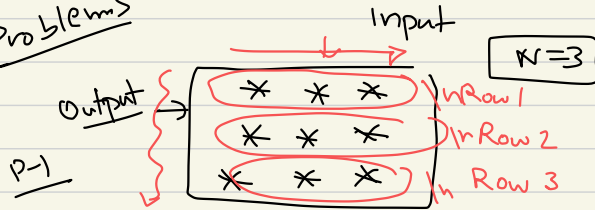


Patterns Problems

Apply the Concepts (Branching, Looping)



$1 \rightarrow \text{Row}$

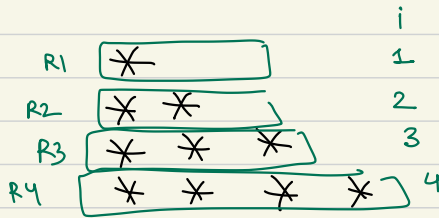
```
for (i=1; i<=N; i++) {
```

// work

```
for (j=1; j<=N; j++) {
    Print('*');
}
```

println

P-2



i no stars in i th Row

Outer $\rightarrow N$
Inner $\rightarrow M$

- Row 1
- Row 2
- Row 3



Rect

$N=3, M=4$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 Row 1 { 1 2 3 4
 Row 2 { 1 2 3 4
 Row 3 { 1 2 3 4

$N=4 \rightarrow$
 $j=1 \rightarrow 1$
 $i=2 \quad j=1 \rightarrow 2$
 $i=3 \quad j=1 \rightarrow 3$
 $i=4 \quad j=1 \rightarrow 4$

\rightarrow in the Row i need
 i numbers
 \rightarrow inner loop $\rightarrow i$ times

$N=4$
 val \rightarrow 1

$N \rightarrow$
 1 2 3 4
 2 3 4 5 6
 3 4 5 6 7 8 9 10

Structure

1
 2 3
 4 5 6
 7 8 9 10

val = 1

N Rows
 l cols in lth row
 Val starts from 1
 And inc by 1 at each step

val is diff from col No

Q) $N=10 \rightarrow$ last no of Pattern

$$1 + 2 + 3 + \dots + N = 10$$

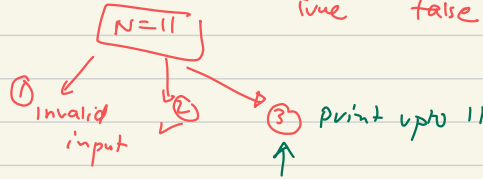
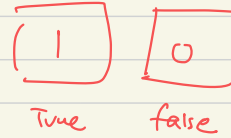
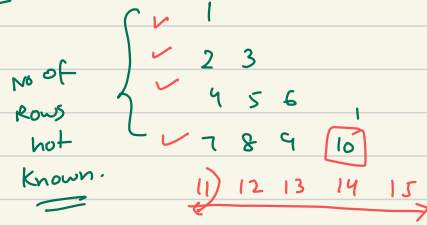
$$\frac{N(N+1)}{2} = 20$$

$$\Rightarrow N^2 + N = 40 \Rightarrow N = 6$$

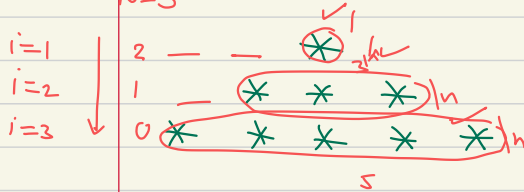
///

boolean $x = \text{true};$

boolean $\text{isRainy} = \text{false};$



$N=3$



Obs.

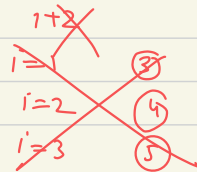
- There are N Rows
 - each Row $\frac{N-i}{2}$ Spaces
- $2i-1$ Stars
- $2i-1$ new line

$N-i$ Spaces

$3-1 = 2$

$3-2 = 1$

$3-3 = 0$



- $(2)-1 = 1$
- $2(2)-1 = 3$
- $2(3)-1 = 5$

4, 8, 12, 16 ... i^{th} term

1, 3, 5, ... $2i-1$

1, 3, 5, ...

$$\begin{aligned} T_i &= a + (i-1)d \\ &= 1 + (i-1)2 \\ &= 1 + 2i - 2 \\ &= \boxed{2i-1} \end{aligned}$$

Proof

Arithmetic Progression (Find out i^{th} term of series)

5, 8, 11, 14, ...

