

# ASSIGNMENT 2

|                     |  |
|---------------------|--|
| NAME                | MANISH SENCHA  |
| CLASS               | B. TECH. III YEAR                                    |
| BRANCH              | CSE  |
| SUBJECT             | DESIGN AND<br>ANALYSIS OF<br>ALGORITHMS<br>(CO34563) |
| ENROLMENT<br>NUMBER | 0801CS191048   |

Algorithm 1:

MergeSort(arr[], l, r)

If  $r > l$

1. Find the middle point to divide the array into two halves:

$$\text{middle } m = l + (r-l)/2$$

2. Call mergeSort for first half:

Call mergeSort(arr, l, m)

3. Call mergeSort for second half:

Call mergeSort(arr, m+1, r)

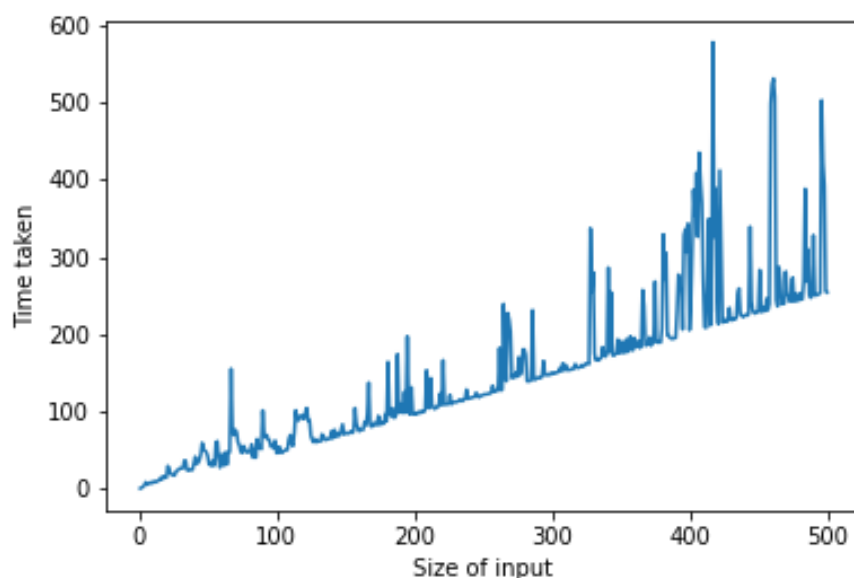
4. Merge the two halves sorted in step 2 and 3:

Call merge(arr, l, m, r)

Time Complexity:

$$T(n) = 2T(n/2) + O(n)$$

$$\Rightarrow O(n \cdot \log(\text{base } 2)(n))$$



| Input  | Output   | Time taken |
|--|--|------------|
| [41]   | [41]   | 0          |
| [8467, 6334]   | [6334, 8467]   | 1          |
| [6500, 9169, 5724]   | [5724, 6500, 9169]   | 2          |
| [1478, 9358, 6962, 4464]                                   | [1478, 4464, 6962, 9358]                                   | 4          |
| [5705, 8145, 3281, 6827, 9961]                             | [3281, 5705, 6827, 8145, 9961]                             | 8          |
| [491, 2995, 1942, 4827, 5436, 2391]                        | [491, 1942, 2391, 2995, 4827, 5436]                        | 5          |
| [4604, 3902, 153, 292, 2382, 7421, 8716]                   | [153, 292, 2382, 3902, 4604, 7421, 8716]                   | 6          |
| [9718, 9895, 5447, 1726, 4771, 1538, 1869, 9912]           | [1538, 1726, 1869, 4771, 5447, 9718, 9895, 9912]           | 7          |
| [5667, 6299, 7035, 9894, 8703, 3811, 1322, 333, 7673]      | [333, 1322, 3811, 5667, 6299, 7035, 7673, 8703, 9894]      | 8          |
| [4664, 5141, 7711, 8253, 6868, 5547, 7644, 2662, 2757, 37] | [37, 2662, 2757, 4664, 5141, 5547, 6868, 7644, 7711, 8253] | 7          |

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| [2859, 8723, 9741, 7529, 778, 2316, 3035, 2190, 1842, 288, 106]                            | [106, 288, 778, 1842, 2190, 2316, 2859, 3035, 7529, 8723, 9741]                            | 9  |
| [9040, 8942, 9264, 2648, 7446, 3805, 5890, 6729, 4370, 5350, 5006, 1101]                   | [1101, 2648, 3805, 4370, 5006, 5350, 5890, 6729, 7446, 8942, 9040, 9264]                   | 8  |
| [4393, 3548, 9629, 2623, 4084, 9954, 8756, 1840, 4966, 7376, 3931, 6308, 6944]             | [1840, 2623, 3548, 3931, 4084, 4393, 4966, 6308, 6944, 7376, 8756, 9629, 9954]             | 9  |
| [2439, 4626, 1323, 5537, 1538, 6118, 2082, 2929, 6541, 4833, 1115, 4639, 9658, 2704]       | [1115, 1323, 1538, 2082, 2439, 2704, 2929, 4626, 4639, 4833, 5537, 6118, 6541, 9658]       | 10 |
| [9930, 3977, 2306, 1673, 2386, 5021, 8745, 6924, 9072, 6270, 5829, 6777, 5573, 5097, 6512] | [1673, 2306, 2386, 3977, 5021, 5097, 5573, 5829, 6270, 6512, 6777, 6924, 8745, 9072, 9930] | 11 |

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| [3986, 3290, 9161,<br>8636, 2355, 4767,<br>3655, 5574, 4031,<br>2052, 7350, 1150,<br>6941, 1724, 3966,<br>3430]          | [1150, 1724, 2052,<br>2355, 3290, 3430,<br>3655, 3966, 3986,<br>4031, 4767, 5574,<br>6941, 7350, 8636,<br>9161]          | 14 |
| [1107, 191, 8007,<br>1337, 5457, 2287,<br>7753, 383, 4945,<br>8909, 2209, 9758,<br>4221, 8588, 6422,<br>4946, 7506]      | [191, 383, 1107,<br>1337, 2209, 2287,<br>4221, 4945, 4946,<br>5457, 6422, 7506,<br>7753, 8007, 8588,<br>8909, 9758]      | 12 |
| [3030, 6413, 9168,<br>900, 2591, 8762,<br>1655, 7410, 6359,<br>7624, 537, 1548,<br>6483, 7595, 4041,<br>3602, 4350, 291] | [291, 537, 900,<br>1548, 1655, 2591,<br>3030, 3602, 4041,<br>4350, 6359, 6413,<br>6483, 7410, 7595,<br>7624, 8762, 9168] | 16 |
| [836, 9374, 1020,<br>4596, 4021, 7348,<br>3199, 9668, 4484,<br>8281, 4734, 53,<br>1999, 6418, 7938,                      | [53, 467, 836, 1020,<br>1999, 3199, 3788,<br>4021, 4484, 4596,<br>4734, 6418, 6900,                                      | 14 |

