Algorithms 2223: Assignment #2 Report

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Contents

Question 1

to run:

1. merge sort: java Main 1
2. quick sort: java Main 2

Question 2

Master Theorum

$$T(n) = aT(\frac{n}{b}) + n^c$$

$$case1 : f(n) = \theta(n^c) \quad where \quad c < log_b(a)$$

$$T(n) = \theta(n^{log_b(a)})$$

$$case2 : f(n) = \theta(n^c) \quad where \quad c = log_b(a)$$

$$T(n) = \theta(n^c log(n))$$

$$case3 : f(n) = \theta(n^c) \quad where \quad c > log_b(a)$$

$$T(n) = \theta(n^c)$$

Problem 1

$$T(n) = T(\frac{n}{2}) + O(1)$$

$$a = 1,\ b = 2,\ c = 0$$

$$c = log_b(a)$$

$$T(n) = O(log(n))$$

$$binary\ search$$

Problem 2

$$T(n) = 2T(\frac{n}{2}) + O(n)$$

$$a = 2,\ b = 2,\ c = 1$$

$$c = log_b(a)$$

$$T(n) = O(n * log(n))$$

$$merge\ sort$$

Problem 3

$$T(n) = 4T(\frac{n}{2}) + O(n)$$

$$a = 4,\ b = 2,\ c = 1$$

$$c < log_b(a)$$

$$T(n) = O(n^2)$$

Question 2 continued on next page...

Problem 4

$$T(n) = 7T(\frac{n}{2}) + O(n^2)$$

$$a = 7,\ b = 2,\ c = 2$$

$$c < log_b(a)$$

$$T(n) = O(n^{2.81})$$

Question 3

$$T(n) = T(n-1) + O(n + log_2(n))$$

$$Master\ Theorum:$$

$$this\ recurrence\ is\ not\ applicable\ to\ the\ master\ theorum$$

$$Tree\ Based\ Method$$

$$n\ elements \qquad n + log_2(n)\ operations$$

$$n-1\ elements \qquad n - 1 + log_2(n-1)\ operations$$

$$n-2\ elements \qquad n - 2 + log_2(n-2)\ operations$$

$$n-3\ elements \qquad n - 3 + log_2(n-3)\ operations$$

$$...$$

$$1\ element \qquad 1\ operation$$

$$summed\ together\ this\ makes\ n\ lines\ of\ n + log_2(n)\ operations\ each$$

$$n * (n + log_2(n)) = n^2 + nlog_2(n)$$

$$O(n^2 + nlog_2(n)) = O(n^2)$$