Programming Project, Part III

**General Description:**

In this third part of the project, you will improve the efficiency of your recursive implementation of the DFT by combining the programs in an optimal way. The objective is to find the optimal threshold for when to switch from the recursive method to the less efficient quadratic method. You will first find the optimal method by theoretical analysis. You will then test the accuracy of your theoretical optimal threshold with experiments.

**Detailed Description:**

First, you have to find an equation that estimates the overhead time for your recursive algorithm of part II, the one that computes the FFT. The overhead time is all the time spent in the procedure, except for the recursive calls. In other word, we have the recurrence: \( T(n) = 2T(n/2) + \Theta(n) \). You have to find out as accurately as possible the equation for the function \( f(n) \) that’s hidden in the \( \Theta \) notation.

Then, take the values that you obtained in the two experiments to calculate a theoretical optimal threshold for switching from the recursive algorithm to the basic algorithm. Explain how you reach this theoretical value.

Now, make some experiments with the calculated optimal threshold, and compare with other values of the threshold. Small variations in the threshold should not change the performance significantly, so do experiments for a wide number of thresholds. If the experiments do not match the theoretical analysis, revisit your constants calculated in part I and II. If still there is no match, explain in your opinion why it happened and/or what you could do. In experimental research, we never change our results to match the theory. There are several possible reasons why the theoretical results don’t match practice.
Turn in: A report containing:

- A half page summary of what you did in part I and II,
- The result of your experiment for overhead time in the recursive algorithm,
- The value for the threshold obtained theoretically with explanations,
- The value for the threshold obtained experimentally,
- Relevant graphs,
- Your conclusion.

Turn in by sending an e-mail to longpre@utep.edu. Please use the subject line “CS5350 Part 3”.

Due date: November 17th, 11:59pm. The penalty is 10% for each day late up to one week late. No homework accepted after one week.