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|---|---|----|
| 6900, 3788, 8127,<br>467]   | 7348, 7938, 8127,<br>8281, 9374, 9668]  |    |
| [3728, 4893, 4648,<br>2483, 7807, 2421,<br>4310, 6617, 2813,<br>9514, 4309, 7616,<br>8935, 7451, 600,<br>5249, 6519, 1556,<br>2798, 303]      | [303, 600, 1556,<br>2421, 2483, 2798,<br>2813, 3728, 4309,<br>4310, 4648, 4893,<br>5249, 6519, 6617,<br>7451, 7616, 7807,<br>8935, 9514]      | 14 |
| [6224, 1008, 5844,<br>2609, 4989, 2702,<br>3195, 485, 3093,<br>4343, 523, 1587,<br>9314, 9503, 7448,<br>5200, 3458, 6618,<br>580, 9796, 4798] | [485, 523, 580,<br>1008, 1587, 2609,<br>2702, 3093, 3195,<br>3458, 4343, 4798,<br>4989, 5200, 5844,<br>6224, 6618, 7448,<br>9314, 9503, 9796] | 29 |
| [5281, 9589, 798,<br>8009, 7157, 472,<br>3622, 8538, 2292,<br>6038, 4179, 8190,<br>9657, 7958, 6191,<br>9815, 2888, 9156,                     | [472, 798, 1511,<br>2292, 2634, 2888,<br>3622, 4179, 4272,<br>5281, 6038, 6191,<br>6202, 7157, 7958,<br>8009, 8190, 8538,                     | 26 |

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| 1511, 6202, 2634,<br>4272]   | 9156, 9589, 9657,<br>9815]   |    |
| [55, 328, 2646,<br>6362, 4886, 8875,<br>8433, 9869, 142,<br>3844, 1416, 1881,<br>1998, 322, 8651, 21,<br>5699, 3557, 8476,<br>7892, 4389, 5075,<br>712]            | [21, 55, 142, 322,<br>328, 712, 1416,<br>1881, 1998, 2646,<br>3557, 3844, 4389,<br>4886, 5075, 5699,<br>6362, 7892, 8433,<br>8476, 8651, 8875,<br>9869]            | 19 |
| [2600, 2510, 1003,<br>6869, 7861, 4688,<br>3401, 9789, 5255,<br>6423, 5002, 585,<br>4182, 285, 7088,<br>1426, 8617, 3757,<br>9832, 932, 4169,<br>2154, 5721, 7189] | [285, 585, 932,<br>1003, 1426, 2154,<br>2510, 2600, 3401,<br>3757, 4169, 4182,<br>4688, 5002, 5255,<br>5721, 6423, 6869,<br>7088, 7189, 7861,<br>8617, 9789, 9832] | 18 |
| [9976, 1329, 2368,<br>8692, 1425, 555,<br>3434, 6549, 7441,<br>9512, 145, 8060,<br>1718, 3753, 6139,   | [145, 193, 555,<br>1329, 1425, 1718,<br>2368, 2423, 2529,<br>2549, 2949, 3434,<br>3753, 5996, 6139,  | 17 |

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| 2423, 6279, 5996,<br>6687, 2529, 2549,<br>7437, 9866, 2949,<br>193]   | 6279, 6549, 6687,<br>7437, 7441, 8060,<br>8692, 9512, 9866,<br>9976]  |    |
| [3195, 3297, 416,<br>8286, 6105, 4488,<br>6282, 2455, 5734,<br>8114, 1701, 1316,<br>671, 5786, 2263,<br>4313, 4355, 1185,<br>53, 912, 808, 1832,<br>945, 4313, 7756,<br>8321]       | [53, 416, 671, 808,<br>912, 945, 1185,<br>1316, 1701, 1832,<br>2263, 2455, 3195,<br>3297, 4313, 4313,<br>4355, 4488, 5734,<br>5786, 6105, 6282,<br>7756, 8114, 8286,<br>8321]       | 17 |
| [9558, 3646, 7982,<br>481, 4144, 3196,<br>222, 7129, 2161,<br>5535, 450, 1173,<br>466, 2044, 1659,<br>6292, 6439, 7253,<br>24, 6154, 9510,<br>4745, 649, 3186,<br>8313, 4474, 8022] | [24, 222, 450, 466,<br>481, 649, 1173,<br>1659, 2044, 2161,<br>3186, 3196, 3646,<br>4144, 4474, 4745,<br>5535, 6154, 6292,<br>6439, 7129, 7253,<br>7982, 8022, 8313,<br>9510, 9558] | 22 |



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| [2168, 4018, 8787, 9905, 7958, 7391, 202, 3625, 6477, 4414, 9314, 5824, 9334, 5874, 4372, 159, 1833, 8070, 7487, 8297, 7518, 8177, 7773, 2270, 1763, 2668, 7192, 3985]       | [159, 202, 1763, 1833, 2168, 2270, 2668, 3625, 3985, 4018, 4372, 4414, 5824, 5874, 6477, 7192, 7391, 7487, 7518, 7773, 7958, 8070, 8177, 8297, 8787, 9314, 9334, 9905]       | 23 |
| [3102, 8480, 9213, 7627, 4802, 4099, 527, 2625, 1543, 1924, 1023, 9972, 3061, 4181, 1003, 7432, 7505, 7593, 2725, 3031, 8492, 142, 7222, 1286, 3064, 7900, 9187, 8360, 2413] | [142, 527, 1003, 1023, 1286, 1543, 1924, 2413, 2625, 2725, 3031, 3061, 3064, 3102, 4099, 4181, 4802, 7222, 7432, 7505, 7593, 7627, 7900, 8360, 8480, 8492, 9187, 9213, 9972] | 25 |
| [974, 4270, 9170, 235, 833, 9711, 5760, 8896, 4667,  | [140, 235, 833, 974, 1018, 1119, 1624, 1694, 2125, 2466,   | 26 |

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| 7285, 2550, 140,<br>3694, 2695, 1624,<br>8019, 2125, 6576,<br>1694, 2658, 6302,<br>7371, 2466, 4678,<br>2593, 3851, 5484,<br>1018, 8464, 1119]  | 2550, 2593, 2658,<br>2695, 3694, 3851,<br>4270, 4667, 4678,<br>5484, 5760, 6302,<br>6576, 7285, 7371,<br>8019, 8464, 8896,<br>9170, 9711]   |    |
| [3152, 2800, 8087,<br>1060, 1926, 9010,<br>4757, 2170, 315,<br>9576, 227, 2043,<br>2758, 7164, 5109,<br>7882, 7086, 9565,<br>3487, 9577, 4474,<br>2625, 5627, 5629,<br>1928, 5423, 8520,<br>6902, 4962, 123,<br>4596] | [123, 227, 315,<br>1060, 1926, 1928,<br>2043, 2170, 2625,<br>2758, 2800, 3152,<br>3487, 4474, 4596,<br>4757, 4962, 5109,<br>5423, 5627, 5629,<br>6902, 7086, 7164,<br>7882, 8087, 8520,<br>9010, 9565, 9576,<br>9577] | 26 |
| [3737, 3261, 195,<br>2525, 1264, 8260,<br>6202, 8116, 5030,<br>326, 9011, 771,<br>6411, 5547, 1153,   | [188, 195, 326, 771,<br>851, 900, 1153,<br>1200, 1264, 1477,<br>1520, 1763, 2525,<br>3007, 3261, 3737,  | 26 |

