1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

3 type of questions possible :-

1) Find the element in ith row and jth column

2) Print all the elements of nth row

3) Print Pascal's triangle till nth row.

<u>1st Question</u>

Formula = $^{i-1}C_{j-1}$

$$^{n}C_{r} = \frac{n!}{(n-r)!\,r!}$$

$\boxed{\text{So, Brute force technique will take } O(n!) \text{ time to find } ^{n}C_{r}}$

$$^{6}C_{4} = \frac{6\times5\times4\times3\times\cancel{2!}}{\cancel{2!}\times4!}$$

$$= \frac{6\times5\times4\times3}{4\times3\times2\times1}$$

Similarly, $^{5}C_{3} = \dfrac{5\times4\times3}{3\times2\times1}$

Always multiply like this.

$\frac{5}{1}\times\frac{4}{2}\times\frac{3}{3}$ (for Coding to get right answer)

So, $\boxed{^{n}C_{r} = \dfrac{n\times(n-1)\times(n-2)\times\text{---- } r \text{ times}}{r\times(r-1)\times(r-2)\times\text{---- } r \text{ times}}}$

optimal way

```
fun(n, r)      ans = 1
for (i=0; i<r; i++) {
    ans = ans * (n-i)
    ans = ans / (i+1);
}
```

$T = O(r)$

$\Downarrow$

To find $^{n}C_{r}$

2nd Question

Brute force approach

```
for (i=1; i <= n ; i++) {
    print( fun(n-1, i-1));
}
```

$T = O(n) \cdot O(r)$
$= O(nr)$

Optimal approach

$n=6$

1	5	10	10	5	1
$^5C_0$	$^5C_1$	$^5C_2$	$^5C_3$	$^5C_4$	$^5C_5$
0	1	2	3	4	5

$1 \quad \frac{5}{1} \quad \frac{5\times4}{1\times2} \quad \frac{5\times4\times3}{1\times2\times3} \quad \frac{5\times4\times3\times2}{1\times2\times3\times4} \quad 1$

obvious $\Leftarrow$ $\Rightarrow$ obvious

One thing we can observe is :-

$ans = ans * \frac{n - col}{col}$ where $1 \leq col \leq n-2$

So,

```
ans=1;
for(int i=1; i<=n-2; i++) {
    ans = ans * (n-i);
    ans = ans / i;
}
```

$T = O(n)$ = optimal

3rd Question

- Make Pascal Triangle :-

  ⇒ Print each of the element in each row. (For row ranges from (1 to n)

  $T = O(n^2)$ = Optimal