

Lecture 6

Series Problem

Trick ~~(*)~~ Relation $b \mid w$ i (loop) & series

~~(*)~~ Generate formula.

Category 1 : Basic sum

Q1

$$1 + 2 + 3 + \dots + N = (\text{Sum of natural numbers})$$

$n=3$

Trick

| | |
|---|----|
| i | t |
| 1 | 1 |
| 2 | =2 |
| 3 | =3 |
| 4 | 4 |

```
for (int i = 1; i <= 3; i++) {
    sum = sum + i;
}
```

Dry Run

Sum = 0
i = 1, 2, 3, 4

i = t =

$$1 + 2 + 3 = 6$$

Q2 $1 + 3 + 5 + 7 + \dots + N =$

$$l \times 2 - 1 = t$$

$$1 \times 2 - 1 = 1$$

$$2 \times 2 - 1 = 3 \quad \text{int sum} = 0;$$

$$3 \times 2 - 1 = 5 \quad \text{for(int } i=1; i \leq n; i++) {$$

i

$$\begin{array}{|c|c|c|} \hline & 1 & \\ \hline 1 & \cancel{1} + a(1) & \\ \hline 2 & \cancel{2} + a(2) & \\ \hline 3 & = 5 & \\ \hline 4 & = 7 & \\ \hline \end{array}$$

$b = 2$

$$\begin{aligned} b + a &= 1 \\ 2 \times b + a &= 3 \\ -b &= -2 \end{aligned}$$

$$a = -1$$

$$\text{sum} = \text{sum} + 2 * i - 1$$

```
int sum = 0;
```

}

```
for(int i = 1; i <= n; i++) {
```

$y + 2^i - 1$

```
    sum = sum + 2 * i - 1
```

x

Dry Run :

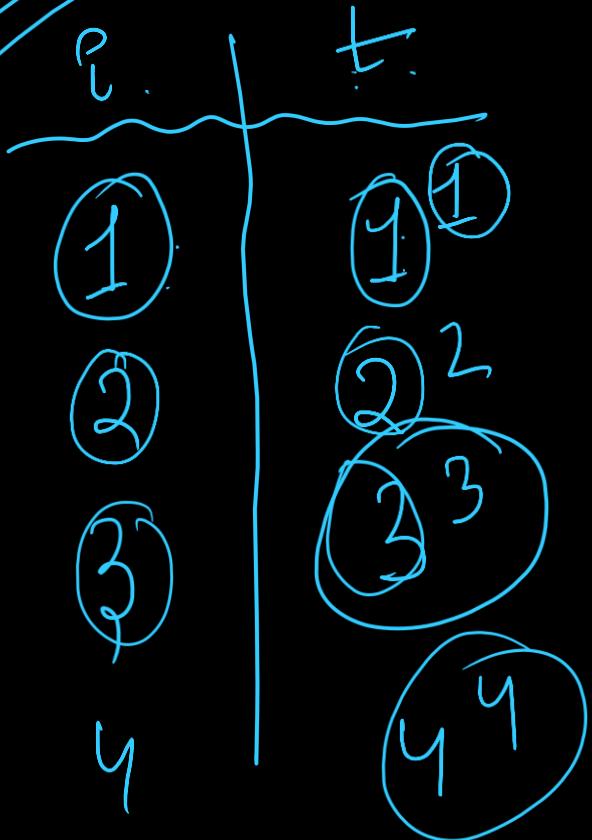
sum = 0

i = 1

~~y~~ ~~2~~ ~~y~~ = 9

$$\frac{Q_2}{H(w)} \cdot 1^1 + 2^2 + \underline{3^3} + 4^4 + \dots + n^n$$

~~$$1^2 + 2^2 + \underline{3^2} + 4^2 + \dots + n^2 =$$~~



$$\boxed{t = 0}$$

int sum = 0;