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| 1520, 9790, 4924,<br>188, 1763, 4940,<br>851, 8662, 3829,<br>900, 7713, 8958,<br>7578, 8365, 3007,<br>1477, 1200]   | 3829, 4924, 4940,<br>5030, 5547, 6202,<br>6411, 7578, 7713,<br>8116, 8260, 8365,<br>8662, 8958, 9011,<br>9790]  |    |
| [6058, 6439, 2303,<br>2760, 9357, 2324,<br>6477, 5108, 1113,<br>4887, 9801, 2850,<br>4460, 2428, 2993,<br>7384, 9405, 6540,<br>1111, 8704, 2835,<br>2356, 6072, 9350,<br>8823, 4485, 556,<br>3216, 1626, 9357,<br>8526, 3357, 9337] | [556, 1111, 1113,<br>1626, 2303, 2324,<br>2356, 2428, 2760,<br>2835, 2850, 2993,<br>3216, 3357, 4460,<br>4485, 4887, 5108,<br>6058, 6072, 6439,<br>6477, 6540, 7384,<br>8526, 8704, 8823,<br>9337, 9350, 9357,<br>9357, 9405, 9801] | 36 |

Algorithm 2:

Dividing the arrays into 1/3 and 2/3 parts

MergeSort(arr[], l, r)

If  $r > l$

1. Find the 1/3<sup>rd</sup> point to divide the array into two halves:

$$\text{mid } m = l + (r-l)/3$$

2. Call mergeSort for first half:

Call mergeSort(arr, l, m)

3. Call mergeSort for second half:

Call mergeSort(arr, m+1, r)

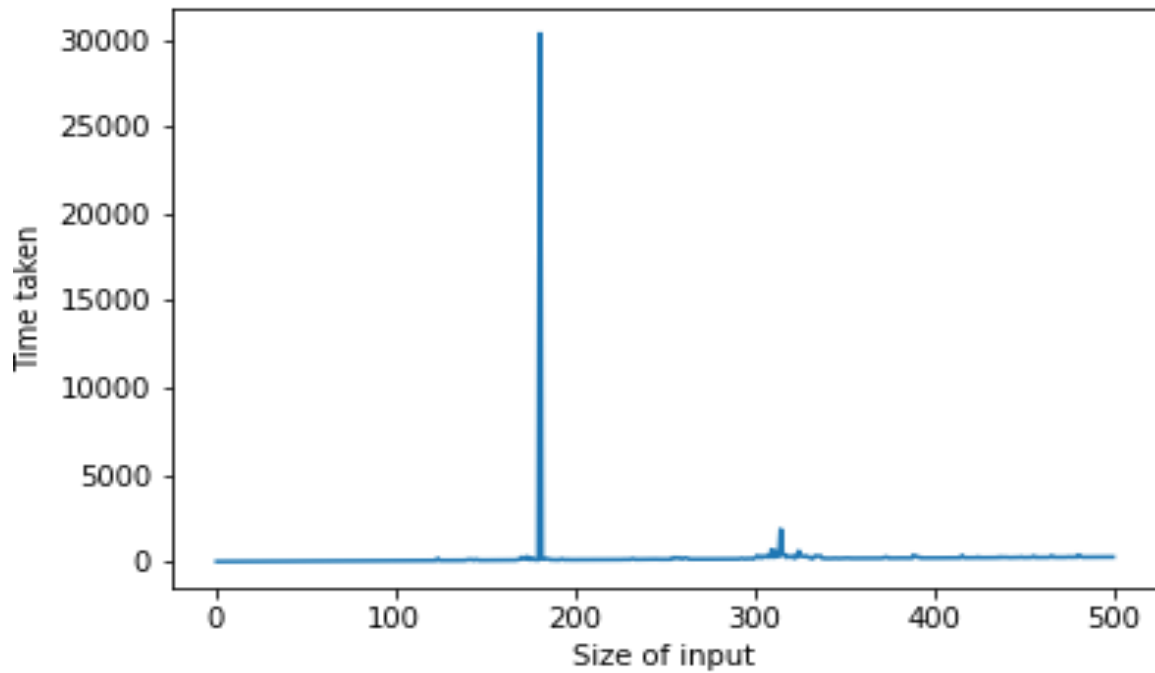
4. Merge the two halves sorted in step 2 and 3:

Call merge(arr, l, m, r)

Time complexity:

$$T(n) = T(n/3) + T(2n/3) + O(n)$$

$$\Rightarrow O(n \cdot \log_{3/2}(n))$$



| Input                                | Output                               | Time taken |
|--------------------------------------|--------------------------------------|------------|
| [6993]                               | [6993]                               | 0          |
| [6353, 5626]                         | [5626, 6353]                         | 0          |
| [5486, 6184, 5243]                   | [5243, 5486, 6184]                   | 0          |
| [572, 2334, 2695, 6507]              | [572, 2334, 2695, 6507]              | 1          |
| [3394, 9766, 7170, 4470, 435]        | [435, 3394, 4470, 7170, 9766]        | 1          |
| [3810, 8274, 8014, 2949, 9088, 7834] | [2949, 3810, 7834, 8014, 8274, 9088] | 2          |

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|---|---|---|
| [6491, 1376, 2855, 6442, 8701, 5669, 8118]                          | [1376, 2855, 5669, 6442, 6491, 8118, 8701]                          | 2 |
| [5011, 7856, 3647, 7755, 6923, 6465, 2361, 2645]                    | [2361, 2645, 3647, 5011, 6465, 6923, 7755, 7856]                    | 2 |
| [7332, 4673, 785, 7420, 9337, 7688, 2475, 1311, 8968]               | [785, 1311, 2475, 4673, 7332, 7420, 7688, 8968, 9337]               | 3 |
| [2443, 4376, 6014, 566, 8049, 2729, 4202, 6623, 6787, 2078]         | [566, 2078, 2443, 2729, 4202, 4376, 6014, 6623, 6787, 8049]         | 3 |
| [7209, 7533, 834, 676, 2767, 3164, 1469, 6111, 841, 3835, 9779]     | [676, 834, 841, 1469, 2767, 3164, 3835, 6111, 7209, 7533, 9779]     | 4 |
| [7060, 9371, 3877, 5621, 90, 7053, 705, 32, 5873, 8177, 2758, 6122] | [32, 90, 705, 2758, 3877, 5621, 5873, 6122, 7053, 7060, 8177, 9371] | 4 |
| [9556, 1144, 8003, 890, 6603, 4582,                                 | [487, 890, 1144, 1412, 1676, 3118,                                  | 4 |

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|---|---|---|
| 3118, 8541, 4229,<br>5907, 1676, 487,<br>1412]  | 4229, 4582, 5907,<br>6603, 8003, 8541,<br>9556]   |   |
| [9827, 6977, 487,<br>3961, 1896, 1240,<br>9486, 9409, 327,<br>4484, 9664, 1952,<br>9033, 6056]                | [327, 487, 1240,<br>1896, 1952, 3961,<br>4484, 6056, 6977,<br>9033, 9409, 9486,<br>9664, 9827]                | 5 |
| [2891, 2029, 3234,<br>4276, 6489, 9518,<br>2919, 9313, 241,<br>9958, 5035, 9392,<br>4803, 7947, 4011]         | [241, 2029, 2891,<br>2919, 3234, 4011,<br>4276, 4803, 5035,<br>6489, 7947, 9313,<br>9392, 9518, 9958]         | 5 |
| [5261, 1139, 8397,<br>5932, 9210, 2677,<br>2085, 3825, 8617,<br>1498, 490, 2161,<br>1865, 3018, 377,<br>1224] | [377, 490, 1139,<br>1224, 1498, 1865,<br>2085, 2161, 2677,<br>3018, 3825, 5261,<br>5932, 8397, 8617,<br>9210] | 6 |
| [1686, 1107, 3542,<br>6876, 9914, 864,<br>6654, 3427, 264,<br>829, 2335, 6819,                                | [264, 490, 829, 864,<br>1107, 1130, 1686,<br>2335, 3427, 3542,<br>6654, 6819, 6876,                           | 6 |

