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① $T(n) = 2+4+6+8+16+\ldots+2^n$

Deret : $\frac{a(r^n-1)}{(r-1)} = \frac{2(2^n-1)}{2-1} = 2^{n+1}-2$

Notasi big O → $O(2^n)$

$T(n) \leq C\,2^n$ $\quad 2-\frac{2}{2} \leq C$

$2^{n+1}-2 \leq C.2^n$ $\quad C \geq 1$

$2-\frac{2}{2} \leq C$

Misal $n=1$

② Buktikan bahwa p,q,r positif $T(n) = pn^2+q+r$ adalah $O(n^2)\,\Omega(n^2) \Theta(n^2)$

* pembuktian Big O

$T(n) \leq C.f(n)$

$pn^2+qn+r \leq C.n^2$

$\frac{pn^2}{n^2}+\frac{qr}{n^2}+\frac{r}{n^2} \leq Cn$

$p+\frac{q}{n}+\frac{r}{n^2}$

misal $n=1$

misalkan $p=q=r=1$

$1+\frac{1}{1}+\frac{1}{1} \leq C$

$C \geq 3$

* pembuktian Big Ω ($\Omega(n^2)$)

$T(n) \geq C(n)$

$pn^2+qn^2+r \geq C.n^2$

misal $n=1$ $p,q,r=1$

$p+\frac{q}{n}+\frac{r}{n^2} \geq C$

$1+1+1 \geq C$

$C \geq 3$

* Big Θ

Karena $\Theta(n^2)$ dan $\Omega(n^2)$ terbukti dan sama maka $\Theta(n^2)$ pun benar.

③ Tentukan kompleksitas waktu

$W_{ij} \leftarrow W_{ik}$ dan W_{kj} berulang sebanyak n,n,n

$T(n) = n^3$

Big O → $O(n^3)$	Big Ω → $\Omega(n^3)$
$n^3 \leq C.n^3$	$n^3 \geq Cn^3$
$C \geq 1$	$C \leq 1$

Big Θ → $\Theta(n^3)$

(karena $O(n^3) = \Omega(n^3)$)

maka $\Theta(n^3)$

④ Algoritma penjumlahan 2 matriks

```
for i ← 1 to n do
  for j ← 1 to n do
    Mij ← aij + bij
  end for
end for
```

$T(n) = n^2$ $\quad \Omega(n^2)$

$O(n^2)$ $\quad n^2 \geq C.n^2$

$n^2 \leq C.n^2$ $\quad C \leq 1$

$C \geq 1$

$\Theta(n^2)$ karena $O(n^2) = \Omega(n^2)$

⑤ Algoritma mencari larik

```
for i ← 1 to n do        T(n) = n
  ai ← bi
end for
```

$O(n)$	$\Omega(n)$
$n \leq Cn$	$n \geq Cn$
$C \geq 1$	$C \leq 1$

$\therefore O(n) = \Omega(n) \rightarrow \Theta(n)$

⑥ a) Operasi perbandingan

$T(n) = (n-1)+(n-2)+(n-3)+\ldots+1$

$= \frac{n(n-1)}{2} = \frac{n^2-n}{2}$

b) max pertukaran terjadi

ketika $\frac{n(n-1)}{2}$

c) kompleksitas waktu

- Best case

perbandingan → $\frac{n(n-1)}{2}$ kali

$T(n) = \frac{n(n-1)}{2} = \frac{n^2-n}{2}$

- Worst case

perbandingan → $\frac{n(n-1)}{2}$

asignment → $\frac{n(n-1)}{2}$

Total $(n) = \frac{n(n-1)}{2} + \frac{3n(n-1)}{2} + \frac{4n(n-1)}{2}$

$= 2n^2 - 2n$

$O(n^2)$

$2n^2 - 2n \leq Cn^2$

$2 - \frac{2}{n} \leq C \mid n = 1$

$2 - 2 \leq C$

$C \geq 0$

$\Omega(n^2)$

$\frac{n^2 - n}{2} \geq Cn^2$

$\frac{1}{2} - \frac{1}{2n} \geq C \mid n = 1$

$\frac{1}{2} - \frac{1}{2} \geq C$

$C \leq 0$

$\therefore O(n^2) = \Omega(n^2) \rightarrow \Theta(n^2)$

⑦ a) Algoritma A $\rightarrow O(\log N)$

b) Algoritma B $\rightarrow O(N \log N)$

c) Algoritma C $\rightarrow O(N^3)$

$N = 8$

- A $\rightarrow O(\log 8) = O(3 \log 2)$
- B $\rightarrow O(8 \log 8) = O(24 \log 2)$
- C $\rightarrow O(8^3) = O(64)$

A tercepat dengan 0.301

⑧ Operasi Assignment

Algo P_2

$bn \leftarrow qn$ 1 kali

$bn \leftarrow qk + b_{k+1}$, x n kali

$T(n) = 1 + n$

$O(n)$ untuk P_2

Algoritma P

Pertambahan = n kali

Perkalian = n kali

$T(n) = 2n$

maka P^2 lebih baik karena lebih kecil dari P