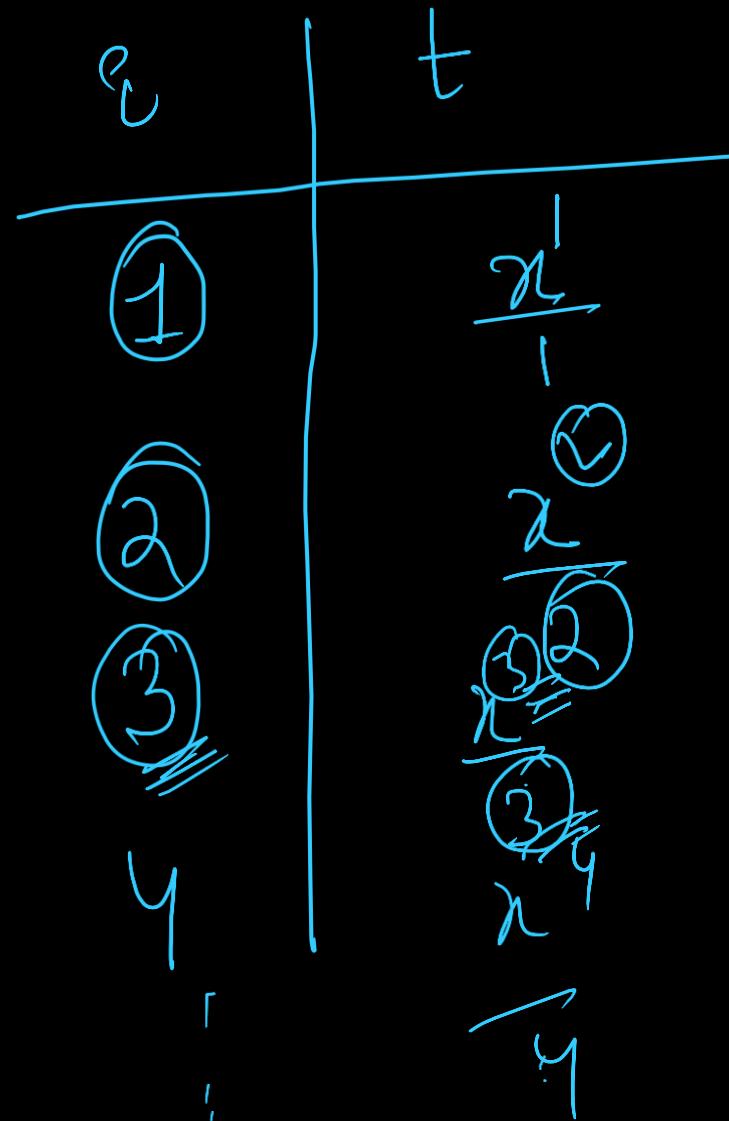
for(int i=1; i<=n; i++){

 sum = sum + pow(l, i)

}

$$1^1 + 2^2 + 3^3$$

$$Q4 \quad 1 + x + \frac{x^2}{2} + \dots + \frac{x^n}{n}$$



```
t = x
for(int i = 1; i <= n; i++) {
    sum = sum + (pow(x, i) / i)
}
```

$$\text{sum} = \text{sum} + \left(\boxed{\text{pow}(x, i)} / i \right)$$

Q5

$$1 \times 2 \times 3 \times 4 \cdots n \quad (\text{h!})$$

$$2! = 1 \times 2$$

$t = i$

$$4! = ((\times 2 \times 3 \times 4))$$

int prod = ~~0~~; $\frac{1}{=}$
for (int i = 1; i <= n; i++) {

prod = prod * i

}

#Category 2 : $t = i \times x + y$

Q1 ① + 4 + 7 + 10

$$\begin{array}{c} i \\ | \\ 1 \end{array} \quad \begin{array}{c} t \\ | \\ 2 \end{array}$$

$$1 \times b + a = 1$$

② $2 \times b + a = 4$

③ 7

$$b + a = 1$$

$$2 \times b + a = 4$$

$$- \quad -$$

$$b = -3$$

$$b = 3$$

$$i \times 3 - 2 = t$$

int sum = 0;

for(int i = 1; i <= n; i++) {

sum = sum + $i \times 3 - 2$

Category 3 : Nested Loop.

