Mandatory 1

Kristian Jensen

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Exercise 1

Exercise 2

I used one python programs for the exercise itself, and another for simulating the different channels for images.
Matplotlib defines a pixel as a list of bits, while I read the Mondrian.csv bit-by-bit. So the implementation of the two tasks are a bit different, but they achieve the same thing. *img_channeø_simulation.py* is the program that simulates the channels with images
Including the images in this latex file gave me some difficulties as some formulas on the bottom of the page were exlcuded. I left out the images from the pdf, but they are included in the assignment folder.

Exercise 3

Exercise 4

$G(x) = \Lambda(x) * G_h(x) + G_0(x) =$

$$\begin{pmatrix} x^2+1 & x & x^2+1 \\ x & 1 & x \end{pmatrix} = \begin{pmatrix} x^2 & 0 \\ 0 & x \end{pmatrix} * \begin{pmatrix} 1 & 0 & 1 \\ 1 & 0 & 1 \end{pmatrix} G_h(x)$$

$G_h(x) = G(x) - \Lambda(x)G_h(x)$

$$G_h(x) = \begin{pmatrix} x^2+1 & x & x^2+1 \\ x & 1 & x \end{pmatrix} \begin{pmatrix} x^2 & 0 & x^2 \\ x & 0 & x \end{pmatrix} = \begin{pmatrix} 1 & x & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

$$T(x) = \begin{pmatrix} 1 & x \\ 0 & 1 \end{pmatrix}$$

$$G'(x) = T(x)G(x) = \begin{pmatrix} 1 & 0 & 1 \\ x & 1 & x \end{pmatrix}$$

$G'_h(x)$ has rank 1, so G'(x) does not give a rate R= k/n = 2/3.
Therefore we need to do this process (at least) once more.

$$G'(x) = \lambda'(x)G'_h(x) + G'_0(x) = \begin{pmatrix} 1 & 0 \\ 0 & x \end{pmatrix} \begin{pmatrix} 1 & 0 & 1 \\ 1 & 0 & 1 \end{pmatrix} + \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

$$T(x) = \begin{pmatrix} 1 & 0 \\ x & 1 \end{pmatrix}$$

Giving us $G''(x) = T'(x)G'(x) = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$. $G''(x)$ has rank 2/3, so it is a minimal generator matrix equivalent to $G(x)$

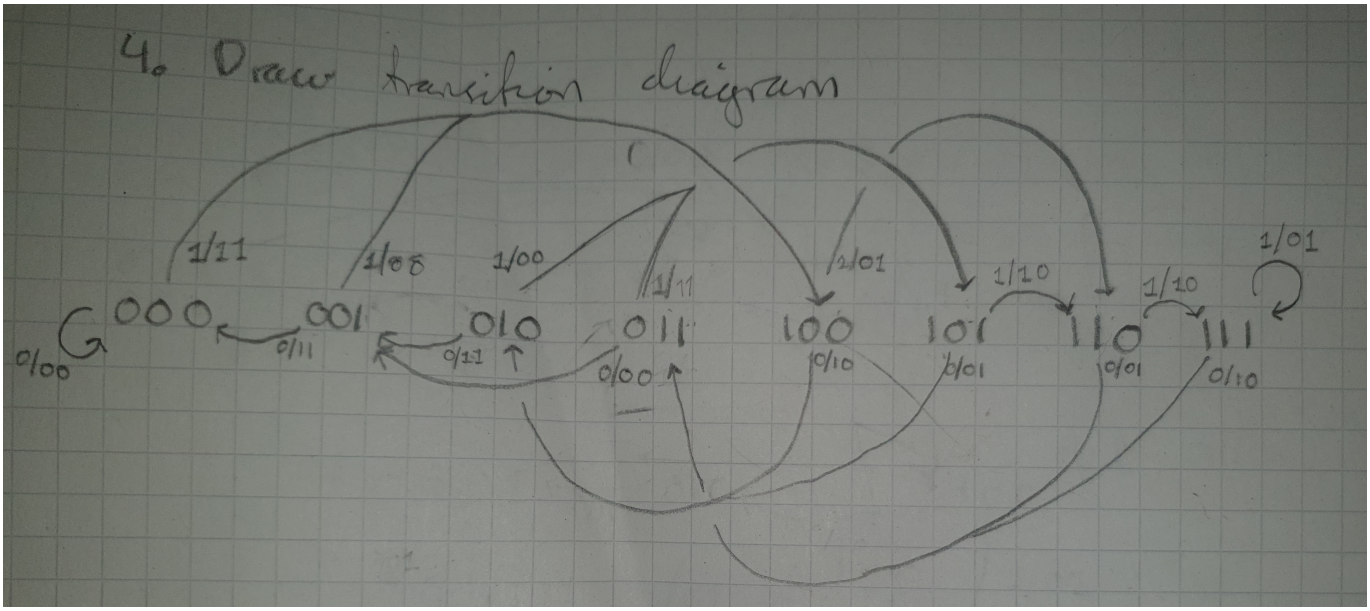
Exercise 5

1. $G(x) = \begin{pmatrix} 1+x+x^2+x^3 & 1+x^2+x^3 \end{pmatrix}$

2. By the smith Normal Form we get $B(x) = \begin{pmatrix} x^2+x & x^3+x^2+1 \\ x^2+x+1 & x^3+x^2+x+1 \end{pmatrix}$. Choosing the first k rows we get the basic matrix $G1(x) = \begin{pmatrix} x^2+x & x^3+x^2+1 \end{pmatrix}$

3. By definition 3.27 in the lecture notes $v_i = max(deg(g_{ij}(x))$ we get that the constraint length equals 3.

4. Draw transition diagram



5. the padding we add are 0's * v. We get $\tilde{m} = (1, 0, 1, 1, 0, 1, 1, 0, 0, 0)$

i	m_i	S_i	o_i
0	Ø	000	Ø
1	1	100	11
2	0	010	10
3	1	101	00
4	1	110	10
5	0	011	01
6	1	101	11
7	1	110	10
8	0	011	01
9	0	001	00
10	0	000	11

Table 1: table for exercise 5.6

6.

