MATLAB Final Problem Set

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Answers

1. **Question 1**

   (a) The function *eye* takes one argument, the number of rows and columns of a square matrix.

   (b) The function *flip* takes 2 arguments, a matrix A and a dimension *dim*. If *dim* is 1, the array is flipped row-wise down. If *dim* is 2, the array is flipped column-wise left to right.

   (c) Matrix A has 3 rows and 3 columns.

   (d) Matrix B has five 1's.

$$B = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

   (e) Matrix C has nine 1's.

$$C = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

2. **Question 2**

   (a) Four total neurons are excited in A.

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

   (b) [MATLAB Output]

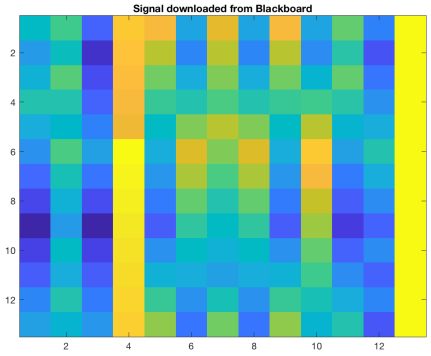

Figure 1: Original message.

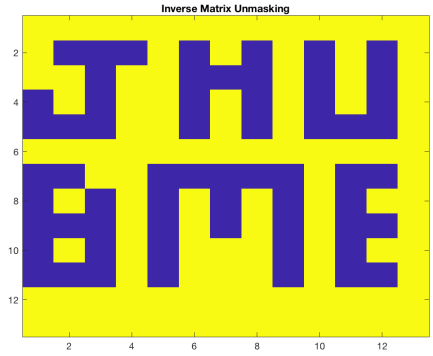

Figure 2: Inverse unmasking.

(c) The decoded signal contains the phrase "JHU BME."

3. **Question 3**

(b) [MATLAB Output]

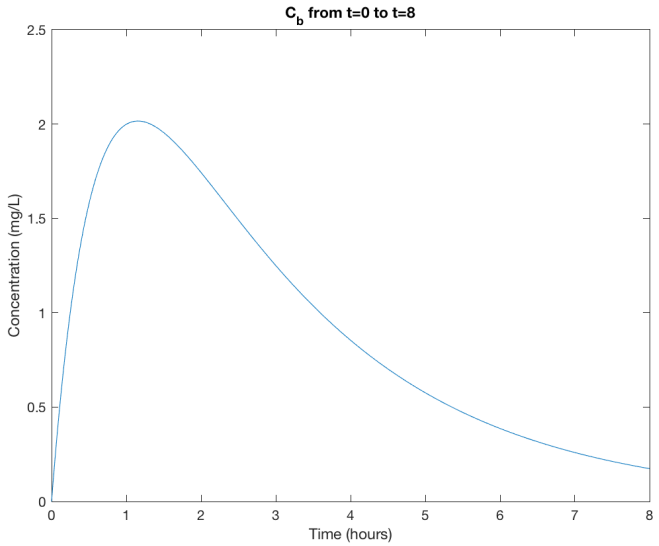

Figure 3: C_b from $t = 0$ to $t = 8$

(c) [MATLAB Output]

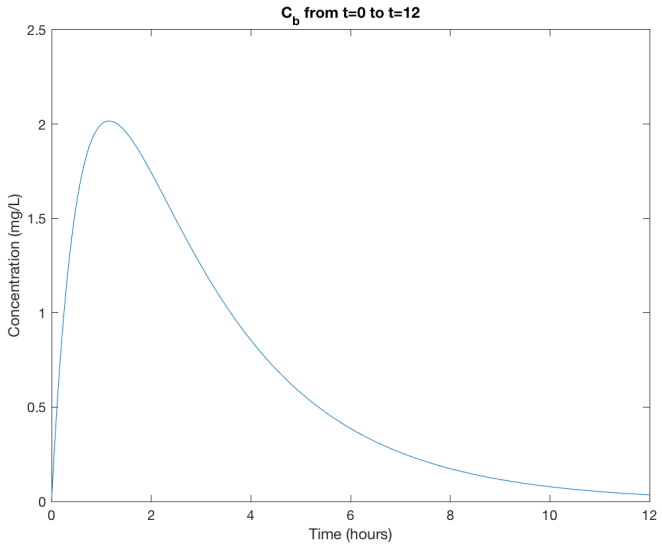

Figure 4: C_b from $t = 0$ to $t = 12$

(d) The maximum C_b of 2.0159 mg/L occurs at 1.1552 s.

$$maxC_b = (1.1552, 2.0159)$$

(e) [MATLAB Output]

