IDENTIFIED CLASSES OF COCYCLIC HADAMARD MATRICES OF ORDER 40

1

This document contains a list of classes of cocyclic Hadamard matrices of order 40 identified in the work of Barrera Acevedo et al., "On Cocyclic Hadamard Matrices of order $8p$". For the list of required templates and instructions to generate such matrices see the aforementioned paper.

Base group $K = C_2^3$ and template $H_1 = \mathcal{H}(S, T, U, V, W, X, Y, Z)^{a,b,c}_{i,j,k,r,s,t}$. The bracket $[abc]$ stores the actions of the elements $a, b, c \in K$ on C_5, where 0 means trivial action, and 1 means inversion action. The bracket $[ijkrst]$ stores the values i, j, k, r, s, t that yield the signs in the template H_1. The list of 40 $\pm$ elements is divided into 8 $\{\pm 1\}$-element lists of length 5, which corresponds to the defining rows of the blocks S, T, U, V, W, X, Y, Z.

Class 01
$[101], [101000]$ $+-+---+--++--+---++++--+-+---+-++++++$
Class 02
$[101], [101010]$ $--++++---+-+++-+-+---+----+--++--+-++++$
Class 03
$[101], [101010]$ $+-+---+--++--+-+-+--++---+-++--+--++----$
Class 04
$[101], [101000]$ $+--+++-+---+--+++-++-+++--++++--+-+++++$
Class 05
$[101], [101000]$ $+-+---+--++--+--+--+++---+--+---+--++++++$
Class 06
$[010], [101010]$ $+-+--+++----+++----++++-++-+--++--+-+++++$
Class 07
$[101], [101000]$ $+-+---+--+---+++-+----+-+--+-+++--++++++$
Class 08
$[100], [101010]$ $--++----++-++--+-+----+---+--++--+-+++++$
Class 09
$[010], [101010]$ $+-+--+++----++++++---+----+--++--+------$
Class 10
$[101], [101000]$ $+-+---+--+--+---++++--+-+---+--+-+--++++++$
Class 11
$[111], [101010]$ $+--++++---+-+---+--+--+--+--+--+-+---++++$
Class 12
$[101], [101000]$ $--+++-+---+--+--+--++--+----+++-+--+-----$
Class 13
$[100], [101010]$ $+-+---+--++--+----++--+----+++---+-+----$
Class 14
$[100], [101010]$ $+++--+-+-+-+--++-++---+--+---+---+--+----$
Class 15
$[001], [101010]$ $+++--+++--+-+-+-+--+++-+++-++-+---+-----$
Class 16
$[001], [101010]$ $+-+-+---++++++----++--+---+--++-+++-++++$
Class 17
$[100], [101010]$ $-++--+-+-+-+--++--++++-++-+++-+-++------$
Class 18
$[000], [111100]$ $-+-+---+----+---+-+-+---+--+----+--+---+$
Class 19
$[110], [111100]$ $-+-+---+--+-----+-+--++----+--+------++--$
Class 20
$[100], [101000]$ $+-+-+--+--+----+-+-+---++--+--+-------++$

Base group $K = D_8$ and template $H_2 = \mathcal{H}(S,T,U,V,W,X,Y,Z)^{a,b,c}_{i,j,k}$. The bracket $[abc]$ stores the actions of the elements $a, b, c \in K$ on C_5, where 0 means trivial action, and 1 means inversion action. The bracket $[ijk]$ stores the values i, j, k that yield the signs in the template H_2. The list of 40 $\pm$ elements is divided into 8 $\{\pm 1\}$-element lists of length 5, which corresponds to the defining rows of the blocks S, T, U, V, W, X, Y, Z.

