ECC Final Project Report

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1. Purpose:

The purpose of this project is to produce a computer program that is capable of decoding the (63,42) RS code over GF(64), whereas the first 21 elements are the parity-check characters and the last 42 are the information characters.

2. Steps:

There are totally 7 steps in my computer program, which are:

(1) Distinguish the erasure errors and use it to build the erasure locator polynomial.

(2) Modify the received data by replacing erasures with 0.

(3) Calculate the syndrome polynomial using the modified received data.

(4) Multiply the syndrome polynomial and the erasure locator polynomial to get the modified syndrome polynomial.

(5) Compute **Euclid's algorithm** to get $v_j(\mathrm{x})$ and $r_j(\mathrm{x})$ and further divided by $v_j(0)$ to get $\sigma_1(x)$, the error locator polynomial, and $\omega(\mathrm{x})$, the error-and-erasure evaluator polynomial.

(6) Finally, I chose time-domain completion to acquire error pattern.

(7) The codeword, if the errors do not exceed the decoding capability, will be th e modified received data added with error pattern,

$$\mathbf{C} = \mathbf{R}' - \mathbf{E}$$

3. Demo result

Input(10 sets):

17 61 31 43 55 17 * 39 39 8 * 26 51 37 38 30 23 22 51 19 1 36 * * * * 29 52 11 * 38 56 22 * 7 38 20 11 * 14 11 * 59 14 18 * * * * * 14 49 52 * * * 23 2 44 27 * * *

41 37 5 5 * * * * * * 12 32 33 51 44 52 59 62 62 27 31 18 62 12 17 43 * * * * * 28 56 16 51 31 1 8 48 59 49 42 57 1 22 38 17 6 56 * * * * * * * * 37 52 35 33 42 27

29 50 28 39 2 24 30 12 56 24 16 19 42 30 55 59 15 9 25 37 37 58 54 31 4 1 61 12 50 35 60 9 8 56 2 30 12 32 2 8 17 *

62 18 48 62 4 7 59 9 45 5 59 21 59 13 4 32 15 22 25 8 34 18 54 42 47 58 17 6 23 1 36 3 25 5 19 22 11 31 19 11 2 11 35 9 28 20 3 42 48 25 26 38 5 39 12 9 53 60 47 26 53 62 14

* * * * * * * * * * * * * * * * * * 62 54 39 55 34 33 20 43 32 19 63 41 25 25 61 58 7 7 26 45 28 9 49 28 2 50 28 55 58 44 47 44 23 11 18 6 0 2 56 27 55 45 4 51 4 20 4

22 38 16 20 11 36 * 1 45 21 1 28 19 17 15 39 2 61 27 38 63 39 25 41 9 56 28 25 51 63 58 42 28 6 33 4 15 55 21 51 35 49 2 41 52 22 34 0 57 4 60 4 7 4 62 36 19 21 46 32 15 38 *

53 55 28 50 26 53 24 5 40 58 48 4 28 49 45 8 54 16 59 23 4 16 43 15 52 3 48 24 24 3 36 24 60 55 18 25

24 63 19 11 45 32 39 23 57 37 10 22 44 14 6 3 11 24 17 56 3 36 6 29 61 49 56

28 23 21 62 60 34 28 49 26 54 9 * * 8 42 61 42 26 18 22 47 * 14 44 51 53 19 31 43 63 7 62 29 21 51 46 56 11 57 43 59 6 32 * 9 * 49 62 47 8 61 6 * 22 * 12 13 12 6 63 33 35 62

33 51 50 5 16 4 38 48 18 57 47 31 45 12 51 2 35 * * * * 37 21 16 56 18 37 32 2 22 2 2 46 24 56 47 5 3 52 3 60 38 44 17 29 40 32 60 46 26 35 25 38 17 4 8 47 45 5 0 10 * 40

53 62 27 20 12 16 20 9 29 39 5 42 33 3 41 59 15 10 54 4 4 5 29 57 54 29 21 57 33 33 8 11 51 18 40 43 55 45 49 27 25 1 5 54 62 53 18 31 59 43 63 * * * 52 * * 43 46 55 10 27 49

Outputs:

17 61 31 43 55 17 6 39 39 8 4 26 51 37 38 30 23 22 51 19 1 36 22 19 6 2 29 52 11 10 38 56 22 16 7 38 20 11 54 14 11 24 59 14 18 55 29 11 42 36 14 49 52 48 61 15 23 2 44 27 4 5 32

41 37 5 57 3 27 24 7 39 32 12 32 33 51 44 52 59 62 62 27 31 18 62 12 17 43 37 52 49 10 26 28 56 16 51 31 1 8 48 59 49 42 57 1 22 38 17 6 56 43 33 2 6 55 10 56 23 37 52 35 33 42 27

Error

62 18 48 62 45 57 59 9 45 5 59 21 59 13 4 32 45 15 25 8 34 18 54 42 47 58 17 6 23 1 36 3 25 5 19 22 11 31 19 11 2 11 35 9 28 20 33 22 48 25 26 38 5 39 12 29 3 60 47 26 53 22 4

Error

Error

Error

28 23 21 62 60 34 28 49 26 54 9 30 8 18 21 61 42 26 18 22 47 3 24 44 51 53 19 31 43 63 7 62 29 21 51 46 56 11 57 43 59 6 32 36 39 9 29 62 47 8 61 63 47 31 53 12 13 12 6 63 33 35 62

33 51 50 5 16 4 38 48 18 57 47 31 45 12 51 2 35 5 22 5 12 37 21 16 56 18 37 32 2 22 2 2 46 24 56 47 5 3 52 3 60 38 44 17 29 40 32 60 46 26 35 25 38 17 21 58 7 5 54 60 20 0 0

53 62 27 20 12 16 20 9 29 39 5 42 33 3 41 59 15 10 54 43 48 53 29 57 54 29 21 57 33 33 8 11 51 18 40 43 55 45 49 27 25 1 5 54 62 53 18 31 59 43 63 34 4 3 52 50 54 43 46 55 10 27 49

※Error represents the flaw that caused by the input data, primarily is the situation which the errors exceed the decoding capability

4. Feedback:

This project means a lot to me. Since I'm a undergraduate student and this is a graduate course, it takes me more effort to accomplish this course. Both midterm project and the final are a challenge to me. I have actually taken the other course, communication system II, that Prof. Chao have lectured. However, this one is even harder than I thought. The project gives me more chance to look deeper into the area of communication. Before this, I have little idea about this field. Not only my programming skill but also my acknowledgement improved. Besides, I've never experienced to finish a large scale project. To sum up, this project as well as this course helps me to have an acquaintance to the graduated courses.