**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) + n2

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = 3, b = 2, g(n) = n2 ⇒ so k = 2, p = 0

a < bk and p >= 0 ⇒ O(nk logp n) = O(n2)

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

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = 4, b = 2, g(n) = n2 ⇒ so k = 2, p = 0

a = bk and p > -1 ⇒ O(nk logp+1 n) = O(n2log n)

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

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = 16, b = 4, g(n) = n⇒ so k = 1, p = 0

a > bk  ⇒ O() = O() = O()

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

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = 2, b = 2, g(n) = nlogn⇒ so k = 1, p = 1

a = bk and p > -1 ⇒ O(nk logp+1 n) = O(nlog2n)

* 1. T(n) = 2T(n/4) + n0.51

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = 2, b = 4, g(n) = n0.51 ⇒ so k = 0.51, p = 0

a < bk and p >= 0 ⇒ O(nk logp n) = O(n0.51)

* 1. T(n) = √2T(n/2) + log n

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = √2, b = 2, g(n) = log n⇒ so k = 0, p = 1

a > bk and p >= 0 ⇒ O() = O() = O()

* 1. T(n) = 6T(n/3) + n2 log n

T(n) = aT(n/b) + g(n) where g(n) = nk logp n

a = 6, b = 3, g(n) = n2 log n⇒ so k = 2, p = 1

a < bk and p >= 0 ⇒ O(nk logp n) = O(n2 log n)

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

T(n) = aT(n-b)+g(n), where g(n) = nk

a = 0.5, b = 1, g(n) = n ⇒ so k = 1

a < 1, O(nk) = O(n)

* 1. T(n) = 2/3T(n-1) + n2

T(n) = aT(n-b)+g(n), where g(n) = nk

a = 2/3, b = 1, g(n) = n2 ⇒ so k = 2

a < 1, O(nk) = O(n2)

* 1. T(n) = T(n-1) + n2

T(n) = aT(n-b)+g(n), where g(n) = nk

a = 2/3, b = 1, g(n) = n2 ⇒ so k = 2

a = 1, O(nk+1) = O(n3)

* 1. T(n) = 2T(n-1) + n2

T(n) = aT(n-b)+g(n), where g(n) = nk

a = 2, b = 1, g(n) = n2 ⇒ so k = 2

a > 1, O(nkan/b) = O(n22n)

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

T(n) = aT(n-b)+g(n), where g(n) = nk

a = 3, b = 2, g(n) = n ⇒ so k = 1

a > 1, O(nkan/b) = O(n 3n/2)