

Adi-Soladi: Muhammed Ramadan

No: 190290605

1)

a)

```
void fun (int n){
```

```
int i,j,count=0;
```

```
for (i=n/2; i<=n; i++)
```

```
for (j=1; j+n/2<=n; j++)
```

```
for (k=1; k<=n; k=k*2)
```

```
count++;
```

```
}
```

cost

time

C_1

1

C_2

$\frac{n}{2}$

C_3

$\frac{n}{2} * n$

C_4

$\frac{n}{2} * n * \log n$

C_5

$1 * \frac{n}{2} * n * \log n$

$$T(n) = C_1 + C_2 \left(\frac{n}{2}\right) + C_3 \left(\frac{n^2}{2}\right) + C_4 \left(\frac{n^2}{n} \log n\right)$$

$$+ C_5 \left(\frac{n^2}{2} \log n\right)$$

$$\Rightarrow T(n) = O(n^2 \log n)$$

```
void fun (int n){
```

```
int i,j;
```

```
for (i=1; i<=n/3; i++)
```

```
for (j=1; j<=n; j+=4)
```

```
printf("Hallo \n");
```

```
}
```

cost

time

C_1

1

C_2

1

C_3

$(n/3+1)C_3$

C_4

$(n/4+1)C_4$

C_5

$n/4 C_5$

$$T(n) = C_1 + C_2 + (n/3+1)C_3 + C_4(n/4+1) + C_5(n/4)$$

$$\Rightarrow T(n) = O(n)$$

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1)
C)
for (int i = 1, count = 0; i <= n; i * 5)
for (int j = i; j <= n; j++)
count++;

cost

C_1

C_2

C_3

time

$\log n$

$n * \log n$

$1 * n * \log n$

$$\Rightarrow \text{Toplam Maliyet} = C_1 * \log n + C_2 * n * \log n + C_3 (1 * n * \log n)$$
$$= 2n \log n + \log n$$

$$T(n) = O(n \log n)$$

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1)
d)

```
Public static int[] F1(int[] A, int n){  
    int temp;  
    int min;  
    for (int i=0; i<n-1; i++){  
        min=i;  
        for (int j=i; j<n; j++){  
            if (A[j]<A[min]){  
                min=j;  
            }  
        }  
        temp=A[i];  
        A[i]=A[min];  
        A[min]=temp;  
    }  
    return A;  
}
```

Cost	time
C_1	1
C_2	1
C_3	$n-1$
C_4	$n-1$
C_5	$n^*(n-1)$
C_6	$n^*(n-1)$
C_7	$n^*(n-1)$
C_8	$n-1$
C_9	$n-1$
C_{10}	$n-1$

$$\begin{aligned} \Rightarrow \text{Total cost} &= C_1 + C_2 + C_3(n-1) + C_4(n-1) + C_5(n^*(n-1)) \\ &\quad + C_6(n^*(n-1)) + C_7(n^*(n-1)) \\ &\quad + C_8(n-1) + C_9(n-1) + C_{10}(n-1) \\ &= 2n^2 + 2n - 3 \\ \Rightarrow T(n) &= O(n^2) \end{aligned}$$

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2)

a) $\frac{1}{2}n^2 - 3n = \mathcal{O}(n^2)$ I yol

II yol

$$\lim_{n \rightarrow \infty} \frac{\frac{1}{2}n^2 - 3n}{n^2} = \frac{1}{2}$$

$$0 \leq c_1 \cdot f(n) \leq f(n) \leq c_2 \cdot f(n)$$

$$c_1 \cdot n^2 \leq \frac{1}{2}n^2 - 3n \leq c_2 \cdot n^2$$

$$c_1 \leq \frac{1}{2} - \frac{3}{n} \leq c_2$$

$$n=14 \quad c_1 = \frac{1}{14} \quad c_2 = \frac{1}{2}$$

b) $2^{n+1} \leq c \cdot 2^n$

$$2^n \leq 2^n$$

$$2^n \cdot 2 \leq c \cdot 2^n$$

$$2^n \cdot 2^n \leq c \cdot 2^n$$

$$c \geq 2$$

$$n \geq 1$$

n 'e bağılı çıkıyor sağlamaz.

