$n/2^k$ $\frac{x^n}{\theta(\log n)}$

$\theta(\log n)$

x^n

x^n $\theta(\log n)$

```
Power(x, n)
  y = 1
  while(n>0)
  { if(n%2 == 1)  y = y × x.
       x = x^2 .
  }    n = n/2
  return y;
```

x^{21}

n	x	$y=1$
21	x	$y=x$
10	x^2	x
5	x^4	x^5
2	x^8	x^5
1	x^{16}	x^{21}
0	x^{32}	

x^{21}

$x \quad x^2 \quad x^4 \quad x^8$

$d_i: \quad n = \sum 2^i b_i$

$x^{d_i}: \quad y = 1$

for d_i

$y := y \times x$

$x = x^{10}$

10

$$n = \sum 10^i d_i \qquad d_i \in \{0 \ldots 9\}$$

x^{10^i}

$$x^n = x^{\sum 10^i d_i}$$

$$x^{10^i d_i} = (x^{10^i})^{d_i}$$

$$= \prod_{i=0}^{k} x^{10^i d_i}$$

10

```
while(d_i > 0)
{
    y = y × x
    d_i--;
}
```

$y = y \cdot x^{d_i}$

$\Theta(\log n)$

$\Theta(n)$

$$F(n) = \left(F(n-1) + F(n-3) + 1\right) \% m \quad \Theta(\log n)$$

$F(n-1)$

$F(n-2)$

$$\begin{bmatrix} F(n+1) \\ F(n) \\ F(n-1) \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} F(n) \\ F(n-1) \\ F(n-2) \\ 1 \end{bmatrix}$$

1. $F(n) = \left(F(n-3) - F(n-1) + 21\right) \% \, \cancel{2} \; m$

2. $F(n) = \left(F(n-4) + F(n-2)\right) \% \, m$

3. $F(n) = \left(F(n-5) - F(n-3) + F(n-1)\right) \% \, m$

a_0 — — — a_{n-1}

Max $a_i - a_j$

max = 0

i → 0 to n

j → 0 to n

if ($a_i - a_j$ > max)