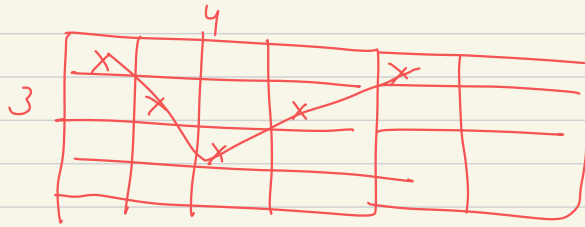
diff
or
cons.
terms
is
constant

$$\begin{aligned} T_n &= a + (n-1)d \\ T_4 &= 5 + (4-1)3 \\ &= 5 + 3 \cdot 3 \\ &= \boxed{14} \end{aligned}$$

5 + 3 + 3 + 3
3 times d to
get n^{th}
term

3, 7, 15, 28 X
3, 7, 11, 15 ✓ (4)

$$\Rightarrow T_i = \underbrace{a}_{\substack{\uparrow \\ i^{\text{th}} \text{ term}}} + (i-1) \underbrace{d}_{\substack{\uparrow \\ \text{diff}}}$$



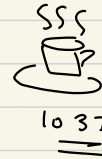
$d = -4$
 $15, 11, 7, 3, \textcircled{-1} \dots$

$(a - 4(5)) \Rightarrow \textcircled{-1}$ $\textcircled{5}$

$$\begin{aligned} T_i &= a + (i-1)d \\ &= 15 + (i-1)(-4) \\ &= 15 - 4i + 4 \\ &= \boxed{19 - 4i} \end{aligned}$$

$N=4$

$\left\{ \begin{array}{ccccccc} & & & 1 & & & \\ & & 2 & 3 & & 2 & \\ & 3 & 4 & 5 & 4 & 3 & \\ 4 & 5 & 6 & 7 & 6 & 5 & 4 \end{array} \right.$



Rows

↳ spaces

→ ↑ no

→ no ↓

3 inner loops

$N=4$
 i^{th} Row

1	- - - -	→ 1
2	- - - -	→ 2 3 2
3	- - - -	→ 3 4 5 4 3
4	- - - -	→ 4 5 6 7 8 5 4
5	5 6 7 8 - - - -	→

Outer Loop
 (Rows)

$i=3$

③ ✓
 ④ ✓
 ⑤ ✓
 ⑥ → stop

$N-i$
 Spaces

3 (4-1)
 2 (4-2)
 1 (4-3)
 0 (4-4)

↘
 1
 Numbers ↑

Start from
 val i
 in every Row

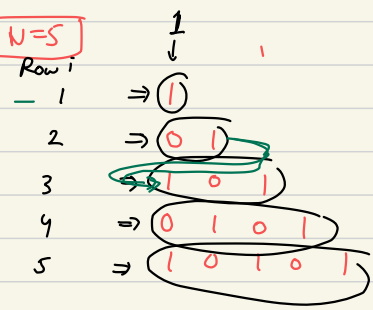
$i-1$

Numbers ↓

0
 1
 2
 3

Start from
 val 1 less
 than last
 printed val.

N=5



✓ i No's in every Row

✓ odd start → 1
Row

✓ even Row start → 0

✓ val is update ^{Toggle} 1 → 0 → 1 → 0 →

val = 0
1
0
1
0

$$\begin{aligned} \text{val} &= 1 - \text{val} \\ &= 1 - 0 \\ &= 1 - 1 \\ &= 1 - 0 \end{aligned}$$

→ update ^{Toggle}

Repeat \cdot $\text{val} = \frac{1 - \text{val}}{1 - 1}$

$\text{val} = 0$
 $1 \rightarrow$
 $0 \rightarrow$
 $1 \rightarrow$

$1 - 0 = 1$
 $1 - 1 = 0$
 $1 - 0 = 1$
 $1 - 1 = 0$

$N = 5$

```

X X X X X
X       X
X       X
X       X
X X X X X

```

\hookrightarrow Hollow Square

(optional) Challenge

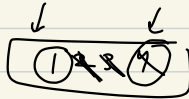
N=3

```

  *      * * *
  *      *
 * * * * *
      *
      *
 * * * * *
```



N=5



print (n/10)

last_digit = n % 10

while (n > 0) {

→ last_digit = n % 10;

→ n = n / 10

print (last_digit) → 1, 4

①

0 % 10 = 0

GCD → Maths (Euclid's Algo) Maths / wed
 ↳ Long Div Method.

	8	12
i=1	✓	✓
i=2	✓	✓
i=3	x	✓
4	✓	✓
5	x	x
6	x	✓
7	x	x
8	x	x

hcf ⇒

①

②

④ ←

for (1 to min(A,B))

↳ biggest

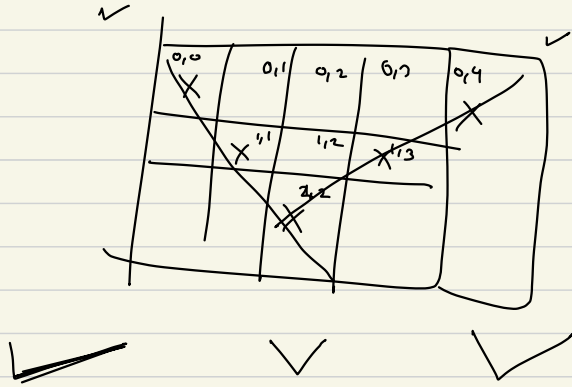
no
div both.

Answer

1 1
 ↓ ↑
 23 23

49, 23

gcd = 1



2D Matrix