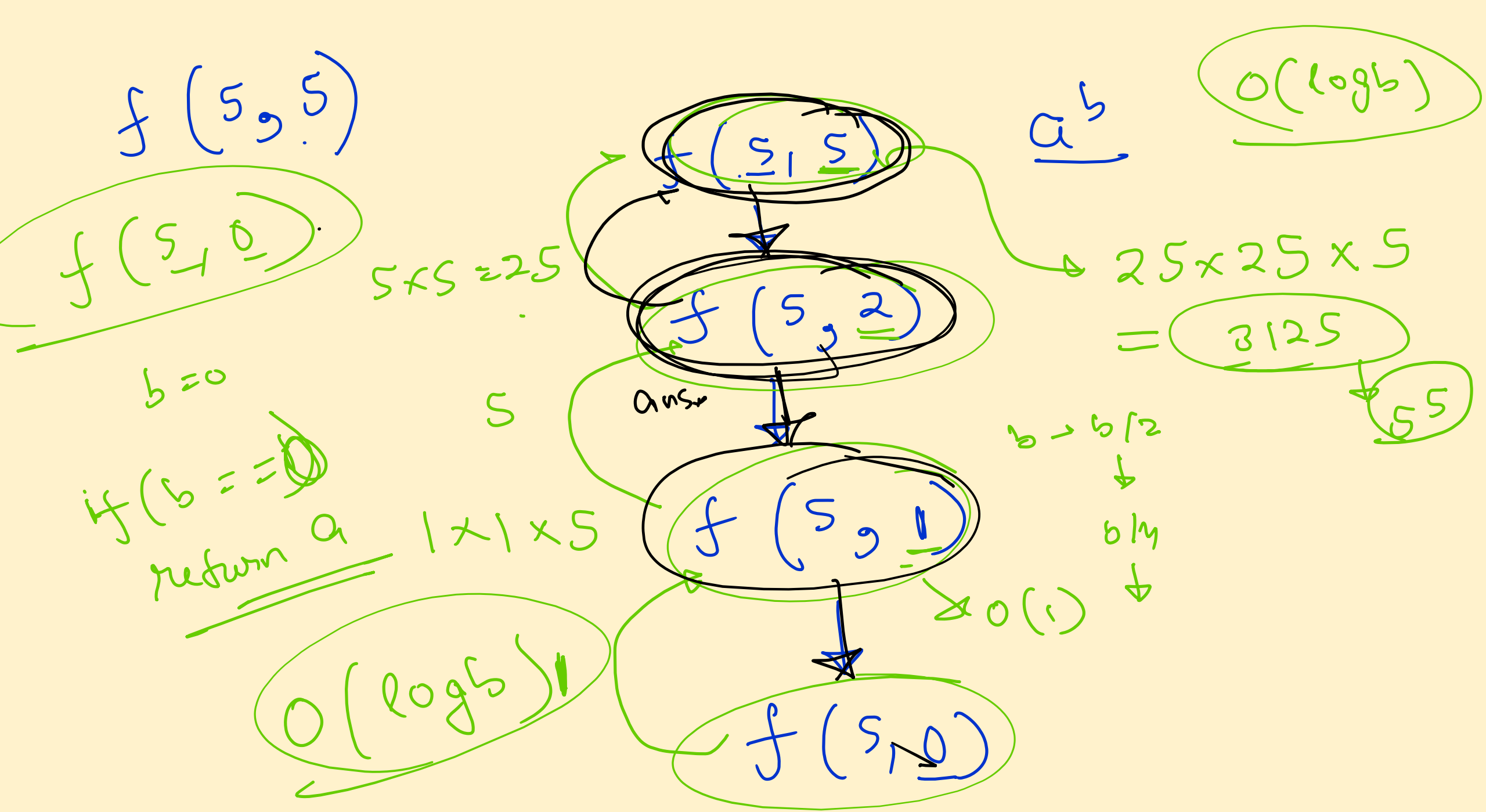
f(n)

return f(n/2)

log n



int f(a, b) {
if(b==0) return 1;
int ans = f(a, b/2)
ans * = ans;
if(b%2==1) return ans x a;
else return ans;
}


f(5,5)
f(5,0)
b==0
if(b==0)
return a
f(5,1)
f(5,2)
f(5,5)
5x5=25
ans
5
1x1x5
f(5,0)
a^b
O(log b)
25x25x5
=3125
5^5
b → b/2
b%2
O(1)
O(log b)

