**First Semester 2023-24**

**Data Structures and Algorithms Design (Merged-SEZG519/SSZG519)**

**Exercises (Analyzing Algorithms)**

1. Use Master’s theorem to solve the following division functions.
   1. T(n) = 3T(n/2) + n^2

a = 3, b = 2, k = 2, p = 0

a = 3, bk = 4 🡺a < b and p = 0

T(n) = O(nk n)= O(n2)

* 1. T(n) = 4T(n/2) + n^2

a = 4, b = 2, k = 2, p = 0

a =4, bk = 4 🡺 a = b and p = 0 which is p > -1

T(n) = O(nk n) = O(n2 log n)

* 1. T(n) = 16T(n/4) + n

a = 16, b = 4, k = 1, p = 0

a = 16, bk = 4 🡺 a > b

T(n) = O() = O(n2)

* 1. T(n) = 2T(n/2) + nlogn

a = 2, b = 2, k = 1, p = 1

a = 2, bk = 2🡺 a = b and p = 1 which p = >-1

T(n) = O(nk n) = O(n log2 n)

* 1. T(n) = 2T(n/4) + n^(0.51)

a = 2, b = 4, k = 0.51, p = 0

a = 2, bk = 2🡺 a = b and p = 1 which p = >-1

T(n) = O(nk n) = O(n0.51)

* 1. T(n) = √2T(n/2) + log n

a = √2, b = 2, k = 0, p = 1

a = √2, bk = 1🡺 a > b

T(n) = O() = O(√n)

* 1. T(n) = 6T(n/3) + n^2 log n

a = 6, b = 3, k = 2, p = 1

a = 6, bk = 9🡺 a < b and p = 1

T(n) = O(nk n) = O(n2 log n)

1. Use Master’s theorem to solve the following decreasing functions.
   1. T(n) = 0.5T(n-1) + n

a = 0.5, b = 1, k = 1 🡺 a < 1

T(n) = O(nk)= O(n)

* 1. T(n) = 2/3T(n-1) + n^2

a = 2/3 = 0.6, b = 1, k = 2 🡺 a < 1

T(n) = O(nk)= O(n)

* 1. T(n) = T(n-1) + n^2

a = 1, b = 1, k = 2 🡺 a = 1

T(n) = O(nk+1) = O(n3)

* 1. T(n) = 2T(n-1) + n^2

a = 2, b = 1, k = 2 🡺 a > 1

T(n) = O() = O(n2 2n)

* 1. T(n) = 3T(n-2) + n

a = 3, b = 2, k = 1 🡺 a >1

T(n) = O() = O(n 3n/2)