(1) int sequentialSearch(int n, int* A, int x){
    int i=0;
    while (i<n && A[i]!=x) → Basic operation
        i++;   → C
    if(i<n)
        return i;
    else
        return -1; }

$C_{best}(n) = 1$ $\qquad C_{worst}(n) = \sum_{i=0}^{n-1} 1 \rightarrow n-1 \approx n$

$C_{avg}(n) \longrightarrow p: \quad 0 \leq p \leq 1$ i. pozisyonda olması $\frac{p}{n}$ olasılık

$C_{avg}(n) = \underset{\text{eğer yoksa}}{n.(1-p)} + \underbrace{\left[\frac{p}{n} + \frac{2p}{n} + \frac{3p}{n} \dots \frac{np}{n}\right]}_{\text{varsa}}$

$\rightarrow \sum_{i=1}^{n} \frac{p}{n} . i = \frac{n.(n+1).p}{2n} \rightarrow \frac{(n+1)p}{2}$

$\rightarrow p = 0$ için $C_{avg}(n) = n + 0 = n$ $\qquad p = 1$ için $C_{avg}(n) = 0 + \frac{n+1}{2} \approx n$

$C_{avg}(n) = n \rightarrow O(n)$ $\qquad C_{worst}(n) = n \rightarrow O(n)$ $\qquad C_{best}(n) = 1 \rightarrow \Omega(1)$

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

if $0 \leq c_2 * g(n) \leq f(n) \leq c_1 * g(n)$ and $c_1 \geq c_2,\ c_1 > 0,\ c_2 > 0$

then $f(n)\ \Theta(g(n))$

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

$c_2 = \frac{1}{3} \rightarrow \frac{1}{3}n^2 \leq \frac{1}{2}n^2 - \frac{1}{2}n \rightarrow n_0 = 25$ $\rightarrow n_0 = 25$ $\quad c_2 = \frac{1}{3} \rightarrow \Omega(n^2)$

$c_1 = 15 \rightarrow \frac{1}{2}n^2 - \frac{1}{2}n \leq 15n^2 \rightarrow n_0 = 25$ $\rightarrow n_0 = 25$ $\quad c_1 = 15 \rightarrow O(n^2)$

$15 > \frac{1}{3}$ $\qquad 15 > 0$ $\qquad \frac{1}{3} > 0$ $\qquad \Theta(n^2)$

3 a. $\sum_{i=3}^{n+1} i \to (n+1-3+1)\cdot\frac{(n+1+3)}{2} = \frac{(n-1)(n+4)}{2} = \frac{n^2+3n-4}{2}$

b. $\sum_{i=0}^{n-1} i(i+1) \to \sum_{i=0}^{n-1} i^2 + \sum_{i=0}^{n-1} i$

$$\frac{(n-1)(n)(2n-1)}{6} + \frac{(n-1)(n)}{2} \to \frac{(2n^2-n)(n-1)+(n-1)(n)\cdot 3}{6}$$

$$\to \frac{(n-1)(2n^2+2n)}{6}$$

4 $x(n/2) = x(n/4) + n/2$ $\quad x(n/4) = x(n/8) + n/4 \to x(n) = x(n/8) + \frac{7n}{4}$

$x(n/2) = x(n/8) + \frac{3n}{2} \to x(n) = x\left(\frac{n}{2^k}\right) + \frac{(2^k-1)n}{2^{k-1}}$

$\to n = 2^k$ $\quad x(n) = \underbrace{x\left(\frac{2^k}{2^k}\right)}_{1} + \frac{(2^{\log_2 n}-1)n}{2^{\log_2 n-1}} \to \frac{(n-1)n}{\frac{n}{2}} + 1 \to 2n-2+1 = 2n-1$

$k = \log_2 n$

5 dToDecimal(m, number, d)

```
digit ← 1
sum ← 0
for i ← 0 to m; do
    endDigit ← number mod 10
    sum ← sum + endDigit * digit
    digit ← d * digit
    number ← number / 10
return sum
```

→ m+1 control

⇒ basic operation

→ 4*m operation

$O \to 5m+1 \le c_1 * m \to c_1 = 20 \to O(n)$

$n_0 = 1$

$\Omega \to c_2 * m \ge 5m+1$ $\quad c_2 = 1 \to \Omega(n)$

$n_0 = 1$

$c_1 \ge c_2 \quad c_1 > 0 \quad c_2 > 0 \quad n_0 = 1$

$\Theta \le c_2 * m \le 5m+1 \le c_1 * m \to \Theta(n)$

Ödev 7

DIVIDE AND CONQUER

```
DAC (A[0...n-1], low, high)
    if high ≤ low then
        return A[low]
    mid = (low + high) / 2
    sum = 0; left_max = min(A);
    for i = mid; i ≥ low; i--
        sum = sum + A[i];
        if (sum > left_max)
            left_max = sum;
    right_max = min(A); sum = 0;
    for i = mid+1; i ≤ high; i++
        sum = sum + A[i];
        if (sum > right_max)
            right_max = sum;
    left_right = max( DAC(A[], low, mid), DAC(A[], mid+1, high))
    return max(left_right, left_max + right_max)
```

$T(n) = 2T(n/2) + N \rightarrow d = 1, \; a = 2, \; b = 2 \qquad 2 = 2^1 \rightarrow n^d \log n \rightarrow n \log n$

Her durumda tüm elemanları dolaşmak zorunda olduğu için

$C_{best} = \Theta(n \log n) \qquad C_{average} = \Theta(n \log n) \qquad C_{worst} = \Theta(n \log n)$

BRUTE FORCE

```
DF(N, A[N])
    max = A[0]
    for i=0; i<N; i=i+1
        tmp=0
        for j=i; j<N; j=j+1
            tmp=tmp+A[j]
            if(tmp > max)
                max = tmp
                left = i;
                right = j;
    return max
```

for $i=0;\ i<N;\ i=i+1$ → N defa dış döngü

for $j=i;\ j<N;\ j=j+1$ → N-i defa iç döngü

$$N + (N-1) + (N-2) \ldots 1 \rightarrow \frac{N * (N+1)}{2} \rightarrow N^2$$

Her durumda tüm elemanları kontrol edeceği için

$C_{best} = \Theta(n\log n)$ $\quad C_{average} = \Theta(n\log n)$ $\quad C_{worst} = \Theta(n\log n)$