c) $6n^3 = \mathcal{O}(n^2)$ I yol

II yol

$$c_1 \cdot n^2 \leq 6n^3 \leq c_2 \cdot n^2$$

$$\lim_{n \rightarrow +\infty} \frac{6n^3}{n^2} = 6n = \infty$$

$$c_1 \leq 6n \leq c_2$$

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3)

a)

$$T(n) = 8T\left(\frac{n}{2}\right) + cn^2, n \geq 2, T(1) = 1$$

$$\Rightarrow T(n) = a * T\left(\frac{n}{b}\right) + f(n)$$

$$\Rightarrow T(n) = 8T\left(\frac{n}{2}\right) + cn^2$$

$$\Rightarrow \frac{a}{b^d} = \frac{8}{2^3} = 1$$

Eğer $f(n) = O(n^b)$ o zaman $T(n) = O(n^d \log n)$

işlemlerin Maliyet n^2 ile $O(n^2)$ arasında

bu nedenle $f(n) = O(n^2)$

\Rightarrow Sonuç $T_n = O(n^2 \log n)$

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3)

b) $T(n) = T\left(\frac{n}{2}\right) + c, n \geq 2, T(1) = 1$

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

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

$$T\left(\frac{n}{4}\right) = T\left(\frac{n}{8}\right) + c$$

⋮

$$\Rightarrow T\left(\frac{n}{2^k}\right) + k \cdot c$$

buna göre $\frac{n}{2^k} = 1 \Rightarrow k = \log(n)$

$$T(n) = T(1) + \log(n) \cdot c$$

$$T(1) = 1$$

$$T(n) = 1 + \log(n) \cdot c$$

$$\Rightarrow T(n) = O(\log n)$$

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3)

c)

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

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

$$T\left(\frac{n}{2}\right) = \left(\frac{n}{2}\right)^3 + 2 \left(T\left(\frac{n}{4}\right) \right)$$

$$T\left(\frac{n}{4}\right) = \left(\frac{n}{4}\right)^3 + 2 \left(T\left(\frac{n}{8}\right) \right)$$

⋮

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

$$\Rightarrow \frac{n}{2^k} = 1$$

$$\Rightarrow T(n) = n^3 \log n$$

$$\Rightarrow T(n) = O(n^3 \log n)$$

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3)

$$d) T(n) = T(n-1) + 2T(n-2), T(0) = 2, T(1) = 7$$

$$\Rightarrow r^2 = r + 2$$

\Rightarrow kökler

$$r_1 = -1, r_2 = 2$$

$$\Rightarrow T(n) = A \cdot (-1)^n + B \cdot 2^n$$

$$\Rightarrow T(0) = 2, T(1) = 7$$

$$\Rightarrow T(0) = 2 \Rightarrow A + B = 2$$

$$\Rightarrow T(1) = 7 \Rightarrow A + 2B = 7$$

$$\Rightarrow A = 1, B = 1$$

$$\Rightarrow T(n) = (-1)^n + 2^n$$

$$\Rightarrow T(n) = O(2^n)$$

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4)

① verilen dizi = $[38, 27, 43, 3, 9, 82, 10]$

ikiye bölünür halleri = $[38, 27, 43]$

ve

$[3, 9, 82, 10]$

② her iki parça ayrı ayrı sıralı.

$[38, 27, 43] \rightarrow [27, 38, 43]$

$[3, 9, 82, 10] \rightarrow [3, 9, 10, 82]$

③ iki parça birleştirilelim

$\Rightarrow [27, 38, 43, 3, 9, 10, 82]$

④

son adımda $\Rightarrow [3, 9, 10, 27, 38, 43, 82]$