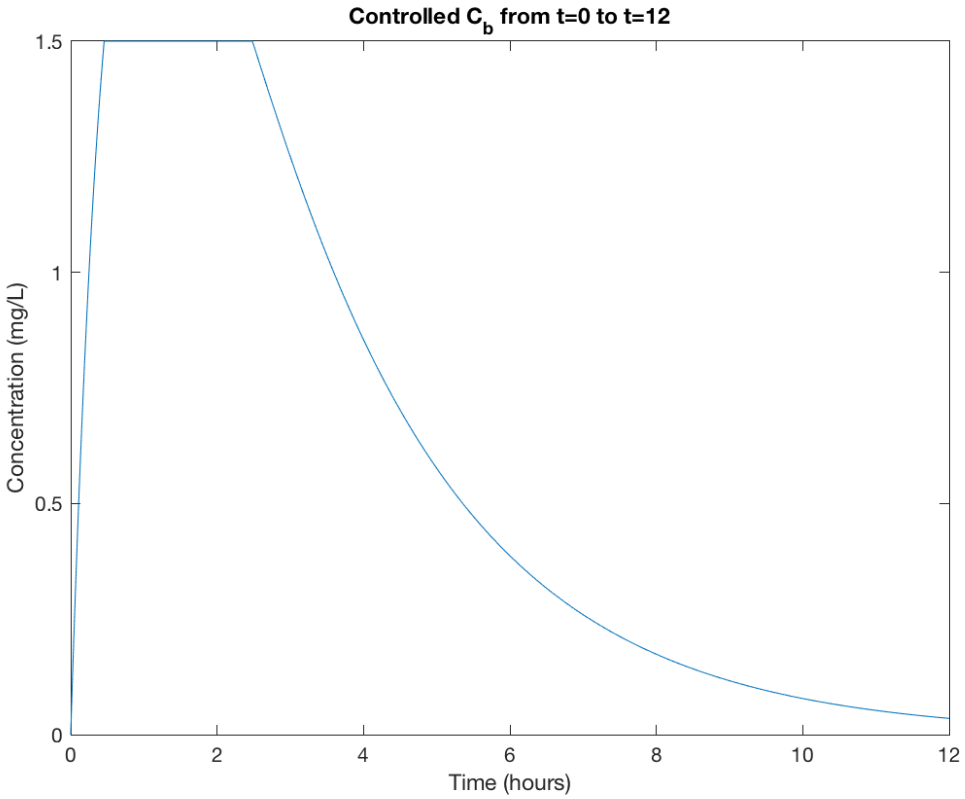

Figure 5: Controlled C_b from $t = 0$ to $t = 12$

4. **Question 4**

(a) The plots result in roughly normal distributions.

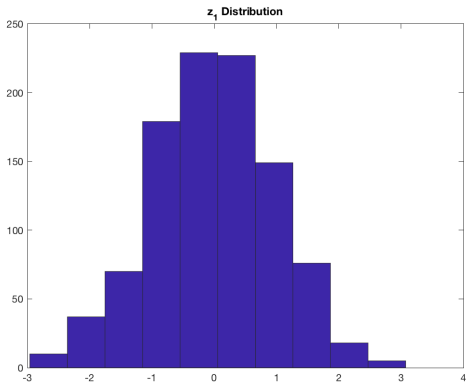

Figure 6: z_1 distribution.

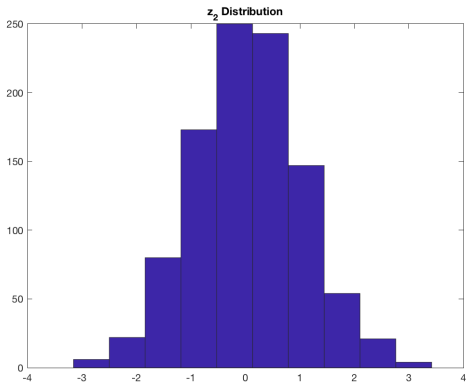

Figure 7: z_2 distribution.

(b) The *rand* function produces an even distribution between 0 and 1 while the *bmt* function results in a roughly normal distribution with mean 0 and standard deviation 1.

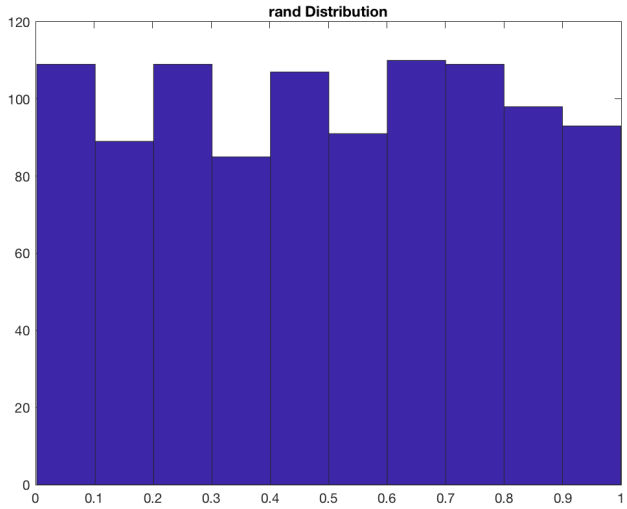

Figure 8: *rand* function distribution.

(c) The *bmt* function has a similar distribution as the *randn* function with mean of 0 and standard deviation of 1 while the *rand* function still produces an even distribution between 0 and 1.

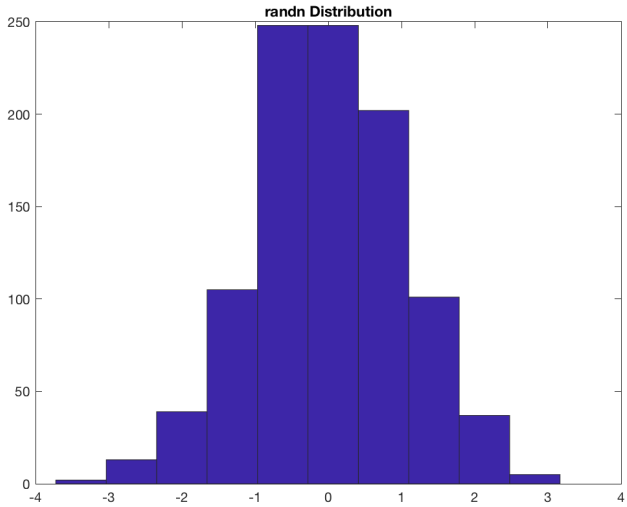

Figure 9: *randn* function distribution.

Notes

The MATLAB script is separated by problem and by subproblem when necessary.