a^7 $\quad b = 7$

$a \times a \times a \times a \times a \times a \times a$

$a \times a \times a \times a$ → ans1 → a^4

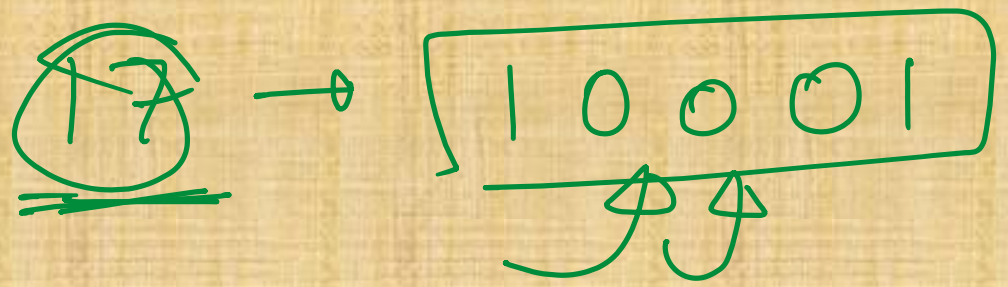
a

$ans = a^7 = ans1 \times ans1 \times a$

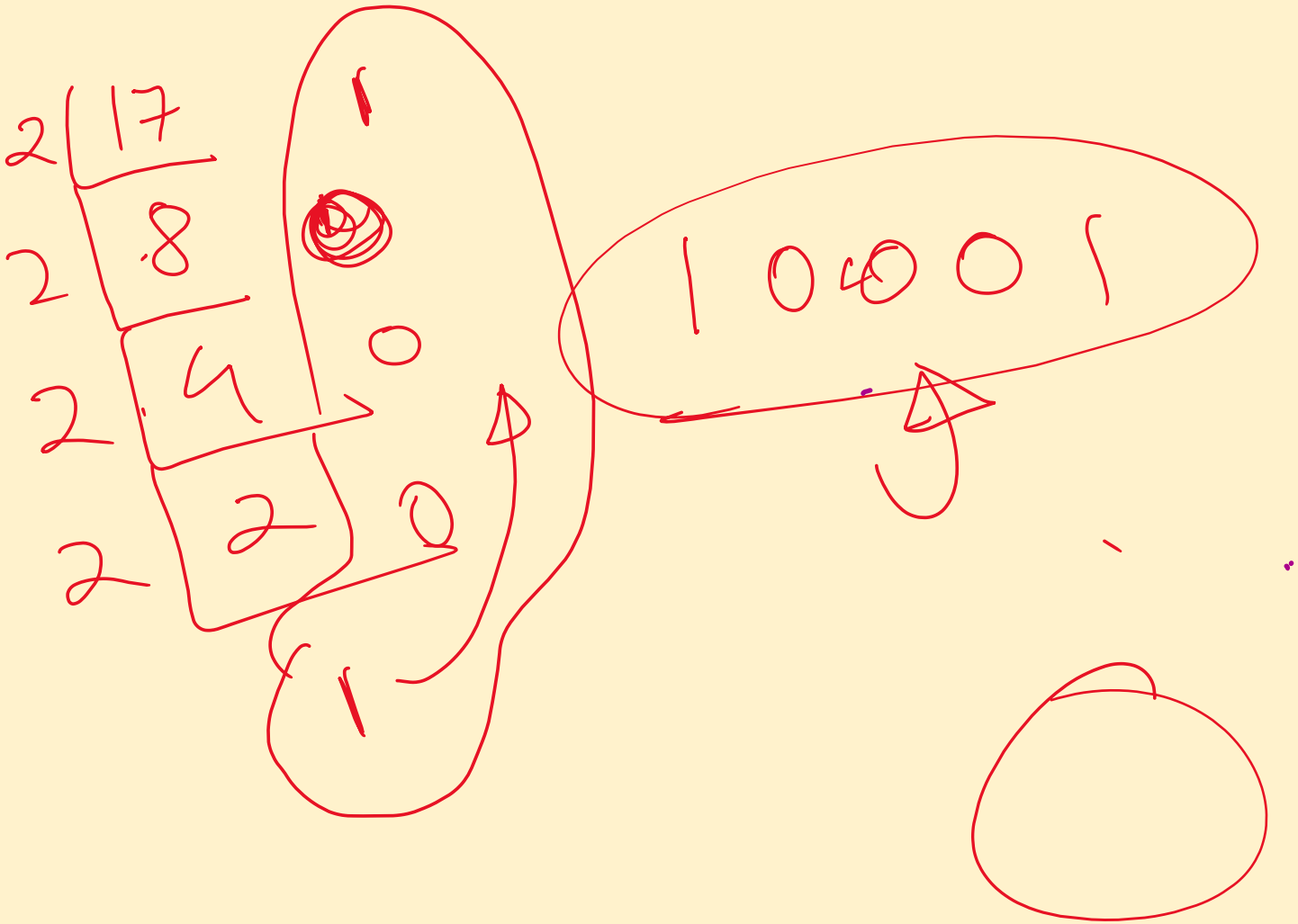
$a^8 = ans1 \times ans1$

$ans1 = f(a, b/2)$

$ans = ans1 \times ans1 \times$ (if b is odd, a)



Generate binary string for number n


2 | 17
2 | 8
2 | 4
2 | 2
2
1
0
0
1
0
0
0
1

f(8) → "1000"

f(n)

base case

string s = f(n/2);

if (n%2 == 1) return s + "1"

else return s + "0";

