Pattern 9:

num = 5

```
1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
```

num = 6

```
1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
6 6 6 6 6 6
```

4? $2^4 \geq 16$ ✓

00000101

1's complement → 11111010

add Binary 1 → + 00000001

2's complement → 11111011

9 → ...00001001

− 7 → ...00001111

2

11111001

+ 00001001

00010010 ←

7's 1 complement:

00000111

1's comp → 11111000

binary 1 → + 00000001

11111001

Subtract in binary:

9 → 1001

7 → 0111

2 → 0010

9−7=2

9+(−7)=2

↓

negative number

−x = x''

2's complement

111

000

001

111101

DSA Lvl-2 (bit manipulation) (-√2n)

int x=5; sout(x)

Decimal no. system	Binary no. system
0	0
1	1
2	
3	
4	
5	
6	
7	
8	
9	

Octal no. system
0 10
1
2
3
4
5
6
7

$(600)_{10}$ octal system

0 1

Binary → 0 1

Conversion bet^n decimal and binary no system

$(57)_{10} \Rightarrow (\ \ )_2$

2	57	1
2	28	0
2	14	0
2	7	1
2	3	1
	1	

(111001)

$(40)_{10} \rightarrow (101000)_2$

even → 0

odd → 1

101000

$32+8=40$

$(68)_{10} \Rightarrow (\ \ )_2$

2	68	1
2	34	0
2	17	0
2	8	0
2	4	0
2	2	0
	1	

$(1000001)_2$

To calculate storage capacity of a data-type.

-2^{n-1} to $2^{n-1}-1$

-2^{n} to $(2^{n}-1)$

int → 32 bits $(-2^{31}$ to $2^{31}-1)$.

long → 64 bits

short → 16 bits

byte → 8 bits (−128 to 127)

bits

0 → 0

1 → 1

2 → 10

3 → 11

4 → 100

5 → 101

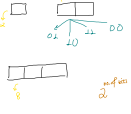
6 → 110

7 → 111

8 → 1000

9 → 1001

10 → 1010



byte	short	int	long
(8 bits)	(16 bits)	(32 bits)	(64 bits)
	n-1 bits	n-1 bits	n-1 bits

msb (MSB) MSB → 0 → +ve, MSB → 1 → −ve

msb	1	0	1	1	0	1	0

$2^7 = 128$

−128 to 127

127 → 01111110

−127 → 01111111

128 → 10000000

−128 → 10000000

byte → −128 to 127.

$(100101)_2 \Rightarrow (37)_{10}$

$2^5 \times 0$ $2^4 \times 1$

100101

$2^2 \times 1$ $2^1 \times 0$ $2^0 \times 1$ $2^5 \times 1$

$32+0+6+4+0+1$

Add 2 nos. in binary system:

11 → 1011

8 → 101

16 → 10000

```
  1 1 1
  1011
   101
  10000
```

```
  1 1 1 1
  1011 1
   101
  1011
  10000
```

Pattern 10:

num = 5

```
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
```

num = 6

```
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
16 17 18 19 20 21
```