به نام خدا

درس: ساختمان داده

کلاس حل تمرین جلسه ۱

استاد : دکتر نجار

حل تمرین :کاظم پور

Email : am.kazempour@gmail.com

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یسری از قواعد ریاضی:

$$\sum_{i=1}^{n}(i) = 1+2+3+_{,,,,,,}+n=$$

$$\sum_{i=۱}^{n} i = ۱ + ۲ + \ldots + n = \frac{n(n+۱)}{۲} \sim \frac{۱}{۲}n^۲ = \theta(n^۲)$$

یسری از قواعد ریاضی:

$$\sum_{i=1}^{n}\left(i^2\right) = 1^2 + 2^2 + 3^2 + \ldots + n^2 =$$

٢) $\displaystyle\sum_{i=١}^{n} i^٢ = ١^٢ + ٢^٢ + \ldots + n^٢ = \frac{n(n+١)(٢n+١)}{۶} \sim \frac{١}{٣}n^٣ = \theta(n^٣)$

$$\sum_{i=1}^{n} \left(i^3\right) = 1^3 + 2^3 + 3^3 + ,,,,,, + n^3 =$$

$$\sum_{i=1}^{n} = \left(i^3\right) = 1^3 + 2^3 + \neg + n^3 = \frac{1}{4} n^4 \Rightarrow \Theta(n^4)$$

یسری از قواعد ریاضی:

$$\sum_{i=1}^{n}\left(i^k\right) = 1^k + 2^k + 3^k + ,,,,,, + n^k =$$

$$\sum_{i=1}^{n} i^k = 1^k + 2^k + ... + n^k \sim \frac{1}{k+1} n^{k+1} = \theta(n^{k+1})$$ (k > 0 عدد ثابت)

$$\sum_{i=1}^{n} = (1) = 1 + 1 + \sim + 1 = n$$

$$\sum_{i=1}^{n}\left(\frac{1}{i}\right) = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n} =$$

$$\sum_{i=1}^{n}\frac{1}{i} = 1 + \frac{1}{\Upsilon} + \frac{1}{\Upsilon} + \ldots + \frac{1}{n} \sim Lnn = \theta(Lgn)$$

$$\sum_{i=m}^{n}(a) =$$

$$\sum_{i=1}^{\infty \leq n}(a) = \underbrace{a + a + \dots + a}_{n} = n\,a \Rightarrow \Theta(n)$$

ضریب

$$\sum_{i=0}^{n}(a \times x^{i}) =$$

$$\sum_{i=1}^{n}(a \times x^{i}) = a * x^{1} + a \times x^{2} + \dots + a \times x^{n}$$

$$= a\,(x^{1} + x^{2} + \dots + x^{n}) \Rightarrow \Theta(x^{n})$$

ضریب

$$\log_c(a \times b) =$$

$$\log_c(a \times b) = \log_c a + \log_c b$$

$$\log_{b^n}(a^m) =$$

$$\log_{b^n} a^m = \frac{m}{n} \log_b |a|$$

$$\log_c\left(\frac{a}{b}\right) =$$

$$\log_c^{\left(\frac{a}{b}\right)} = \log_c^{a} - \log_c^{b}$$

$$\log_b(a) =$$

$$\log_b^{a} = \frac{1}{\log_a^{b}}$$

$$a^{\log_c(b)} =$$

$$a^{Log_c^b} = b^{Log_c^a}$$

$$a^{\log_a(b)} =$$

$$a^{Log_a^b} = b$$

تعداد چاپ "*" در هر چقدر است؟

```
for ( i = 0 to 10)
{
    print("*")
}
```

for (i=1 to 10) => 10 => $\Theta(1)$
print("*")
باب اجرا

منظب
(10) x 1

```
for ( i = 0 to n)
{
    print("*")
}
```

for (i=1 to n) => n => $\Theta(n)$
print("*")
باب اجرا

```
for ( i = 0 to n)
{
    for ( j = 0 to 10)
    {
        print("*")
    }
}
```

$$\Rightarrow \quad 10 \, n \quad \Rightarrow \theta(n)$$
$$\text{بار}$$
$$\text{اجرا}$$

```
for ( i = 0 to n)
{
    for ( j = 0 to n)
    {
        print("*")
    }
}
```

$$\sum_{i=0}^{n} \sum_{j=0}^{n} (1) \Rightarrow \sum_{i=0}^{n} (n) \Rightarrow \overbrace{n+n+\dots+n}^{n \text{ بار}} = n \times n = n^2$$
$$\Rightarrow \theta(n^2)$$

تعداد چاپ "*" در هر چقدر است؟

```
for ( i = 0 to n )
{
    for ( j = 0 to i )
    {
        print("*")
    }
}
```

$$\sum_{i=0}^{n} \sum_{j=0}^{i} (1) \Rightarrow \sum_{i=0}^{n} (i) \Rightarrow 0 + 1 + 2 + 3 + \cdots n$$

$$= \frac{n(n+1)}{2} \Rightarrow \theta(n^2)$$

تعداد چاپ "*" در هر چقدر است؟

```
for (i = 1 to n)
    for (j = 1 to i)
        for (k = 1 to j)
            print (" * ")
```

$$\sum_{j=0}^{n} \sum_{j=0}^{i} \sum_{k=0}^{j} (1) \Rightarrow \sum_{i=0}^{n} \sum_{j=0}^{i} (j) \Rightarrow \sum_{i=0}^{n} \frac{i(i+1)}{2}$$

$$\Rightarrow \underbrace{\frac{1}{2}}_{\text{ضریب}} \left(\underbrace{\sum_{i=0}^{n} i^2}_{\theta(n^3)} + \underbrace{\sum_{i=0}^{n} i}_{\theta(n^2)} \right) \Rightarrow \theta(n^3 + n^2) = \theta(n^3).$$