

CECS 528, In Class Assignment 3, February 9th, 2025, Dr. Ebert

Directions:

1. Form a group with two other students to solve each of the following problems.
2. Read over the problems and decide on who will serve the roles of “Student 1”, “Student 2”, and “Student 3”.
3. On a single sheet of paper having your name, provide handwritten solutions to the problems that pertain to your role. Share your solutions with your groupmates to verify correctness. Please show all steps/work.
4. All solutions should be turned in before leaving class. **Please initialize your groupmates’ papers at the bottom of each page.** Please do *not* staple them, as they will be graded and returned individually.

Problems

Given polynomials $A(x) = -5 + 3x$ and $B(x) = 4 - x$, do the following.

- Student 1. a) Use algebra to compute the quadratic polynomial $C(x) = A(x) \times B(x)$. Show steps. (3 pts)
- Student 2. a) Compute $\text{DFT}_4(A)$ using the definition and verify your answer by computing it using the FFT algorithm. Demonstrate the algorithm by computing the entire recursion tree as was done in the lecture notes/recording. (7 pts)
- Student 3. a) Compute $\text{DFT}_4(B)$ using the definition and verify your answer by computing it using the FFT algorithm. Demonstrate the algorithm by computing the entire recursion tree as was done in the lecture notes/recording. (7 pts)
- Student 1. b) Use the part a) results from Students 2 and 3 to compute $\text{DFT}_4(C(x))$. Verify your answer by applying the FFT algorithm using the coefficients you computed in part a). Demonstrate the algorithm by computing the entire recursion tree as was done in the lecture notes/recording. (7 pts)
- Student 2. b) Use the results from part b) of Student 1, to compute $\text{DFT}_4^{-1}(p)$, where the coefficients of p are the components of $\text{DFT}_4(C(x))$. Verify your answer by re-computing $\text{DFT}_4^{-1}(p)$ using the IFFT algorithm. Demonstrate the algorithm by computing the entire recursion tree as was done in the lecture notes/recording. (7 pts)
- Student 3. b) Verify that Student 1’s part a) answer matches with Students 2’s part b) answer, meaning that Student 2 successfully computed the coefficients of $C(x)$ using the inverse Fourier transform. (3 pts)