Question 1

Part 1:

1. (i) The standard function for N = 4 are:

The Walsh Hadamard matrix for N = 4 is:

Using the definition the functions are:

(ii) First we will calculate the coefficients using this formula:

Using the coefficient and the functions we are getting the following approximation:

The function we got look like this:

1. (i) We got zero coefficient because the transformation between doesn’t change the MSE. The best representation for this signal by Hadamard-Walsh basis for N = 4 is when used only 3 coefficients.

(ii) The function doesn’t get zero coefficient for .

Calculations:

Part 2

1. The functions that the matrix defines are
2. First we will calculate the coefficients:

Calculations of the approximations:

1. Comparison between the two representations of the linear signal:

|  |  |  |
| --- | --- | --- |
|  | Walsh-Hadamard | Haar |
| MSE(1) | 0.0833 | 0.0833 |
| MSE(2) | 0.0208 | 0.0208 |
| MSE(3) | 0.0052 | 0.013 |
| MSE(4) | 0.0052 | 0.0052 |

From the table and the graph we can see that for this signal both of the representations have the same MSE for N = 4 functions as expected. also , We can see that the Hadamard-Walsh representation is better for the 3-term approximations, not as expected.