**UE19CS311– Advanced Algorithms ( 5th Sem Elective)**

**Fast Polynomial Multiplication with DFT/FFT implementation, RSA Encryption , Image compression**

1. **Implement 1-D DFT ,on coefficient vectors of two polynomials A(x), B(x) by multiplication of Vandermonde matrix . ( O(n2 ) - Complexity)**

A screenshot of a computer

Description automatically generated with medium confidence

1. **ii) Implement 1-D FFT on the same vectors, of A(x) and B(x). Ensure above two steps produce same results.**

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**(iii)Pointwise multiply results of Step (ii) to produce C(x) in P-V form**

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**(iv) RSA encrypt (128-bit , 256-bit and 512-bit ) , with public key , the C(x) in PV form, for transmission security and decrypt with a private key and verify .**

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**v) Implement 1-D Inverse FFT (I-FFT) on C(x), in PV form (Interpolation) to get C(x) in Coefficient form (CR) Polynomial.**

**vi) Verify correctness of C(x) , by comparing with the coefficients generated by a Elementary “Convolution For Loop” on the Coefficients of A(x) and B(x)**

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**vii) Implement a 2-D FFT and 2-D I-FFT module using your 1-D version (This just means , applying FFT on the Rows First and Columns Next on M x N matrix of numbers !!)**

**viii) Verify your of Step (vii) correctness on a Grayscale matrix ( which has random integer values in the range 0-255; 255 → White & 0 → Black))**

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**ix) Apply your 2D-FFT on TIFF/JPG (lossless) Grayscale image and drop Fourier coefficients below some specified magnitude and save the 2D- image to a new file. ( relates to % compression – permanent Lossy compression) ( by sorting and retaining only coefficients greater than some(quantization) value. Rest are made 0.)**

**x) Apply 2D I-FFT, on the Quantized Grayscale image and render it to observe Image Quality.**

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A picture containing porcelain

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**Real Image**

A close-up of the moon

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**Grayscale Image**

A picture containing invertebrate, branchiopod crustacean

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**Compressed Image**