③ $f(n) = \log n!$ find Θ, O, Ω

$$c_1 \cdot g(n) \le f(n) \le c_2 \cdot g(n)$$

$$\log(1 \times 1 \times \cdots 1) \le \log(1 \times 2 \times \cdots \times n) \le \log(n \times n \times \cdots \times n)$$ (n times)

$$\log 1 \le \log n! \le \log n^n$$

$$0 \le \log n! \le n \cdot \log n. \quad \text{— (A)}$$

Zero

$$\therefore f(n) = O(n \cdot \log n)$$

$$f(n) = \Omega(1)$$

But $f(n)$ dont have Average Bound Θ.

④ $f(n) = \log n$

$$\therefore c_1 \cdot g(n) \le f(n) \le c_2 g(n)$$

$$1 \le \log n \le 2 \log n. \quad \text{for } n > 1$$

$$\therefore f(n) = O(\log n)$$

$$f(n) = \Omega(1)$$

$f(n)$ - dont have Θ bound.

⑤ Class Problem:-

$f(n) = 4n^3 + 8n$ Find Θ, O & Ω

$$c_1 \cdot g(n) \le f(n) \le c_2 \cdot g(n)$$

$$4n^3 \le 4n^3 + 8n \le 4n^3 + 8n^3$$

$$4n^3 \le 4n^3 + 8n \le 12n^3.$$

$$\therefore f(n) = O(n^3)$$

$$f(n) = \Omega(n^3)$$