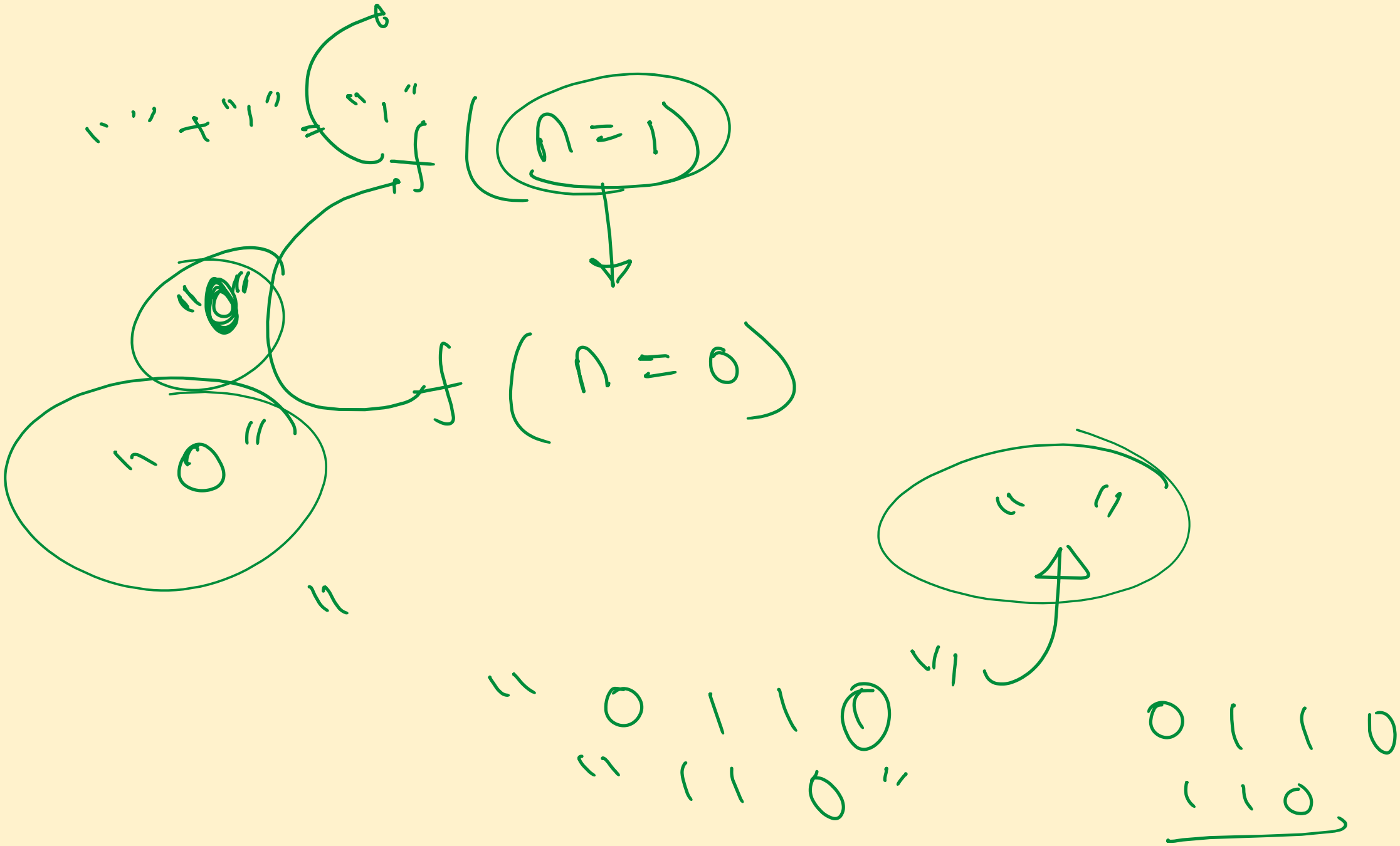
if (1) ⟶ 1

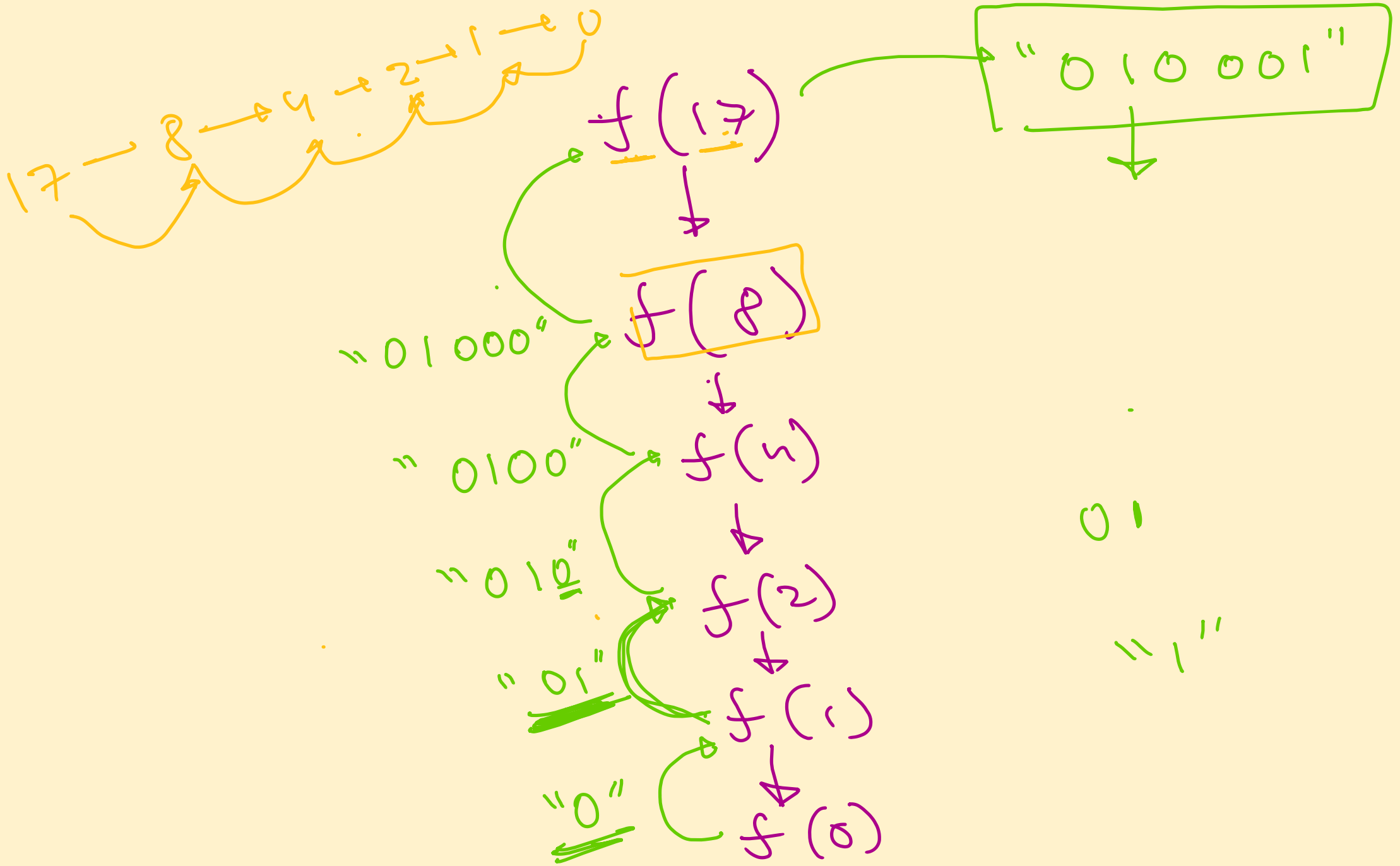