max = $a_i - a_j$

$\theta(n^2)$

max - min

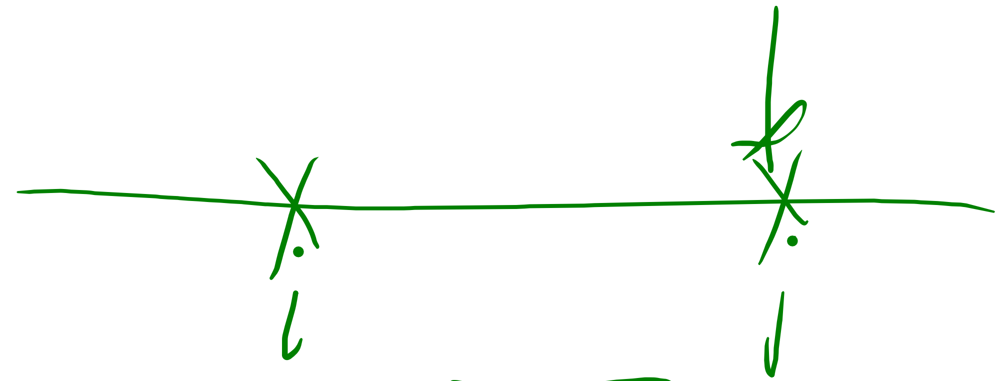
$\theta(n)$

$\cancel{\max_{i} a_k}$

$$i = \arg\min_{k<j} a_k$$

$$\max_{j>i} a_j - a_i$$

$a_0 \ldots \ldots a_{n-1}$



99, 100 2 75 1, 2

$i \to 0$ to n

$j \to i+1$ to n

if $(a_j - a_i > max)$

$max = a_j - a_i$

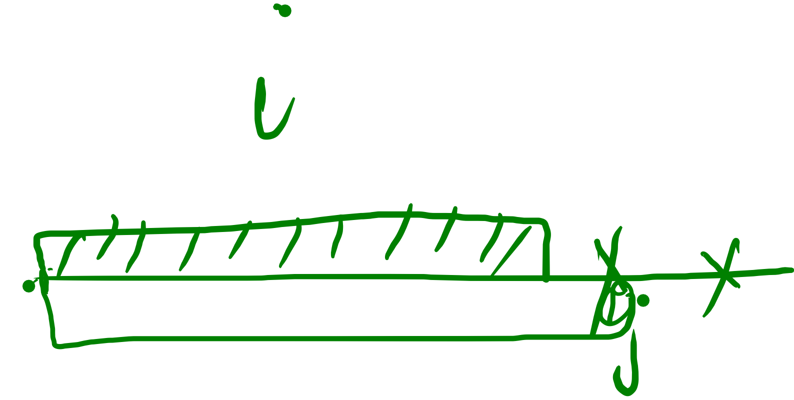
$\Theta(n^2)$

$i = 0 \quad max = -\infty$

$j \to 1$ to n

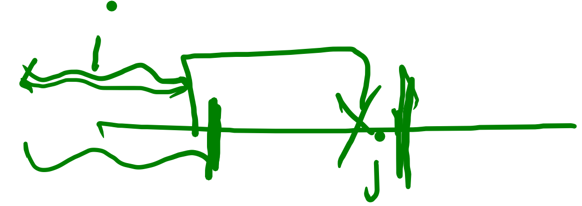
if $(a_j - a_i > max)$ $max = a_j - a_i$

if $(a_j < a_i)$ $i = j$;



Max $a_j - a_i$

$j \geq i+1$



$i = 0$

$i \to 0$ to n

$j \to i+1$ to n

if$(a_j - a_i > max)$

$max = a_j - a_i$

$O(n^2)$

$j \to l$ to n

if$(a_j - a_i > max)$

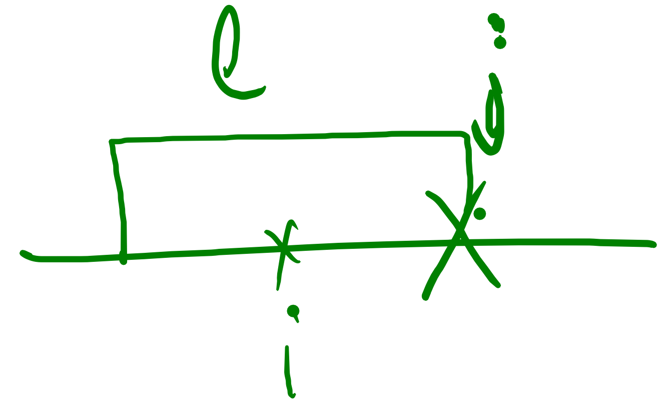
$max = a_j - a_i$

if$(a_{j-l+1} < a_i)$

$i = j - l + 1;$

Max $a_j - a_i$

$i+l \geq j > i$



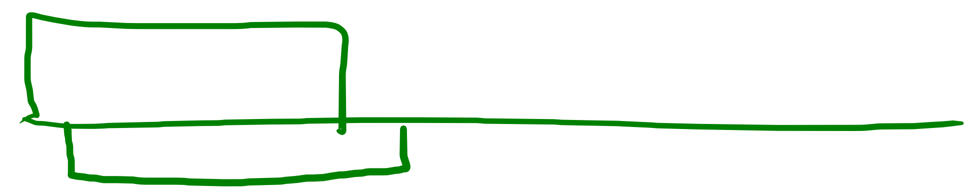
$i \to 0$ to n

$j \to i+1$ to $i+l+1$

if ($a_j - a_i > max$)

$max = a_j - a_i$

$\underline{\underline{\theta(n^2)}}$.



a_0 - a_1 a_2 - - - a_{n-1}

x^4

3

$n-l$

2 3 1 6 4 7 9 2

$l = 3$

3 5 7 9

2 3 2 1 1 1 4 4 2

Queue.

stack

i

$n = \sum_{i=0}^{k} b_i 2^i \quad b_i \in \{0, 1\}$

$x^{2^i} \quad b_i \to 1$

$x^n = x^{\sum_{i=0}^{k} b_i 2^i}$

$x^{a+b} = x^a \cdot x^b$

$y = y \times x$

$$= \prod_{i=0}^{k} x^{b_i 2^i}$$

$\sum x_i$

$b_i \begin{cases} 0 & x^{b_i 2^i} = 1 \\ 1 & x^{b_i 2^i} = x^{2^i} \end{cases}$

$\prod x_i$

$b_k \ldots \ldots b_j \cancel{b_1} \, b\cancel{0}$

$b_k \ldots \ldots b_i$

$i = 0$; $a = 0$; $top = 0$;

$S[top{+}{+}] = i$

for $j \to 1$ to n

if $(a_j - a_{S[top]} > max)$ $max = a_j - a_i$

while$(top > 0$ & $A_{S[top-1]} > a_j)$ $top--$;

$S[top{+}{+}] = j$

$1 + j - i > l$

$i = S[a]$

if $(j + 1 - i > l)$ $i = S[a{+}{+}]$