1. Construct a table for GF(2^2) using primitive polynomial 1 + X + X^2 over GF(2). Display the power, polynomial and vector representation of each of the four elements, similar to Table 2.8 in textbook. Instead of using α to denote the element (the notation α will be used later), use ω.

2. We will construct GF(4^2) using GF(4) constructed in Problem 1. \( p(X) = X^2 + X + \omega \) is a primitive polynomial over GF(4). Using this \( p(X) \) and GF(4) from Problem 1, construct GF(4^2). For each element 0, 1, \( \alpha^i \), \( i = 1, \cdots, 14 \), in which \( \alpha \) is a root of \( p(X) \), write down the polynomial form.

3. For \( \alpha \), \( \alpha^2 \), \( \alpha^3 \) and \( \alpha^4 \) in GF(4^2) constructed in Problem 2, find their corresponding minimum polynomials.

4. Find the generator polynomial of a double error correcting (i.e., \( t = 2 \)) BCH code over GF(4) of length 15 (i.e., \( q = 4 \) and \( m = 2 \)).