Class 21
$[1,0,0],[101]$ $+-+---+--+++---+-+-+--+----++-+-+-------$
Class 22
$[1,0,0],[101]$ $+-+---+--+++---+-+-+--+----++-+---++++$
Class 23
$[1,0,0],[100]$ $-+++-+-+----++-+-+--++--+--+---++---+----$
Class 24
$[1,0,0],[100]$ $--++++++--++-+---+--++++--+--+-+++-+----$
Class 25
$[1,0,0],[100]$ $-+++-+-+---+--++--+-+---++++--+++-++----$
Class 26
$[1,0,0],[100]$ $+++--+-+---+--++++--+--++++--+---+-------$
Class 27
$[1,0,0],[100]$ $+---+---++-++--+-+---+--++-+-+----++++$
Class 28
$[1,0,0],[100]$ $+-+--+++---+--++++--+++--+--+-+-+++++++$
Class 29
$[1,0,0],[101]$ $+-+--++---+++----+-+-+--++--+-+-+-------$
Class 30
$[1,0,0],[101]$ $+-+--++---+++----+-+-+--++--+-+-+---++++$
Class 31
$[1,0,0],[100]$ $+-+--+---+-+--++---+++--+--+---+--++++$
Class 32
$[1,0,0],[100]$ $+-+--+--++-+--+-+++-+--+-++--++++----$
Class 33
$[1,0,0],[100]$ $++--++++--+-+---+--++++--+--+-++++++++$
Class 34
$[1,0,0],[100]$ $++--++-+---+--++-+--++-+++--+--+----+----$
Class 35
$[1,0,0],[100]$ $+-+------++++----+-+-+--++--+-+---+--++++$
Class 36
$[1,0,0],[101]$ $--+++-+--++++---+--+-+--+-+---+-+-------$
Class 37
$[1,0,0],[101]$ $--+++-+--++++---+--+-+--+-+---+-+---++++$
Class 38
$[1,0,0],[100]$ $-++--+---++-+---+--++++--+--+-----++++++$
Class 39
$[1,0,0],[100]$ $+-+---+--++-++--+--++++---+--++++++++----$
Class 40
$[1,0,0],[100]$ $+--+++--+++-+---+--+-++--+-++---++++----$
Class 41
$[1,0,0],[100]$ $--++++-+--+---+-+--++--+---++++-++----$
Class 42
$[1,0,0],[100]$ $+-+---+--++--+-+-+++-+++--++++-++++++$
Class 43
$[1,0,0],[100]$ $+-+-+++---++--+-+--+--++++-++--+---++++$
Class 44

$[1,0,0],[100]$ $+-+-+++---+---+-+--+--++++-++-+-++++++++$
Class 45
$[1,0,0],[101]$ $-+++-++--+-+++-+-+-+-+--++-++--+--+-------$
Class 46
$[1,0,0],[101]$ $-+++-++--+-+++-+-+-+-+--++-++--+--+--++++$
Class 47
$[1,1,0],[101]$ $--++-+-+-+-+++--+--++-++-++--++--+--+-------$
Class 48
$[1,1,0],[101]$ $--++-+-+-+-+++--+--++-++-++--++--+--+--++++$
Class 49
$[0,1,0],[100]$ $---++++--+-+-+-+--++---++-++-++-+++++++$
Class 50
$[1,0,0],[101]$ $--+-++--+-++---+-------+++--+-+----+------$
Class 51
$[1,0,0],[101]$ $--+-++--+-++---+-------+++--+-+----+-++++$
Class 52
$[1,0,0],[101]$ $++-+--+-+---+-+++-++---++--+++-+----$
Class 53
$[1,0,0],[101]$ $++-+--+-+---+-+++-++---++--+++-++++++$
Class 54
$[0,1,0],[100]$ $++-+--++---+-+-+--++-+++--+-+-+--+-------$
Class 55
$[1,0,0],[100]$ $--+-++-++--++---+++-+-+++++--+-+-+-+--+--++++$
Class 56
$[1,0,0],[100]$ $--+-++-++-++--+++-+++--+-+-+-+-++++++++$
Class 57
$[0,1,0],[101]$ $+---++-+-+-+-+--++---+-+--++-+-+-+-++-------$
Class 58
$[0,1,0],[101]$ $+---++-+-+-+-+--++---+-+--++-+-+-+-++---++++$