

# The Existence of Regular Hadamard Matrices, Maximum Excess and SBIBD( $4k^2, 2k^2 + k, k^2 + k$ )

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With the results of two recent papers [17] and [6] the status of the existence of regular symmetric hadamard matrices of order  $4k^2$  and  $SBIBD(4k^2, 2k^2 + k, k^2 + k)$  becomes that they exist for  $k \in \{1, 3, 5, \dots, 45, 49, \dots, 69, 73, 75, 81, \dots, 101, 105, 107, 109, \dots, 125, 129, 131, 135, 137, 139, 143, \dots, 149, 153, \dots, 165, 169, \dots, 175, \dots, 189, 193, \dots, 197, 201, \dots, 207, 211, 215, 219, 221, 225, 227, 229, 233, 235, 241, \dots, 251, 255, \dots, 261, 267, 269, 273, 275, 277, 281, \dots, 299, 301, 303, 307, 313, \dots, 327, 331, \dots, 339, 343, \dots, 353, 361, 363, 371, 373, 375, 379, 385, \dots, 393, 397, \dots, 401, 405, \dots, 411, 415, 417, 419, 421, 427, 429, 433, 441, 443, 447, 449, 451, 457, 461, 465, \dots, 471, 475, 477, 481, 489, 491, 495, 499, 507, 509, 511, 513, 519, 521, 523, 525, 529, 531, \dots, 543, 547, 549, 551, 555, \dots, 559, 563, 567, 569, 571, 575, 577, 579, 583, 587, 591, 593, 601, 603, 605, 609, 613, \dots, 625, 633, 637, 641, 643, 645, 653, 655, 659, 661, 667, 671, 673, 675, 677, 679, 683, 687, 691, 695, 699, \dots, 709, 723, 725, 729, 731, 733, 735, 739, 741, 747, 753, 757, 761, 763, 767, \dots, 779, 783, 787, 791, 797, 803, \dots, 811, 815, 819, 821, 827, 829, 831, 841, \dots, 859, 865, 867, 871, 875, 877, 879, 881, 883, 885, 891, 895, 897, 907, 909, 921, 925, 929, 931, 937, 939, 941, \dots, 947, 951, 953, 957, 959, 961, 963, 971, 975, 977, 979, 981, 993, 997, 999, 1015, 1035, 1081, 1147, 1189, 1209, 1219, 1275, 1305, 1311, 1357, 1375, 1377, 1395, 1485, 1519, 1767,  $q_1, q_2, q_1q_2, q_1q_4, q_2q_3N, q_3q_4N\}$ , where  $q_1, q_2$  and  $q_3$  are prime power,  $q_1 \equiv 1 \pmod{4}$ ,  $q_2 \equiv 3 \pmod{8}$ ,  $q_3 \equiv 5 \pmod{8}$ ,  $q_4 = 7$  or  $23$ ,  $N = 2^a3^bt^2$ ,  $a, b = 0$  or  $1$ ,  $t \neq 0$  is an arbitrary integer,  $r \geq 0$ .$

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