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| 9866, 490, 1130,<br>7723, 8953]  | 7723, 8953, 9866,<br>9914]   |   |
| [7295, 9080, 6928,<br>6046, 3215, 7611,<br>9594, 6951, 3824,<br>1078, 3505, 9388,<br>2074, 2688, 9857,<br>7090, 6077, 2708]            | [1078, 2074, 2688,<br>2708, 3215, 3505,<br>3824, 6046, 6077,<br>6928, 6951, 7090,<br>7295, 7611, 9080,<br>9388, 9594, 9857]            | 7 |
| [7638, 111, 5048,<br>1132, 4820, 9823,<br>7335, 8512, 7637,<br>1319, 5165, 7754,<br>3305, 6616, 8947,<br>604, 7881, 8791,<br>4687]     | [111, 604, 1132,<br>1319, 3305, 4687,<br>4820, 5048, 5165,<br>6616, 7335, 7637,<br>7638, 7754, 7881,<br>8512, 8791, 8947,<br>9823]     | 7 |
| [6516, 541, 1498,<br>4424, 1646, 6671, 5,<br>2328, 2282, 1231,<br>1573, 4692, 5984,<br>1575, 1501, 5641,<br>1969, 9314, 8464,<br>2071] | [5, 541, 1231, 1498,<br>1501, 1573, 1575,<br>1646, 1969, 2071,<br>2282, 2328, 4424,<br>4692, 5641, 5984,<br>6516, 6671, 8464,<br>9314] | 9 |



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| [1888, 4409, 8414, 8562, 5105, 2623, 9154, 2646, 1505, 4766, 8331, 4315, 9783, 5296, 7946, 3353, 4057, 3187, 91, 9454, 7569]        | [91, 1505, 1888, 2623, 2646, 3187, 3353, 4057, 4315, 4409, 4766, 5105, 5296, 7569, 7946, 8331, 8414, 8562, 9154, 9454, 9783]        | 8  |
| [2775, 9336, 7630, 2289, 1193, 7530, 490, 7652, 4725, 929, 1764, 5560, 8807, 8166, 2289, 3785, 4835, 671, 5968, 2784, 1079, 675]    | [490, 671, 675, 929, 1079, 1193, 1764, 2289, 2289, 2775, 2784, 3785, 4725, 4835, 5560, 5968, 7530, 7630, 7652, 8166, 8807, 9336]    | 10 |
| [6731, 7244, 3629, 1790, 620, 2639, 3797, 71, 6530, 3036, 6450, 9921, 9363, 9167, 9907, 6767, 8243, 1054, 5, 5163, 8006, 2318, 647] | [5, 71, 620, 647, 1054, 1790, 2318, 2639, 3036, 3629, 3797, 5163, 6450, 6530, 6731, 6767, 7244, 8006, 8243, 9167, 9363, 9907, 9921] | 9  |

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| [2712, 2595, 9402, 239, 2310, 4747, 2368, 3995, 2487, 1208, 9275, 2603, 4496, 2792, 5880, 1229, 1025, 1276, 9251, 9816, 7769, 2620, 2162, 5885]    | [239, 1025, 1208, 1229, 1276, 2162, 2310, 2368, 2487, 2595, 2603, 2620, 2712, 2792, 3995, 4496, 4747, 5880, 5885, 7769, 9251, 9275, 9402, 9816]    | 9  |
| [5668, 8798, 2822, 3098, 3382, 5110, 9117, 7266, 2076, 8672, 6410, 6426, 8417, 5836, 2345, 2676, 14, 1658, 4029, 2113, 726, 230, 1965, 6355, 9153] | [14, 230, 726, 1658, 1965, 2076, 2113, 2345, 2676, 2822, 3098, 3382, 4029, 5110, 5668, 5836, 6355, 6410, 6426, 7266, 8417, 8672, 8798, 9117, 9153] | 11 |
| [3285, 9023, 3265, 9895, 5617, 5443, 9279, 3040, 2848, 4148, 8621, 3769, 8412, 9834, 6910, 8634, 1583, 9811,                                       | [1583, 1731, 2070, 2124, 2654, 2848, 3040, 3265, 3285, 3769, 4148, 4626, 5443, 5617, 6632, 6910, 7193, 8412,                                       | 10 |

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| 2124, 2070, 2654,<br>1731, 7193, 4626,<br>6632, 8506]  | 8506, 8621, 8634,<br>9023, 9279, 9811,<br>9834, 9895]   |    |
| [3193, 4953, 8782,<br>3237, 335, 3007,<br>2324, 4007, 8326,<br>6517, 8665, 5641,<br>1153, 5580, 2340,<br>2304, 5716, 6014,<br>9807, 815, 9812,<br>4345, 4265, 5148,<br>7820, 3389, 1335]       | [335, 815, 1153,<br>1335, 2304, 2324,<br>2340, 3007, 3193,<br>3237, 3389, 4007,<br>4265, 4345, 4953,<br>5148, 5580, 5641,<br>5716, 6014, 6517,<br>7820, 8326, 8665,<br>8782, 9807, 9812]    | 10 |
| [2007, 5139, 2809,<br>394, 248, 1402,<br>4849, 5319, 1736,<br>5242, 9026, 8338,<br>9172, 8285, 3817,<br>2028, 781, 7323,<br>2337, 16, 2339,<br>4665, 1307, 6680,<br>7027, 8189, 7363,<br>5365] | [16, 248, 394, 781,<br>1307, 1402, 1736,<br>2007, 2028, 2337,<br>2339, 2809, 3817,<br>4665, 4849, 5139,<br>5242, 5319, 5365,<br>6680, 7027, 7323,<br>7363, 8189, 8285,<br>8338, 9026, 9172] | 11 |

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| [1278, 7908, 5696, 1807, 3276, 7784, 6172, 8009, 1809, 668, 9589, 3273, 3663, 5130, 3236, 4839, 28, 336, 7788, 5300, 4118, 4517, 1941, 9868, 5380, 274, 6809, 207, 5902]          | [28, 207, 274, 336, 668, 1278, 1807, 1809, 1941, 3236, 3273, 3276, 3663, 4118, 4517, 4839, 5130, 5300, 5380, 5696, 5902, 6172, 6809, 7784, 7788, 7908, 8009, 9589, 9868]          | 11 |
| [5167, 9886, 7100, 3136, 6843, 6582, 7791, 3643, 5617, 1443, 5789, 124, 7751, 9855, 1565, 4913, 504, 9547, 3818, 2633, 3429, 7622, 6326, 7532, 6983, 1984, 6689, 331, 8489, 3952] | [124, 331, 504, 1443, 1565, 1984, 2633, 3136, 3429, 3643, 3818, 3952, 4913, 5167, 5617, 5789, 6326, 6582, 6689, 6843, 6983, 7100, 7532, 7622, 7751, 7791, 8489, 9547, 9855, 9886] | 13 |
| [2587, 4569, 1395, 2003, 166, 7898, 1913, 9606, 1263,   | [139, 166, 470, 983, 1078, 1085, 1213, 1263, 1395, 1602,  | 12 |

