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Soru 1

$$\underset{d_0 \quad d_1}{\underbrace{2\times 3}}\; M_1 \times \underset{d_2}{\underbrace{3\times 6}}\; M_2 \times \underset{d_3}{\underbrace{6\times 4}}\; M_3 \times \underset{d_4}{\underbrace{4\times 2}}\; M_4 \times \underset{d_5}{\underbrace{2\times 7}}\; M_5$$

$$\frac{n(n-1)}{2} = n^2 \times n = n^3$$

$$O(n^3)$$

M ($i \downarrow$, $J \rightarrow$)

M	1	2	3	4	5
1	0	36	84	96	124 → Çarpma sayısı
2		0	72	84	126
3			0	48	132
4				0	56
5					0

K	1	2	3	4	5
1	–	1	2	1	4
2		–	2	2	4
3			–	3	4
4				–	4
5					–

$\rightarrow (M_1 \times M_2 \times M_3 \times M_4) \times M_5$

$((M_1) \times M_2 \times M_3 \times M_4) \times M_5$

$\boxed{((M_1) \times ((M_2) \times (M_3 \times M_4))) \times M_5}$

→ Çarpma sırası

$$c[i,J] = \min_{i \leq k < J} \{ c[i,k] + c[k+1,J] + d_{i-1} \times d_k \times d_J \}$$ → Genel formül

$$c[1,2] = \min_{1 \leq k < 2} \quad k=1 \left\{ \begin{matrix} c[1,1] + c[2,2] + d_0 \times d_1 \times d_2 \\ 0 + 0 + 2 \times 3 \times 6 \end{matrix} \right\} = 36$$

$$c[2,3] = \min_{2 \leq k < 3} \quad k=2 \left\{ \begin{matrix} c[2,2] + c[3,3] + d_1 \times d_2 \times d_3 \\ 0 + 0 + 3 \times 6 \times 4 \end{matrix} \right\} = 72$$

$$c[3,4] = \min_{3 \leq k < 4} \quad k=3 \left\{ \begin{matrix} c[3,3] + c[4,4] + d_2 \times d_3 \times d_4 \\ 0 + 0 + 6 \times 4 \times 2 \end{matrix} \right\} = 48$$

$$c[4,5] = \min_{4 \leq k < 5} \quad k=4 \left\{ \begin{matrix} c[4,4] + c[5,5] + d_3 \times d_4 \times d_5 \\ 0 + 0 + 4 \times 2 \times 7 \end{matrix} \right\} = 56$$

$$c[1,3] = \min_{1 \leq k < 3} \begin{matrix} k=1 \\ k=2 \end{matrix} \left\{ \begin{matrix} c[1,1] + c[2,3] + d_0 \times d_1 \times d_3 \rightarrow 0 + 72 + (2 \times 3 \times 4) = 96 \\ c[1,2] + c[3,3] + d_0 \times d_2 \times d_3 \rightarrow 36 + 0 + (2 \times 6 \times 4) = 84 \rightarrow \min \end{matrix} \right.$$

$$c[2,4] = \min_{2 \leq k < 4} \begin{matrix} k=2 \\ k=3 \end{matrix} \left\{ \begin{matrix} c[2,2] + c[3,4] + d_1 \times d_2 \times d_4 \rightarrow 0 + 48 + (3 \times 6 \times 2) = 84 \rightarrow \min \\ c[2,3] + c[4,4] + d_1 \times d_3 \times d_4 \rightarrow 72 + 0 + (3 \times 4 \times 2) = 96 \end{matrix} \right.$$

$$c[3,5] = \min_{3 \leq k < 5} \begin{matrix} k=3 \\ k=4 \end{matrix} \left\{ \begin{matrix} c[3,3] + c[4,5] + d_2 \times d_3 \times d_5 \rightarrow 0 + 56 + (6 \times 4 \times 7) = 224 \\ c[3,4] + c[5,5] + d_2 \times d_4 \times d_5 \rightarrow 48 + 0 + (6 \times 2 \times 7) = 132 \rightarrow \min \end{matrix} \right.$$

$$c[1,4] = \min_{1 \leq k < 4} \begin{matrix} k=1 \\ k=2 \\ k=3 \end{matrix} \left\{ \begin{matrix} c[1,1] + c[2,4] + d_0 \times d_1 \times d_4 \rightarrow 0 + 84 + (2 \times 3 \times 2) = 96 \rightarrow \min \\ c[1,2] + c[3,4] + d_0 \times d_2 \times d_4 \rightarrow 36 + 48 + (2 \times 6 \times 2) = 108 \\ c[1,3] + c[4,4] + d_0 \times d_3 \times d_4 \rightarrow 84 + 0 + (2 \times 4 \times 2) = 100 \end{matrix} \right.$$

