Algorithms Assignment Solution

**Part 1**

The Master Theorem applies to recurrences of the following form:

T (n) = aT (n/b) + f(n) where a ≥ 1 and b > 1 are constants and f(n) is an asymptotically positive function.

There are 3 cases:

1. If f(n) = O(n logb a− ) for some constant > 0, then T (n) = Θ(n logb a ).

2. If f(n) = Θ(n logb a logk n) with1 k ≥ 0, then T (n) = Θ(n logb a logk+1 n).

3. If f(n) = Ω(n logb a+ ) with > 0,

and f(n) satisfies the regularity condition, then T (n) = Θ(f(n)).

Regularity condition: af(n/b) ≤ cf(n) for some constant c < 1 and all sufficiently large n.

Find the time complexity of the below functions in Θ form. Write NA if the function does not apply to any case.

1. T (n) = 3T (n/2) + n

**T (n) = Θ(n^log 3 )** (Case 1)

**Θ(n1.54) ~ Θ(n2)**

1. T (n) = 64T (n/8) − n^2(log n)

**N.A.**

1. T (n) = 2nT (n/2) + n^n

**N.A.**

1. T (n) = 3T (n/3) + n/2

**T (n) = Θ(n log n)** (Case 2)

1. T (n) = 7T (n/3) + n^2

**T (n) = Θ(n^2 )** (Case 3)

**Θ(n1.77) ~ Θ(n2)**