Trick

① Formula for outer series

② Formula for inner series

③ Relation b/w i & j

$$\begin{aligned}
 Q1 &= (1 + 3 + 5) + (1 + 3 + 5 + \dots + n) \\
 &\quad + (1 + 3 + 5) + (1 + 3 + 5) + \dots + n
 \end{aligned}$$

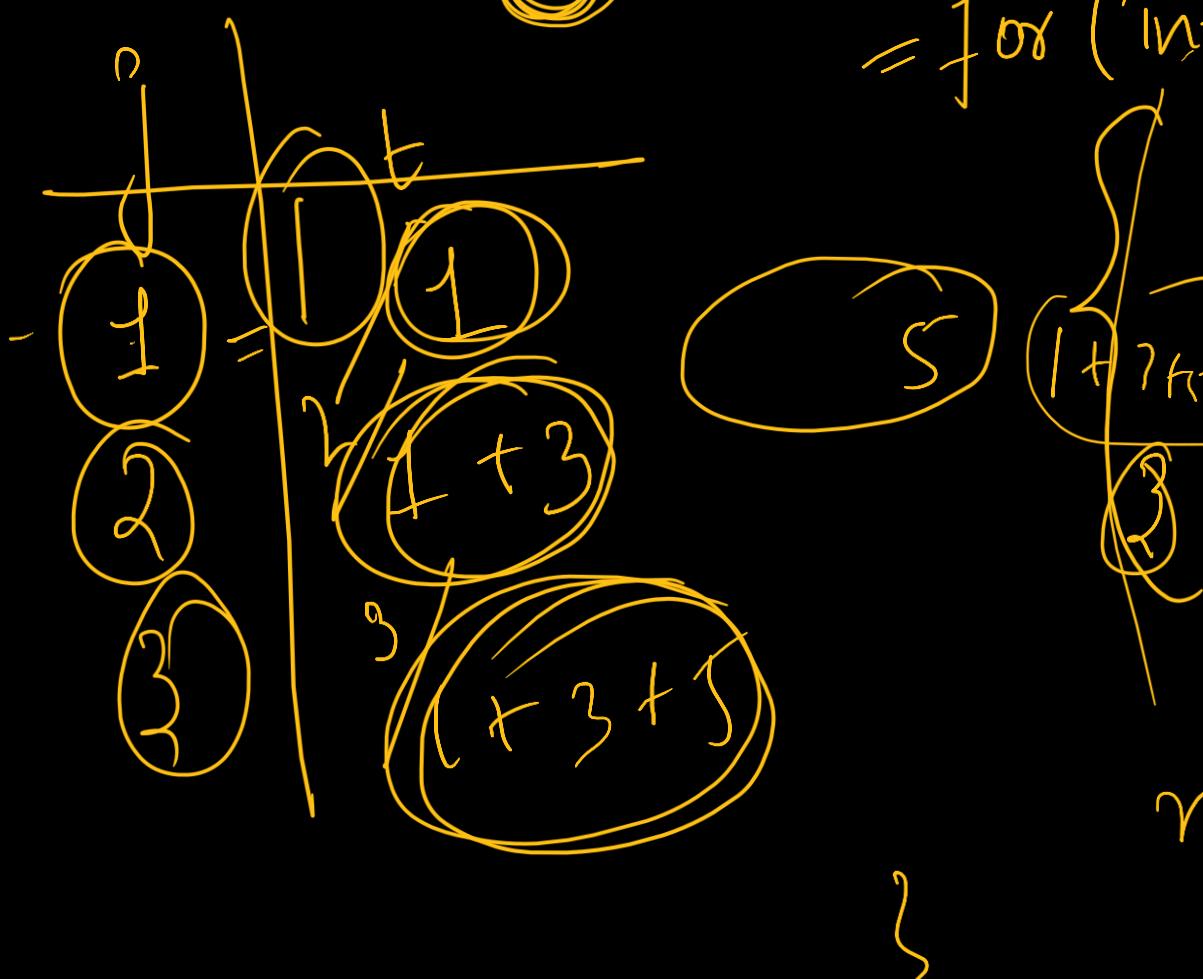
$\text{int } ns = 0;$
 $\text{for } (\text{int } j = 1; j \leq n; j++) \{$