0 1

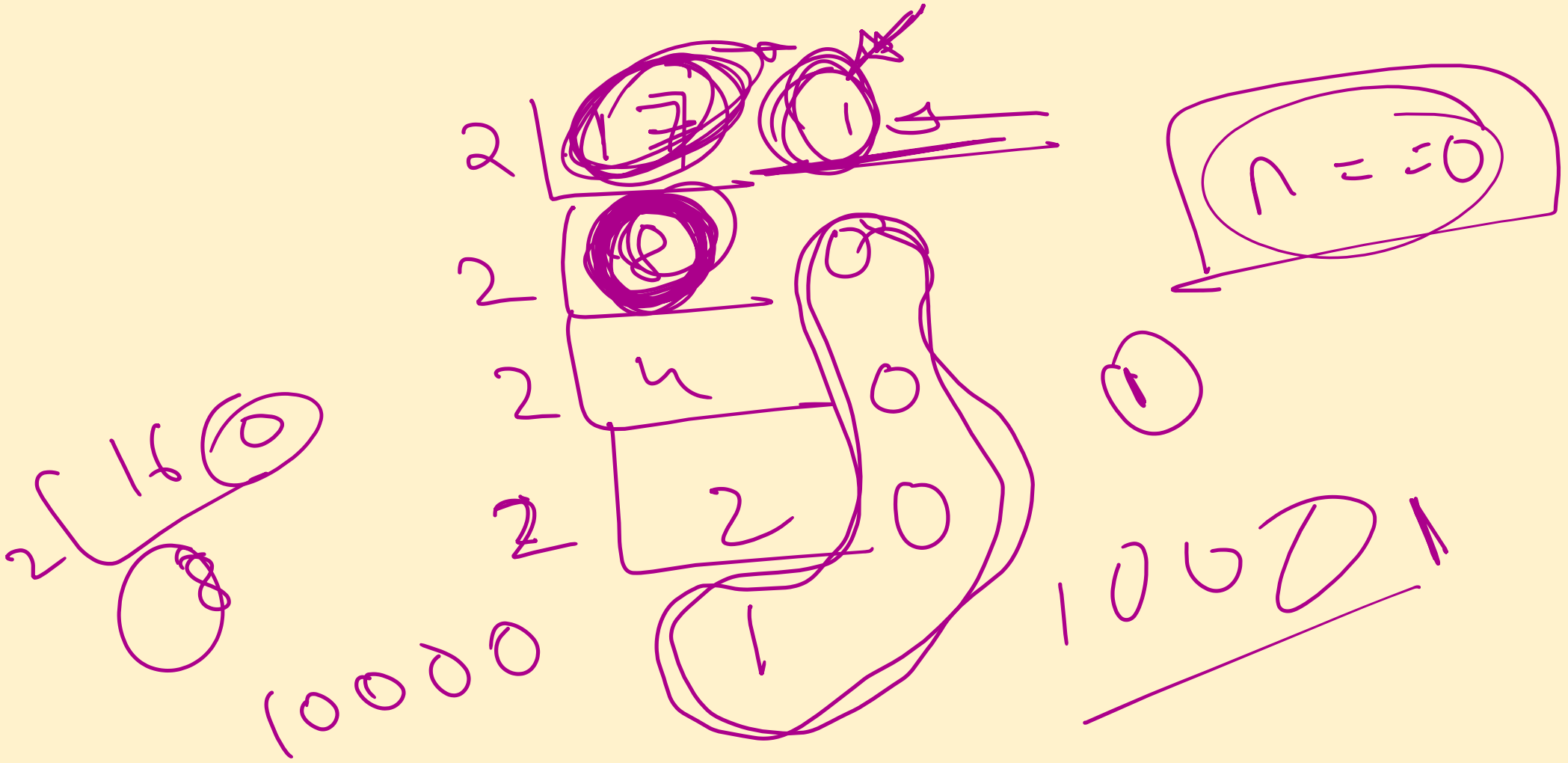
if (n == 1) return "1";