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|---|---|----|
| 2602, 5574, 470,<br>3614, 1602, 9475,<br>2293, 139, 1078,<br>1085, 6992, 3604,<br>3587, 3190, 8479,<br>1213, 8135, 9882,<br>5804, 983, 2177,<br>2548]   | 1913, 2003, 2177,<br>2293, 2548, 2587,<br>2602, 3190, 3587,<br>3604, 3614, 4569,<br>5574, 5804, 6992,<br>7898, 8135, 8479,<br>9475, 9606, 9882]   |    |
| [7368, 1508, 4315,<br>2898, 4458, 1594,<br>7124, 3239, 7065,<br>7990, 1043, 9343,<br>7452, 4306, 7033,<br>3800, 5056, 5498,<br>9143, 8576, 9722,<br>8236, 8336, 2537,<br>5326, 9855, 1664,<br>356, 8464, 7893,<br>9213, 6829] | [356, 1043, 1508,<br>1594, 1664, 2537,<br>2898, 3239, 3800,<br>4306, 4315, 4458,<br>5056, 5326, 5498,<br>6829, 7033, 7065,<br>7124, 7368, 7452,<br>7893, 7990, 8236,<br>8336, 8464, 8576,<br>9143, 9213, 9343,<br>9722, 9855] | 13 |
| [8728, 3987, 588,<br>1523, 2043, 8592,<br>1847, 6539, 5527,<br>9228, 7854, 6757,  | [106, 235, 404, 588,<br>1475, 1523, 1688,<br>1711, 1843, 1847,<br>1999, 2043, 2564,   | 13 |

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| 1711, 2564, 9452,<br>3215, 7800, 6867,<br>8555, 2824, 1475,<br>8091, 106, 1688,<br>3565, 404, 9086,<br>1999, 1843, 4436,<br>4743, 235, 2905]   | 2824, 2905, 3215,<br>3565, 3987, 4436,<br>4743, 5527, 6539,<br>6757, 6867, 7800,<br>7854, 8091, 8555,<br>8592, 8728, 9086,<br>9228, 9452]  |    |
| [2528, 8533, 8957,<br>205, 3009, 250,<br>7598, 296, 27, 545,<br>5166, 453, 6026,<br>7968, 8574, 6149,<br>30, 154, 3967, 9409,<br>3720, 5432, 4762,<br>5634, 4805, 2761,<br>3153, 7406, 571,<br>3687, 37, 9043, 658,<br>2989] | [27, 30, 37, 154,<br>205, 250, 296, 453,<br>545, 571, 658, 2528,<br>2761, 2989, 3009,<br>3153, 3687, 3720,<br>3967, 4762, 4805,<br>5166, 5432, 5634,<br>6026, 6149, 7406,<br>7598, 7968, 8533,<br>8574, 8957, 9043,<br>9409] | 15 |
| [2714, 2281, 6869,<br>7222, 7800, 2643,<br>1993, 1862, 8372,<br>471, 8669, 5007,<br>3566, 9998, 4562,  | [308, 471, 1191,<br>1299, 1862, 1877,<br>1993, 2281, 2595,<br>2643, 2714, 2809,<br>2913, 2956, 3052,   | 14 |

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|---|---|----|
| 4477, 3052, 7502,<br>5852, 8627, 3175,<br>7174, 8794, 4746,<br>308, 2809, 2595,<br>5974, 1877, 5022,<br>8466, 2956, 2913,<br>1191, 1299]  | 3175, 3566, 4477,<br>4562, 4746, 5007,<br>5022, 5852, 5974,<br>6869, 7174, 7222,<br>7502, 7800, 8372,<br>8466, 8627, 8669,<br>8794, 9998]   |    |
| [9265, 4130, 8114,<br>6686, 3173, 6621,<br>9213, 7412, 6304,<br>4712, 5213, 9991,<br>4523, 5879, 7616,<br>1551, 5618, 3943,<br>8096, 8058, 6792,<br>4702, 5291, 2516,<br>4844, 386, 4690,<br>1527, 7130, 2730,<br>4975, 7604, 3429,<br>866, 8219, 4995] | [386, 866, 1527,<br>1551, 2516, 2730,<br>3173, 3429, 3943,<br>4130, 4523, 4690,<br>4702, 4712, 4844,<br>4975, 4995, 5213,<br>5291, 5618, 5879,<br>6304, 6621, 6686,<br>6792, 7130, 7412,<br>7604, 7616, 8058,<br>8096, 8114, 8219,<br>9213, 9265, 9991] | 14 |
| [1076, 9379, 942,<br>3815, 5371, 4130,<br>9160, 7942, 4684,<br>6391, 9503, 824,   | [74, 717, 797, 824,<br>942, 1076, 1312,<br>1445, 1678, 1728,<br>2383, 2557, 3150,   | 15 |

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|---|---|----|
| 4573, 6914, 4282,<br>3150, 4811, 9561,<br>1678, 1445, 2383,<br>9636, 8935, 3674,<br>8368, 717, 6793,<br>1728, 74, 6194,<br>5975, 6063, 797,<br>2557, 6116, 1312,<br>9033]   | 3674, 3815, 4130,<br>4282, 4573, 4684,<br>4811, 5371, 5975,<br>6063, 6116, 6194,<br>6391, 6793, 6914,<br>7942, 8368, 8935,<br>9033, 9160, 9379,<br>9503, 9561, 9636]  |    |
| [4006, 5176, 5527,<br>6280, 8822, 9733,<br>1088, 2508, 4768,<br>3114, 4573, 8876,<br>6252, 9448, 670,<br>2921, 5459, 1844,<br>5298, 9221, 2946,<br>7692, 4254, 4566,<br>7288, 5902, 60,<br>2792, 4050, 9237,<br>3509, 193, 9354,<br>3636, 3649, 328,<br>8315, 5528] | [60, 193, 328, 670,<br>1088, 1844, 2508,<br>2792, 2921, 2946,<br>3114, 3509, 3636,<br>3649, 4006, 4050,<br>4254, 4566, 4573,<br>4768, 5176, 5298,<br>5459, 5527, 5528,<br>5902, 6252, 6280,<br>7288, 7692, 8315,<br>8822, 8876, 9221,<br>9237, 9354, 9448,<br>9733] | 17 |



### Algorithm 3:

Dividing the arrays into 3 equal parts

MergeSort(arr[], l, r)

If  $r > l$

- Find the  $1/3^{\text{rd}}$  and  $2/3^{\text{rd}}$  point to divide the array into three halves:

$$\text{mid } m1 = l + (r-l)/3, m2 = l + 2((r-l)/3)+1$$

- Call mergeSort for first part:

Call mergeSort(arr, l, m1)

- Call mergeSort for second part:

Call mergeSort(arr, m1, m2)

- Call mergeSort for third part:

Call mergeSort(arr, m2, r)