$\text{int } sum = 0;$

$(\text{int } i = 1; i \leq j; i++) \{$

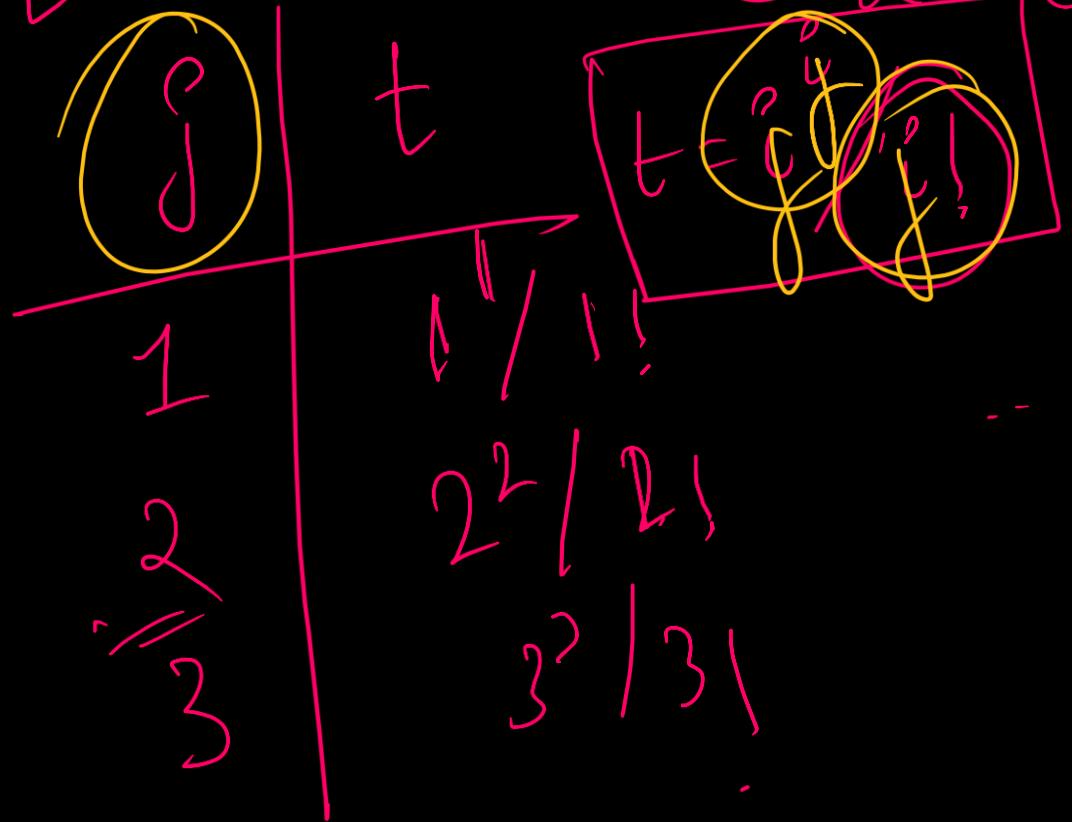
$sum = sum + 2 * i - 1;$

$ns = ns + j / sum$



$$\frac{1}{1!} + \frac{2^2}{2!} + \frac{3^3}{3!} + \dots + \frac{n^n}{n!}$$

$$t = \sum_{i=1}^n i^i$$



int ns = 0;

```
foo(int j = 1; j < n; j++) {
```

```
{ int prod = 1;
for (int i = 1; i <= j; i++) {
```

```
    prod *= i;
}
```

$ns = ns + \text{pow}(j, j) / prod$

Category 5 : Special Series

6 9 14 21 30