$$c[2,5] = \min_{2 \leq k < 5} \begin{matrix} k=2 \\ k=3 \\ k=4 \end{matrix} \left\{ \begin{matrix} c[2,2] + c[3,5] + d_1 \times d_2 \times d_5 \rightarrow 0 + 132 + (3 \times 6 \times 7) = 258 \\ c[2,3] + c[4,5] + d_1 \times d_3 \times d_5 \rightarrow 72 + 56 + (3 \times 4 \times 7) = 212 \\ c[2,4] + c[5,5] + d_1 \times d_4 \times d_5 \rightarrow 84 + 0 + (3 \times 2 \times 7) = 126 \rightarrow \min \end{matrix} \right.$$

$$c[1,5] = \min_{1 \leq k < 5} \begin{matrix} k=1 \\ k=2 \\ k=3 \\ k=4 \end{matrix} \left\{ \begin{matrix} c[1,1] + c[2,5] + d_0 \times d_1 \times d_5 \rightarrow 0 + 126 + (2 \times 3 \times 7) = 168 \\ c[1,2] + c[3,5] + d_0 \times d_2 \times d_5 \rightarrow 36 + 132 + (2 \times 6 \times 7) = 252 \\ c[1,3] + c[4,5] + d_0 \times d_3 \times d_5 \rightarrow 84 + 56 + (2 \times 4 \times 7) = 196 \\ c[1,4] + c[5,5] + d_0 \times d_4 \times d_5 \rightarrow 96 + 0 + (2 \times 2 \times 7) = 124 \rightarrow \min \end{matrix} \right.$$

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Soru 2

A = x z y z z y x
B = z x y y z x z

LCS uygula

B

		z	x	y	y	z	x	z
	-1	0	1	2	3	4	5	6
	-1	0	0	0	0	0	0	0	0
x	0	0	0	1	1	1	1	1	1
z	1	0	1	1	1	1	2	2	2
y	2	0	1	1	2	2	2	2	2
z	3	0	1	1	2	2	3	3	3
z	4	0	1	1	2	2	3	3	4
y	5	0	1	1	2	3	3	3	4
x	6	0	1	2	2	3	3	4	4

A

xyzz

$|L(n,m)| = 4$

zyyx

m = S2 x length
n = S1 x length
Algoritma çalışma zamanı $O(n \times m)$

Örnek katarlar
zyyx
xyzz

Soru 3

1 ve $n^{1/\log n} < \log(\log^* n) < \log^*(\log n)$ ve $\log^* n < 2^{\log^* n} < \ln(\ln n) < \sqrt{\log n} < \ln n$

$< \log^2 n < 2^{\sqrt{2\log n}} < (\sqrt{2})^{\log n} < n$ ve $2^{\log n} < n\log n$ ve $\log n! < n^2$ ve $4^{\log n} < n^3$

$< (\log n)! < n^{\log(\log n)}$ ve $(\log n)^{\log n} < \left(\frac{3}{2}\right)^n < 2^n < n.2^n < e^n < n! < (n+1)!$