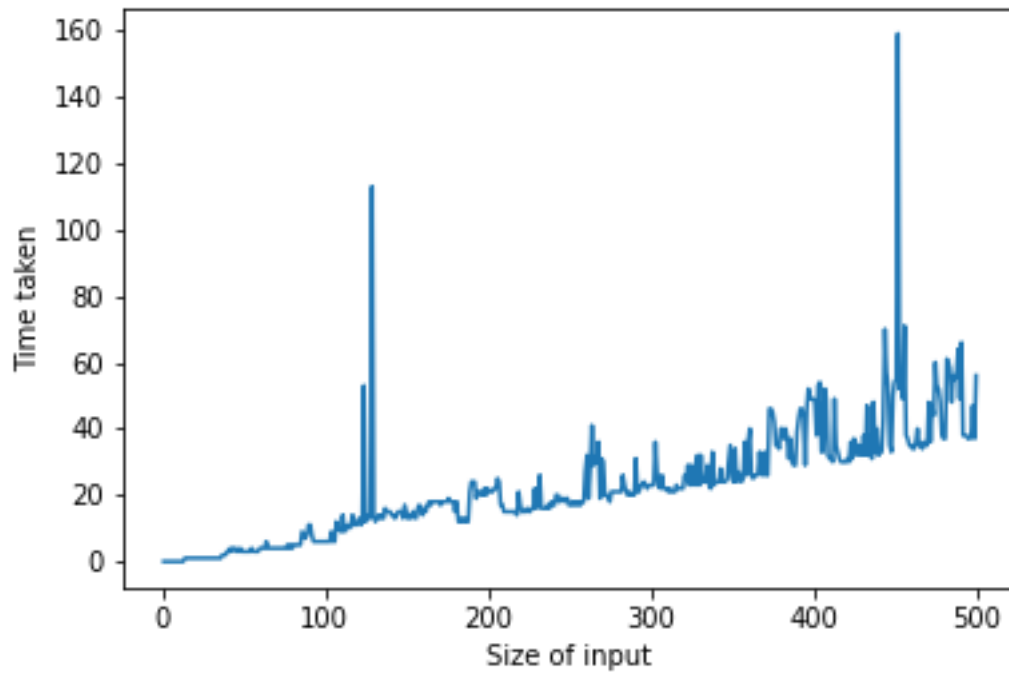
- Merge the two halves sorted in step 2, 3 and 4:

Call merge(arr, l, m, r)

Time complexity:

$$T(n) = 3T(n/3) + O(n)$$

$$\Rightarrow O(n \cdot \log(\text{base } 3)(n))$$



| Input                                    | Output                                   | Time taken |
|--|--|------------|
| [3439, 794, 9718, 9799]                  | [794, 3439, 9718, 9799]                  | 0          |
| [1896, 2713, 5707, 8167, 5226]           | [1896, 2713, 5707, 8167, 5226]           | 0          |
| [2683, 1102, 6403, 6427, 12, 2491]       | [1102, 2683, 6403, 6427, 12, 2491]       | 0          |
| [2947, 7471, 7921, 5976, 4315, 4764, 10] | [2947, 4764, 7471, 7921, 5976, 4315, 10] | 0          |

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|--|--|---|
| [1459, 7838, 4971, 5798, 3739, 4174, 7154, 1196]                             | [1459, 4174, 4971, 5798, 3739, 7154, 7838, 1196]                             | 0 |
| [5601, 1687, 6464, 5958, 4048, 7837, 888, 1408, 123]                         | [5601, 1687, 6464, 5958, 4048, 7837, 888, 1408, 123]                         | 0 |
| [5043, 1378, 1986, 6070, 1437, 1758, 3466, 5993, 8248, 8763]                 | [5043, 1378, 1986, 5993, 6070, 1437, 1758, 3466, 8248, 8763]                 | 0 |
| [782, 1424, 2537, 7063, 8289, 4597, 419, 7767, 499, 5458, 749]               | [782, 1424, 2537, 7063, 7767, 499, 5458, 8289, 4597, 419, 749]               | 0 |
| [3113, 3182, 5026, 8499, 3688, 1950, 4552, 4779, 273, 2528, 5842, 3803]      | [3113, 3182, 4779, 273, 2528, 5026, 5842, 8499, 3688, 1950, 4552, 3803]      | 0 |
| [2179, 895, 1118, 7402, 4188, 4891, 3326, 1588, 1794, 5947, 1865, 2834, 718] | [2179, 895, 1118, 4188, 4891, 3326, 1588, 1794, 5947, 1865, 2834, 7402, 718] | 0 |

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|--|--|---|
| [9124, 9746, 1321, 9776, 746, 5453, 3297, 9823, 3510, 7646, 3817, 2799, 8361, 8948]                    | [746, 5453, 3297, 7646, 3817, 2799, 8361, 9124, 9746, 1321, 9776, 9823, 3510, 8948]                    | 1 |
| [121, 1449, 1761, 8455, 2025, 325, 3353, 3678, 5728, 1451, 4805, 3892, 191, 1387, 7135]                | [121, 1449, 1451, 1761, 2025, 325, 3353, 3678, 4805, 3892, 191, 1387, 5728, 8455, 7135]                | 1 |
| [7099, 159, 2457, 6060, 1, 5608, 8909, 8226, 9619, 9555, 3962, 5869, 2287, 9363, 8525, 272]            | [5608, 5869, 2287, 7099, 159, 2457, 6060, 1, 8909, 8226, 9363, 8525, 9619, 9555, 3962, 272]            | 1 |
| [4654, 9807, 9240, 3898, 9634, 2883, 1712, 8793, 8108, 5993, 8100, 5603, 3170, 1345, 3871, 6322, 6623] | [2883, 1712, 4654, 5603, 3170, 1345, 3871, 6322, 8793, 8108, 5993, 8100, 9807, 9240, 3898, 9634, 6623] | 1 |
| [4216, 6896, 4512, 5611, 4568, 7352,   | [1085, 4216, 5223, 6896, 4512, 5611,   | 1 |

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|--|--|---|
| 2884, 780, 2012,<br>9027, 6891, 1085,<br>5223, 8794, 6554,<br>3246, 7302, 2520]  | 4568, 7352, 2884,<br>780, 2012, 8794,<br>6554, 3246, 7302,<br>9027, 6891, 2520]  |   |
| [4979, 4364, 5155,<br>6508, 439, 2930,<br>8059, 7647, 9851,<br>4416, 5170, 1542,<br>6510, 6860, 6693,<br>5466, 1769, 9063,<br>8929]      | [4979, 4364, 5155,<br>6508, 439, 2930,<br>6860, 6693, 5466,<br>1769, 8059, 7647,<br>9063, 9851, 4416,<br>5170, 1542, 6510,<br>8929]      | 1 |
| [3255, 8455, 5921,<br>6835, 1937, 9543,<br>3950, 7087, 270,<br>9872, 5995, 6980,<br>8047, 4613, 940,<br>4911, 3616, 7002,<br>1896, 9936] | [3255, 3950, 4613,<br>940, 4911, 3616,<br>7002, 1896, 7087,<br>270, 8455, 5921,<br>6835, 1937, 9543,<br>9872, 5995, 6980,<br>8047, 9936] | 1 |
| [4883, 1990, 6967,<br>7386, 968, 4488,<br>3930, 7423, 257,<br>5294, 6157, 8411,<br>739, 4164, 4489,                                      | [3930, 4164, 4489,<br>4883, 1990, 6967,<br>7386, 968, 4488,<br>7423, 257, 5294,<br>6157, 8411, 739,                                      | 1 |