if (n == 0) return "0";

if (n == 0) return "";

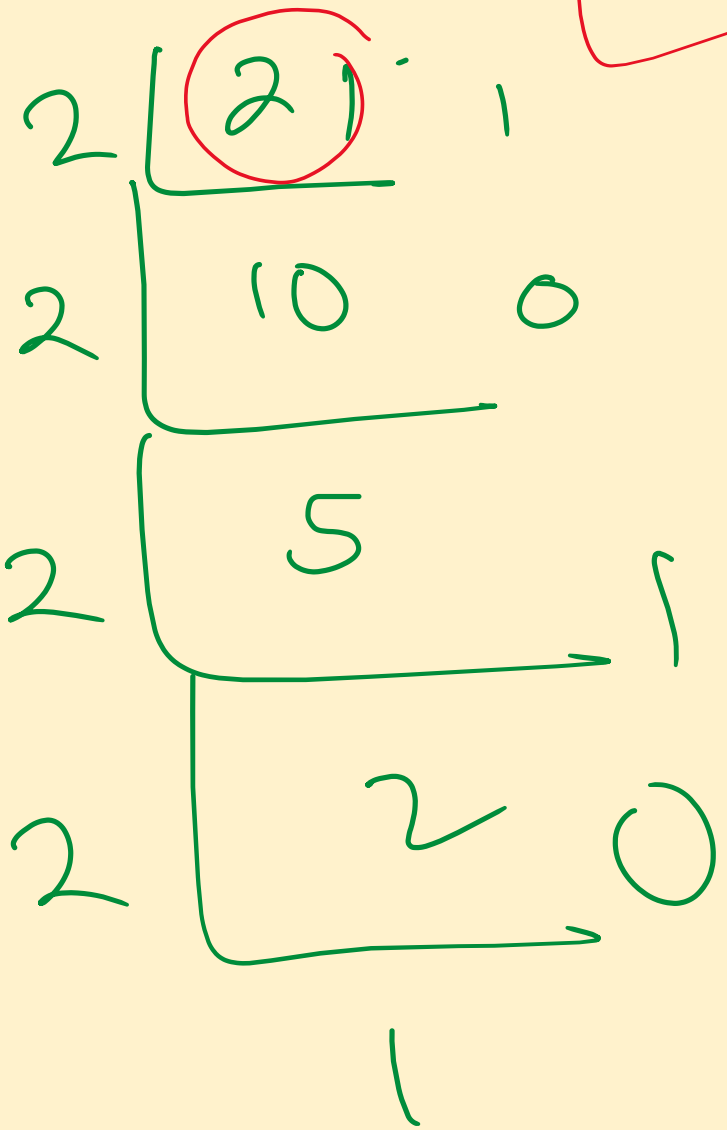

"1" + "1" = "10"
f(n = 1)
f(n = 0)
"0"
"1"
"11"
"0110"
"110"
0110
110


17 → 8 → 4 → 2 → 1 → 0
f(17)
"010001"
f(8)
"01000"
f(4)
"0100"
f(2)
"010"
f(1)
"01"
f(0)
"0"
01
"1"