$< 2^{2^n} < 2^{2^{n+1}}$

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Soru 4

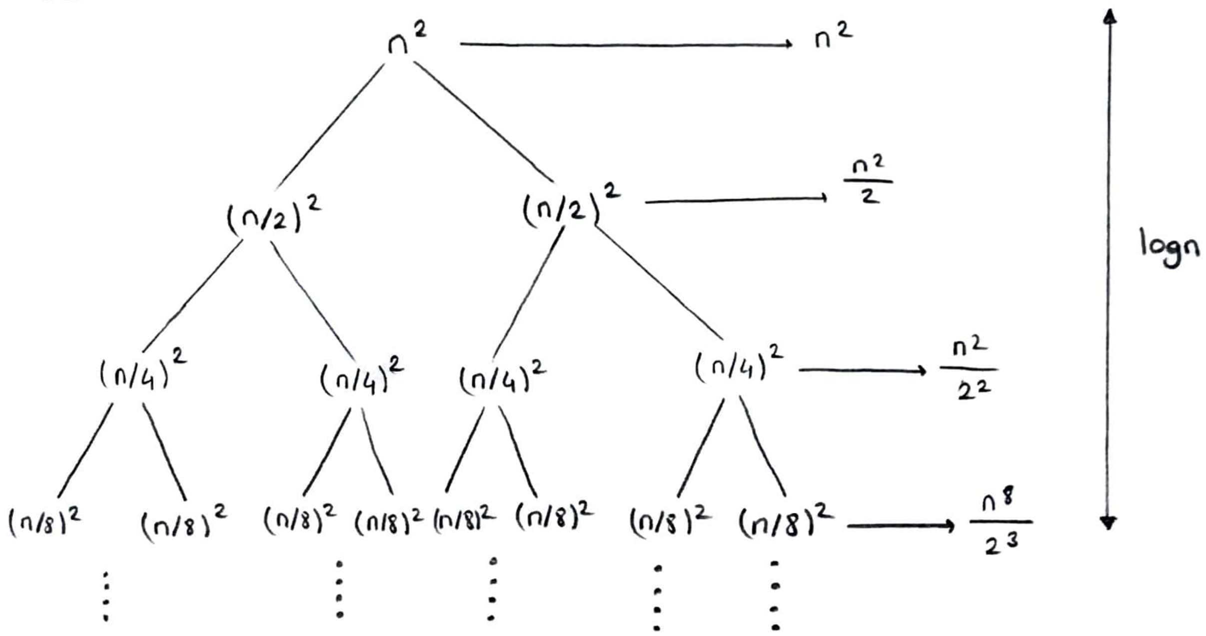
$$\sum_{i=1}^{n-1}\sum_{j=i+1}^{n}\sum_{k=1}^{j}1=\sum_{i=1}^{n-1}\sum_{j=i+1}^{n}j=\sum_{i=1}^{n-1}\left(\sum_{j=1}^{n}j-\sum_{j=1}^{i}j\right)=\sum_{i=1}^{n-1}\left(\frac{n(n+1)}{2}-\frac{i(i+1)}{2}\right)$$

$$=\frac{n.(n+1).(n-1)}{2}-\frac{1}{2}\sum_{i=1}^{n-1}\left(i^2+i\right)=\frac{n.(n+1).(n-1)}{2}-\frac{1}{2}\left[\frac{n.(n-1).(2n-1)}{6}\right]-\frac{1}{2}\cdot\frac{(n-1).n}{2}$$

$$=\frac{1}{12}n.(n-1)(4n+4)=\frac{1}{3}n(n-1)(n+1)=\Theta(n^3)$$

Soru 5

$$T(n)=2T\left(\frac{n}{2}\right)+n^2$$



$$T(n)=\underbrace{n^2+\frac{n^2}{2}+\frac{n^2}{4}+\frac{n^2}{8}\cdots\cdots}_{\text{logn tane}}\leq n^2\sum_{i=0}^{\infty}\left(\frac{1}{2^i}\right)\leq n^2\left(\frac{1}{1-\frac{1}{2}}\right)\leq 2n^2$$

$$T(n)=\Theta(n^2)$$

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Soru 6

$T(n) = T\left(\frac{2n}{3}\right) + 1$

$\left.\begin{array}{l} a=1 \\ b=3/2 \\ c=0 \\ f(n)=1 \end{array}\right\}$ $\log_{3/2}^{1} = 0$ ve $c=0$ $\Rightarrow c = \log_b^a$ yani <u>2. durum</u>

$\theta(n^c \log_n^{k+1}) = \boxed{\theta(\log n) \text{ olur.}}$

$T(n) = 3T\left(\frac{n}{4}\right) + n\log n$

$\left.\begin{array}{l} a=3 \\ b=4 \\ f(n)=n\log n \end{array}\right\}$ $n^{\log_b^a} = n^{\log_4^3} = O(n^{0.793})$

<u>Durum 3:</u>

$f(n) = \Omega(n^{\log_4 3+\varepsilon})$ ve $\varepsilon \approx 0{,}2$ olduğu için

$af(n/b) \leq c f(n)$, $c<1$ olmak koşulu ile

$3\left(\frac{n}{4}\right)\log\left(\frac{n}{4}\right) \leq \left(\frac{3}{4}\right) n\log n$, $c = \frac{3}{4} < 1$ için

$\boxed{T(n) = \theta(n\log n)}$

$T(n) = 4T\left(\frac{n}{2}\right) + n$

$\left.\begin{array}{l} a=4 \\ b=2 \\ c=1 \\ f(n)=n \end{array}\right\}$ $\log_b^a = \log_2^4 = 2$ ve $c=1$ $\Rightarrow$ $c < \log_b^a$ yani <u>1. durum</u>

$\theta(n^{\log_b^a}) = \boxed{\theta(n^2) \text{ olur.}}$