COSC581 - Algorithms
Spring 2023
Homework #8

Due: Monday, 04/03/2023, at 5PM.

1. Let ω be an n^{th} root of unity, and let k be a fixed integer. Evaluate:
$$1 + \omega^k + \omega^{2k} + \cdots + \omega^{(n-1)k}$$

2. Use the FFT to compute $C(x)$ as the product of $A(x)$ and $B(x)$, where $A(x) = x^2 + 3x + 1$ and $B(x) = x + 7$.
    a. Find the value of $A(x)$ at the complex fourth roots of unity (1, -1, i, -i).
    b. Find the value of $B(x)$ at the complex fourth roots of unity.
    c. Use the results of (a) and (b) to find the value of $C(x)$ at the complex fourth roots of unity.
    d. Use these results to find the coefficients of $C(x)$.

3. What is the totient of 3044?

4. Consider an RSA crypto scheme with n=25 and D=5.
    a. What is a possible value(s) of E?
    b. Encode two messages of your choosing.
    c. Name three messages that are unencodable.

5. Given a finite simple undirected graph *G* and a positive integer *k*, explain how you would reduce the problem of finding in *G* an independent set of size *k* to the problem of merely deciding whether such a set exists.