SC 461

Introduction to Coding Theory and its Applications

Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT)

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INSTRUCTIONS:

- There are total 8 pages. Ensure that you have all the pages.
- Answer **all questions**, writing clearly in the space provided.
- Show all your work and explain how you arrived at your answers, unless explicitly told to do otherwise.
- You can do the rough work on the supplementary sheets.
- Write your name and student number **clearly** at the top of each page.
- You have **two hours** to complete the test
- Marks for each question are indicated in brackets at right. You may use point form for your answers, but make sure the points are clear and unambiguous.

FOR MARKER'S USE ONLY

Question	Possible	Received
1	12	
2	13	
3	13	
4	12	
TOTAL	50	

1. (a) Construct (if possible) a binary code of length $n = 8$ having 16 codewords with minimum Hamming distance $d = 2$ using a suitable code over $\mathbb{Z}_4$. Show all the details how you will get this code. (12)

2. (a) Consider the generator matrix of G of a $(4, 2)$ convolutional code as given below. What is the memory M of this encoder? Construct an encoding table for each clock cycle having all four codewords $\mathbf{c}_1(i), \mathbf{c}_2(i), \mathbf{c}_3(i)$ and $\mathbf{c}_4(i)$ for encoding the input $(11010, 10111)$. You may draw a physical encoder having shift-registers.

$$G = \begin{bmatrix} 1+D & 0 & 1 & D \\ D & 1+D+D^2 & D^2 & 1 \end{bmatrix}. \tag{13}$$

3. (a) Construct a $[7, 3, 5]$ Reed Solomon code by taking a primitive element α as a root of $x^3 + x + 1$ over $GF(8)$ and $t = 2$. Describe its parity check matrix. (13)

4. True / False: Mark the statements below as true or false and also justify them by an example.

   (a) Binary image of a linear code over $\mathbb{Z}_4$ always produces a binary linear code of twice the length of the original code via Gray map. (6)

   (b) For constructing double error correcting binary and linear BCH code we need to take design distance δ of the code as $\delta = 2$. (6)