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| 9407, 9198, 2506,<br>1340, 7938, 6656]   | 9407, 9198, 2506,<br>1340, 7938, 6656]   |   |
| [2842, 8333, 2435,<br>471, 2584, 2666,<br>9361, 678, 6523,<br>7380, 4382, 5258,<br>3867, 7934, 3778,<br>1917, 2538, 5346,<br>3756, 5707, 2728,<br>6005]      | [678, 1917, 2538,<br>2842, 5346, 3756,<br>5707, 2728, 6523,<br>7380, 4382, 5258,<br>3867, 7934, 3778,<br>8333, 2435, 471,<br>2584, 2666, 9361,<br>6005]      | 1 |
| [6638, 963, 1330,<br>2860, 9866, 2432,<br>6332, 5326, 9127,<br>4857, 2943, 8156,<br>9241, 4022, 8851,<br>1695, 240, 1300,<br>2529, 1456, 607,<br>2106, 7506] | [1695, 240, 1300,<br>2529, 1456, 607,<br>2106, 5326, 6638,<br>963, 1330, 2860,<br>9127, 4857, 2943,<br>8156, 9241, 4022,<br>8851, 9866, 2432,<br>6332, 7506] | 1 |
| [510, 8496, 3965,<br>9500, 3851, 9494,<br>1377, 5279, 1032,<br>7299, 1057, 1226,<br>8802, 6491, 8384,  | [510, 5279, 1032,<br>6212, 221, 2072,<br>3281, 376, 7299,<br>1057, 1226, 7521,<br>6656, 6357, 8496,  | 1 |

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| 6212, 221, 2072,<br>3281, 376, 7521,<br>6656, 6357, 9711]  | 3965, 8802, 6491,<br>8384, 9500, 3851,<br>9494, 1377, 9711]  |   |
| [722, 3188, 8899,<br>2340, 5892, 7034,<br>8348, 4037, 1197,<br>5757, 9887, 2470,<br>813, 2115, 9178,<br>2634, 1437, 4144,<br>6883, 8916, 9780,<br>2314, 8918, 4746,<br>6416]         | [722, 1197, 3188,<br>4144, 5757, 6883,<br>8899, 2340, 5892,<br>7034, 8348, 4037,<br>8916, 9780, 2314,<br>8918, 4746, 9887,<br>2470, 813, 2115,<br>9178, 2634, 1437,<br>6416]         | 1 |
| [1020, 9072, 6364,<br>2643, 8686, 9179,<br>4404, 2987, 8373,<br>4554, 1534, 6614,<br>8535, 9256, 7529,<br>7045, 9842, 8428,<br>9567, 2833, 3853,<br>1680, 3586, 9036,<br>2063, 3042] | [1020, 8373, 4554,<br>1534, 6614, 8428,<br>8535, 9072, 6364,<br>2643, 8686, 9179,<br>4404, 2987, 9256,<br>7529, 7045, 9567,<br>2833, 3853, 1680,<br>3586, 9036, 2063,<br>9842, 3042] | 1 |
| [3255, 5722, 9582,<br>1018, 1943, 7615,  | [3255, 5722, 5924,<br>9248, 1966, 3526,  | 1 |

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| 1355, 877, 5924,<br>9434, 253, 7618,<br>6809, 7810, 1563,<br>9155, 6709, 9248,<br>1966, 3526, 1161,<br>110, 6165, 2604,<br>9935, 7902, 619]  | 1161, 110, 6165,<br>2604, 9434, 253,<br>7618, 6809, 7810,<br>1563, 9155, 6709,<br>9582, 1018, 1943,<br>7615, 1355, 877,<br>9935, 7902, 619]  |   |
| [3801, 7102, 7886,<br>470, 1174, 4124,<br>7946, 6993, 6788,<br>9683, 8067, 5757,<br>8850, 5095, 3502,<br>1028, 3616, 8214,<br>5056, 6894, 6788,<br>8257, 809, 5095,<br>6669, 8283, 9598,<br>208] | [3801, 6894, 6788,<br>7102, 7886, 470,<br>1174, 4124, 7946,<br>6993, 6788, 8257,<br>809, 5095, 6669,<br>8283, 9598, 9683,<br>8067, 5757, 8850,<br>5095, 3502, 1028,<br>3616, 8214, 5056,<br>208] | 1 |
| [9703, 975, 940,<br>308, 47, 1255, 890,<br>7151, 3351, 9658,<br>4702, 9690, 683,<br>7253, 5330, 6970,<br>6341, 5406, 4616,   | [4362, 9658, 4702,<br>9690, 683, 7253,<br>5330, 6970, 6341,<br>5406, 4616, 9703,<br>975, 940, 308, 47,<br>1255, 890, 7151,   | 1 |



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|---|---|---|
| 4362, 9774, 1780,<br>2364, 5798, 3047,<br>4827, 6314, 3210,<br>4855]  | 3351, 9774, 1780,<br>2364, 5798, 3047,<br>4827, 6314, 3210,<br>4855]  |   |
| [4119, 1423, 7513,<br>213, 9415, 9332, 34,<br>2808, 9828, 5960,<br>5488, 8684, 9018,<br>3933, 4802, 2281,<br>4118, 7510, 6106,<br>975, 7712, 2240,<br>8361, 1044, 8075,<br>3455, 8075, 7794,<br>6091, 9401] | [975, 4119, 1423,<br>5960, 5488, 7513,<br>213, 7712, 2240,<br>8361, 1044, 8075,<br>3455, 8075, 7794,<br>6091, 8684, 9018,<br>3933, 4802, 2281,<br>4118, 7510, 6106,<br>9415, 9332, 34,<br>2808, 9828, 9401] | 1 |
| [8047, 1066, 9606,<br>5881, 1994, 589,<br>1934, 1853, 7820,<br>2365, 2942, 9857,<br>6163, 9487, 5155,<br>511, 8671, 9044,<br>8845, 6023, 9878,<br>1880, 5590, 9996,<br>2040, 266, 7842,                     | [1880, 2942, 5590,<br>8047, 1066, 9606,<br>5881, 1994, 589,<br>1934, 1853, 7820,<br>2365, 9857, 6163,<br>9487, 5155, 511,<br>8671, 9044, 8845,<br>6023, 9878, 9996,<br>2040, 266, 7842,                     | 1 |

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|--|--|---|
| 8127, 821, 1325,<br>8280]  | 8127, 821, 1325,<br>8280]  |   |
| [640, 5022, 1711,<br>6480, 8274, 7626,<br>9864, 4541, 9743,<br>9210, 1349, 893,<br>9884, 8223, 2342,<br>6510, 9005, 8554,<br>788, 2947, 2828,<br>2292, 4152, 1944,<br>8438, 6399, 7095,<br>930, 1190, 9501,<br>8210, 7579] | [640, 1349, 893,<br>2292, 4152, 1944,<br>5022, 1711, 6480,<br>8274, 7626, 8438,<br>6399, 7095, 930,<br>1190, 9501, 8210,<br>9864, 4541, 9743,<br>9210, 9884, 8223,<br>2342, 6510, 9005,<br>8554, 788, 2947,<br>2828, 7579] | 1 |
| [3063, 1535, 2782,<br>7724, 9988, 3985,<br>4734, 8731, 5634,<br>3428, 7514, 1384,<br>3889, 3548, 2570,<br>8082, 2606, 9227,<br>6915, 9808, 8733,<br>2957, 4390, 2397,<br>581, 1654, 4613,                                  | [2957, 3063, 1535,<br>2782, 4390, 2397,<br>581, 1654, 4613,<br>7363, 764, 2409,<br>7287, 2267, 7514,<br>1384, 3889, 3548,<br>2570, 7724, 8082,<br>2606, 9227, 6915,<br>9808, 8733, 9988,                                   | 1 |