2 17 1
2 8
2 4 0
2 2 0
1
n == 0
2 16 0
0
10000
10021

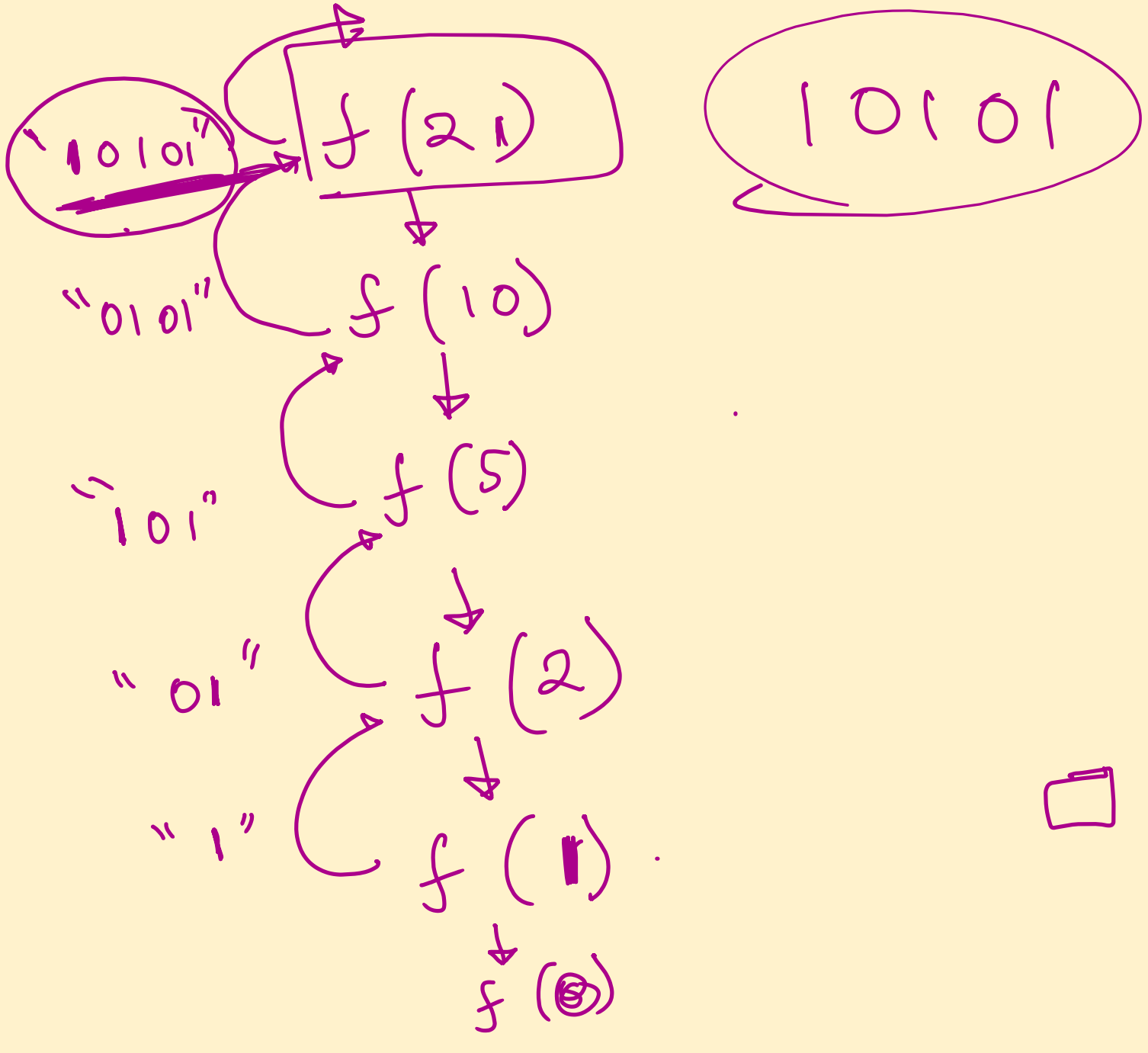
ans +=

f(21) → 10101

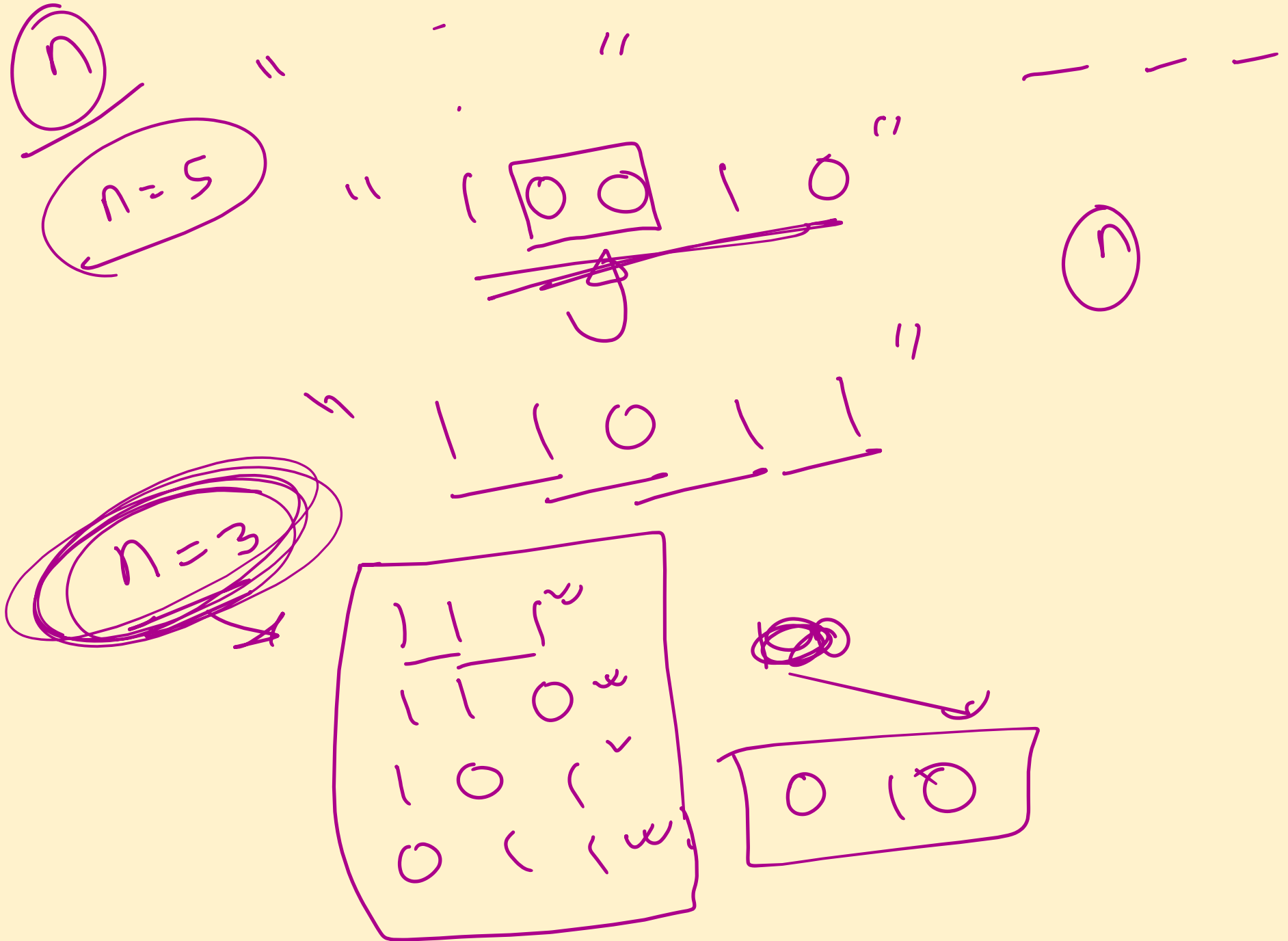


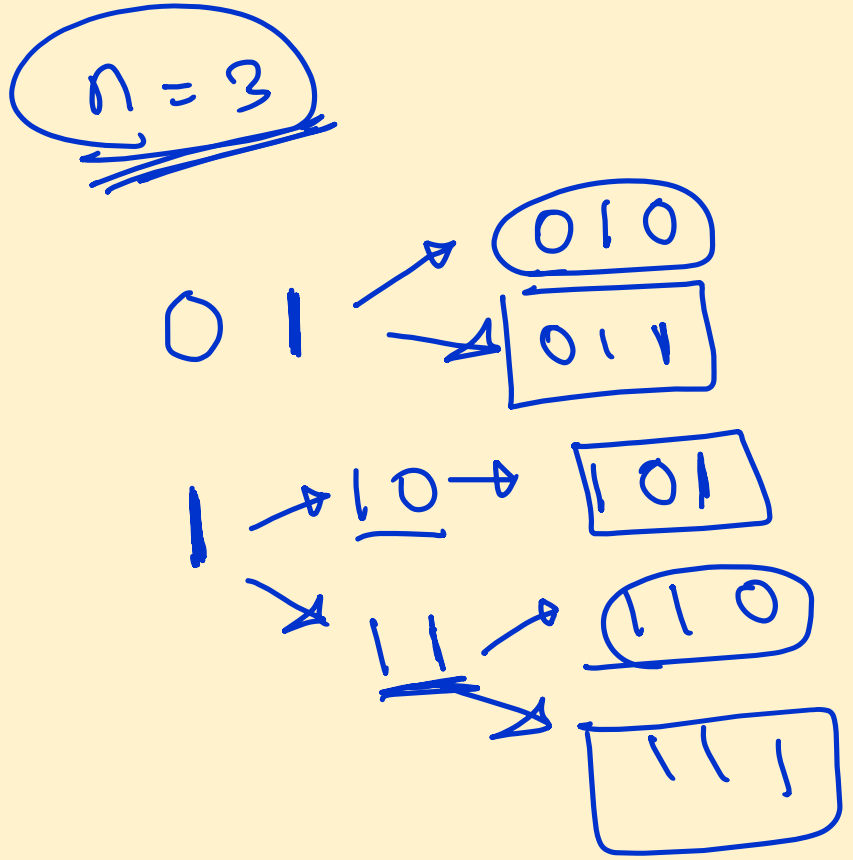
10101

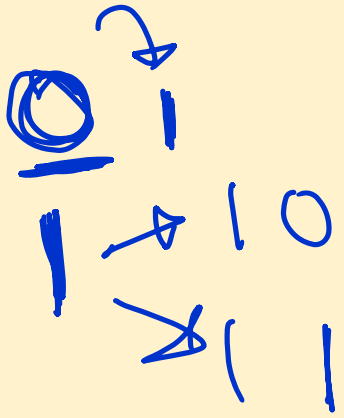
