# Homework 4

1. Master Theorem
   1. T(n) = 5T(n/3) + n

a = 5, b = 3, d = 1, b^ d = 3 < 5 = a

since b^d is less than a, this is recursion dominant

therefore Θ (n^(log3 (n) ) )

* 1. T(n) = 2.7T(n/5) + n^2

a = 2.7, b = 5, d = 2, b^d = 25 > 2.7 = a

since b^d is greater than a, this is overhead dominate

therefore Θ (n^2)

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

There is no b in this case and therefore we cannot use the master theorem

* 1. T(n) = 1.1 T(0.2n) + 1 = 1.1 T(n/5) +1

a = 1.1, b = 5, d = 0 b^d = 1 < 1.1 = a

since b^d is less than a, this is recursion dominant

therefore Θ (n^(log5 (n) ) )

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

Though not in polynomial form, we know that n log n is a middle case and we can hope that it is balanced case.

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

a = 2, b = 2, d = ½ b^d ~= 1.414 < 2 = a

since b^d is less than a, this is recursion dominant

therefore Θ (n^(log2 (n) ) )

* 1. T(n) = 4T(n/2) + (n^4 – n + 10)^1/2 ~= Θ (n^2)

a = 4, b = 2, d = 2 b^d = 4 == 4 = a

since b^d is equal to a, this is balanced

therefore Θ (n^(log2 (n) ) log 2 (n) )

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

a = 7, b = 3, d = 2 b^d = 9 > 7 = a

since b^d is greater than a, this is overhead dominate

therefore Θ (n^2)

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

Not in right format to get d, though n^n is one of the worst complexities so will assume that is the dominant one.

* 1. T(n) = 8T(n/3) + n^3

a = 8, b = 3, d = 3 b^d = 27 > 8 = a

since b^d is greater than a, this is overhead dominate

therefore Θ (n^3)

1. D&C Master Theorem
   1. Algo 1
   2. Algo 2
2. Merge Sort
3. Consider Algorithm
4. Travers Tree
   1. Pre

A, B, D, E, C, F

* 1. In

D, B, E, A, C, F

* 1. Post

D, E, B, F, C, A

1. Karatsuba divide-and-conquer algorithm
2. Straasen’s Algorithm
3. D&C 2-D Closest Pair