7. since $rk(G_{h1}(x)) = rk(\begin{pmatrix} 1 & 1 \end{pmatrix}) = 1$ $G_1(x)$ is minimal

Exercise 6

instead of having m as two rows for the two different inputs, i zipped the two rows so each element in the zipped-list was input for the generator matrix at time 'i'.
$\tilde{m}$ = [(1, 1), (1, 1), (1, 1), (1, 1), (1, 1), (1, 1), (0, 1), (1, 1), (1, 0), (0, 0), (1, 1), (1, 1), (0, 0), (0, 1), (0, 0), (1, 0), (1, 0), (0, 1), (0, 1), (0, 0), (1, 1), (1, 1), (0, 0), (1, 0), (0, 1), (1, 1), (1, 0), (1, 1), (0, 0), (1, 0), (1, 0), (0, 0), (0, 1), (0, 1), (0, 1), (0, 1), (0, 1), (0, 0), (1, 1), (0, 0), (1, 0), (1, 1), (0, 0), (0, 1),

(1, 1), (0, 0), (0, 0), (1, 0), (1, 0), (0, 0), (0, 1), (1, 1), (1, 1), (0, 1), (1, 0), (1, 0), (1, 0), (0, 1), (1, 0), (0, 0), (0, 0), (1, 0), (1, 1), (0, 0), (1, 0), (0, 1), (0, 1), (1, 0), (1, 1), (0, 0), (0, 0), (1, 0), (0, 1), (1, 1), (0, 1), (0, 0), (0, 0), (1, 1), (1, 1), (1, 0), (1, 1), (1, 0), (1, 0), (1, 0), (0, 0), (1, 0), (0, 0), (1, 0), (0, 0), (1, 0), (1, 1), (1, 1), (0, 0), (1, 1), (0, 1), (0, 1), (0, 0), (1, 0), (1, 1), (0, 0), (0, 0), (0, 0)]

outputs of encoding: [[1, 1, 0], [0, 0, 1], [1, 0, 0], [1, 0, 0], [1, 0, 0], [1, 0, 0], [0, 0, 1], [0, 1, 0], [1, 1, 1], [0, 1, 1], [1, 1, 0], [0, 0, 1], [0, 1, 0], [1, 1, 0], [0, 0, 1], [0, 0, 0], [0, 1, 1], [1, 0, 1], [0, 1, 0], [1, 0, 0], [0, 1, 1], [0, 0, 1], [0, 1, 0], [0, 0, 0], [1, 0, 1], [1, 1, 1], [1, 1, 1], [1, 0, 1], [1, 1, 1], [0, 0, 0], [0, 1, 1], [1, 1, 0], [0, 1, 1], [0, 1, 0], [1, 1, 1], [1, 1, 1], [1, 1, 1], [1, 0, 0], [0, 1, 1], [1, 1, 1], [0, 0, 0], [0, 0, 0], [1, 1, 1], [1, 1, 0], [1, 1, 1], [0, 1, 0], [1, 0, 1], [1, 0, 1], [0, 1, 1], [1, 1, 0], [0, 1, 1], [1, 1, 1], [1, 0, 0], [0, 0, 1], [0, 0, 1], [1, 1, 0], [0, 1, 1], [1, 0, 1], [1, 0, 0], [0, 1, 1], [0, 0, 0], [1, 0, 1], [0, 0, 0], [1, 1, 1], [0, 0, 0], [1, 0, 1], [0, 1, 0], [0, 0, 1], [1, 0, 1], [1, 1, 1], [1, 0, 1], [1, 0, 1], [1, 0, 1], [1, 1, 1], [0, 0, 1], [1, 0, 0], [1, 0, 1], [1, 1, 0], [0, 0, 1], [1, 1, 1], [1, 0, 1], [0, 1, 0], [1, 1, 0], [0, 1, 1], [1, 1, 0], [1, 0, 1], [1, 1, 0], [1, 0, 1], [1, 1, 0], [1, 0, 1], [0, 0, 0], [0, 0, 1], [0, 1, 0], [0, 1, 1], [1, 0, 0], [1, 1, 1], [1, 0, 0], [0, 0, 0], [0, 0, 0], [1, 1, 1], [1, 0, 1], [0, 0, 0]]

Figure 1: This frog was uploaded via the file-tree menu.

Item	Quantity
Widgets	42
Gadgets	13

Table 2: An example table.

1 Some examples to get started

1.1 How to include Figures

First you have to upload the image file from your computer using the upload link in the file-tree menu. Then use the include graphics command to include it in your document. Use the figure environment and the caption command to add a number and a caption to your figure. See the code for Figure 1 in this section for an example.

Note that your figure will automatically be placed in the most appropriate place for it, given the surrounding text and taking into account other figures or tables that may be close by. You can find out more about adding images to your documents in this help article on including images on Overleaf.

1.2 How to add Tables

Use the table and tabular environments for basic tables — see Table 2, for example. For more information, please see this help article on tables.

1. Like this,
2. and like this.

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- Like this,
- and like this.