10101

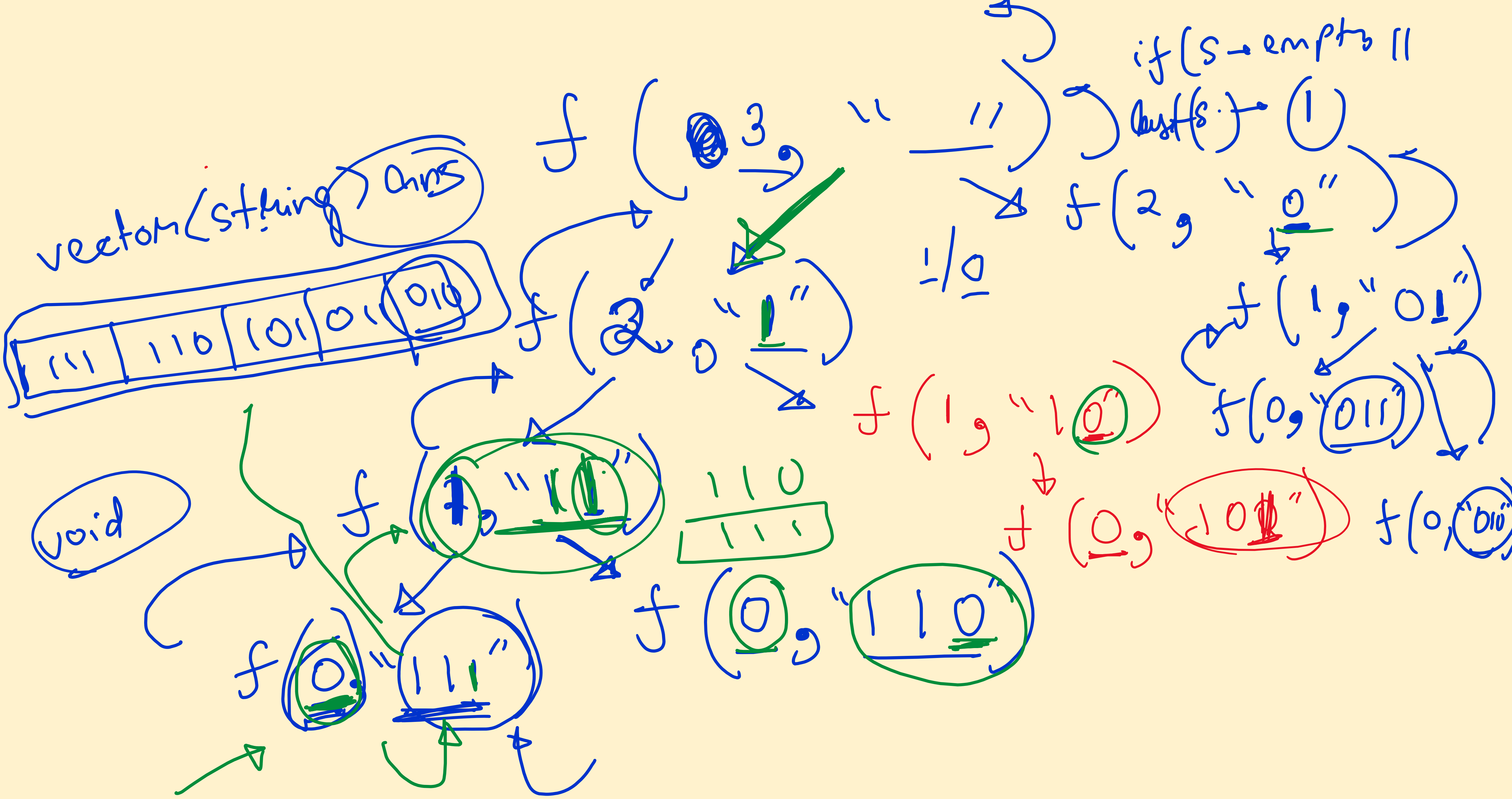

"10101"
f(21)
"0101"
f(10)
"101"
f(5)
"01"
f(2)
"1"
f(1)
f(0)
10101

Generate binary strings without adjacent zeroes

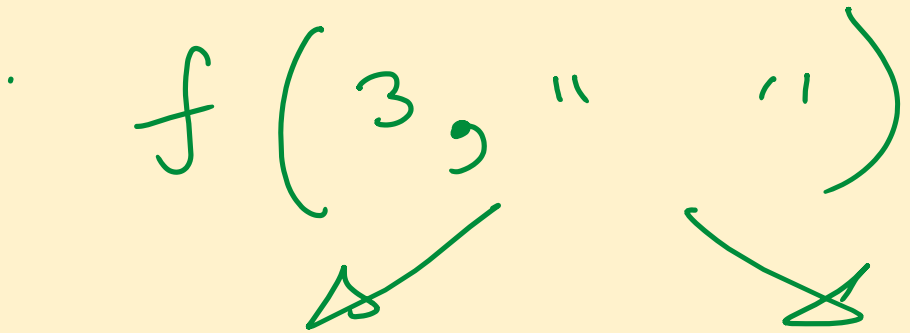

n
n=5
n
n=3


n = 3
0
1
010
011
1
10
101
11
110
111


0
1
1
10
1



vector<string> ans
111 | 110 | 101 | 011 | 010
void
f(3, "")
if(s→empty ||
push(s.) → 1
1/0
f(2, "1")
f(2, "0")
f(1, "11")
110
111
f(1, "10")
f(1, "01")
f(0, "111")
f(0, "110")
f(0, "101")
f(0, "011")
f(0, "010")


f (3 , " , ")