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| 7363, 764, 2409,<br>7287, 2267, 3861]  | 3985, 4734, 8731,<br>5634, 3428, 3861]   |   |
| [1435, 5390, 2659,<br>7414, 3479, 8935,<br>2561, 4623, 8914,<br>962, 9528, 3032,<br>4082, 1459, 5896,<br>2507, 9147, 3016,<br>4683, 6786, 9850,<br>5163, 6365, 834,<br>7237, 5482, 4572,<br>1048, 7906, 598,<br>577, 4386, 552,<br>8537] | [834, 1435, 3032,<br>4082, 1459, 5390,<br>2659, 5896, 2507,<br>7237, 5482, 4572,<br>1048, 7414, 3479,<br>7906, 598, 577,<br>4386, 552, 8935,<br>2561, 4623, 8914,<br>962, 9147, 3016,<br>4683, 6786, 9528,<br>9850, 5163, 6365,<br>8537] | 1 |
| [5244, 1329, 1347,<br>9403, 9575, 8733,<br>556, 6918, 6772,<br>1786, 136, 7336,<br>1464, 8522, 5984,<br>1498, 1308, 8884,<br>8241, 6079, 9826,<br>531, 6260, 255,<br>1861, 6786, 5489,   | [255, 1861, 5244,<br>1329, 1347, 6786,<br>5489, 4453, 5604,<br>1222, 1167, 805,<br>5152, 1980, 7336,<br>1464, 8522, 5984,<br>1498, 1308, 8884,<br>8241, 6079, 9403,<br>9575, 8733, 556,  | 1 |

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| 4453, 5604, 1222,<br>1167, 805, 5152,<br>1980, 8431]  | 6918, 6772, 1786,<br>136, 9826, 531,<br>6260, 8431]   |   |
| [113, 7108, 1381,<br>7995, 8494, 277,<br>5166, 2088, 4499,<br>89, 2933, 6627,<br>7122, 4221, 7466,<br>6236, 2714, 1473,<br>6242, 3820, 1836,<br>5943, 6034, 9180,<br>1132, 7629, 2346,<br>2009, 8667, 1159,<br>3999, 2867, 8243,<br>3520, 1213, 1781] | [113, 6627, 7108,<br>1381, 7122, 4221,<br>7466, 6236, 2714,<br>1473, 6242, 3820,<br>1836, 5943, 6034,<br>7995, 8494, 277,<br>5166, 2088, 4499,<br>89, 2933, 9180,<br>1132, 7629, 2346,<br>2009, 8667, 1159,<br>3999, 2867, 8243,<br>3520, 1213, 1781] | 1 |
| [1154, 1842, 1501,<br>3146, 3210, 868,<br>2180, 4413, 8072,<br>3667, 5516, 3073,<br>3844, 6565, 391,<br>4227, 5480, 8170,<br>1856, 1373, 1653,<br>6259, 9893, 1020,   | [1154, 1842, 1501,<br>3146, 3210, 868,<br>2180, 3844, 4413,<br>6565, 391, 4227,<br>5480, 6680, 1490,<br>3925, 5239, 5428,<br>5503, 7219, 2713,<br>7908, 6894, 2116,   | 2 |

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| 3715, 6680, 1490,<br>3925, 5239, 5428,<br>5503, 7219, 2713,<br>7908, 6894, 2116,<br>8006]  | 8072, 3667, 5516,<br>3073, 8170, 1856,<br>1373, 1653, 6259,<br>9893, 1020, 3715,<br>8006]  |   |
| [1152, 2397, 4661,<br>9348, 4537, 9331,<br>2522, 820, 8612,<br>3401, 1010, 9869,<br>69, 1701, 59, 1303,<br>9360, 1231, 898,<br>9892, 2539, 174,<br>942, 8518, 6008,<br>3987, 526, 4413,<br>4018, 9065, 639,<br>2159, 6550, 3882,<br>9138, 3837, 6356,<br>1286] | [69, 1152, 1701, 59,<br>1303, 2397, 3987,<br>526, 4413, 4018,<br>4661, 9065, 639,<br>2159, 6550, 3882,<br>9138, 3837, 6356,<br>9348, 4537, 9331,<br>2522, 820, 8612,<br>3401, 1010, 9360,<br>1231, 898, 9869,<br>9892, 2539, 174,<br>942, 8518, 6008,<br>1286] | 2 |
| [9486, 2660, 2150,<br>4320, 1378, 4961,<br>7809, 5257, 7757,<br>4105, 5817, 5121,<br>2482, 9032, 9737,   | [445, 2482, 9032,<br>9230, 6627, 6062,<br>9486, 2660, 2150,<br>4320, 1378, 4961,<br>7809, 5257, 7757,  | 2 |

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| 6314, 8854, 9768,<br>1155, 6096, 5436,<br>1540, 4197, 5206,<br>3187, 445, 9230,<br>6627, 6062, 9549,<br>527, 8765, 3396,<br>5418, 9972, 1892,<br>1753, 9677, 9429]  | 4105, 5817, 5121,<br>9549, 527, 8765,<br>3396, 5418, 9737,<br>6314, 8854, 9768,<br>1155, 6096, 5436,<br>1540, 4197, 5206,<br>3187, 9972, 1892,<br>1753, 9677, 9429]   |   |
| [8290, 8125, 52,<br>5544, 17, 1364,<br>2549, 8378, 6719,<br>7125, 3876, 3326,<br>2654, 9366, 39,<br>1573, 9662, 9833,<br>839, 9615, 4782,<br>2864, 9610, 4160,<br>5232, 7590, 3887,<br>4198, 7326, 3313,<br>9753, 378, 7114,<br>7650, 6176, 6709,<br>1306, 9583, 2516,<br>1509] | [4198, 7326, 3313,<br>8290, 8125, 52,<br>5544, 17, 1364,<br>2549, 8378, 6719,<br>7125, 3876, 3326,<br>2654, 9366, 39,<br>1573, 9662, 9753,<br>378, 7114, 7650,<br>6176, 6709, 1306,<br>9583, 2516, 9833,<br>839, 9615, 4782,<br>2864, 9610, 4160,<br>5232, 7590, 3887,<br>1509] | 3 |

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| [1558, 3987, 7549, 719, 213, 7054, 9318, 5548, 6651, 5269, 7780, 9105, 3088, 8992, 1861, 9477, 8747, 314, 3287, 6464, 1045, 4616, 28, 3598, 9166, 2475, 1900,  | [1558, 3987, 4399, 2766, 630, 7549, 719, 213, 7054, 8831, 8707, 943, 212, 1067, 1445, 8937, 6292, 8992, 1861, 9318, 5548, 6651, 5269, 7780, 9105, 3088, 9477,  | 4 |

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| 4399, 2766, 630,<br>8831, 8707, 943,<br>212, 1067, 1445,<br>8937, 6292, 9962,<br>1813, 4046, 4215]   | 8747, 314, 3287,<br>6464, 1045, 4616,<br>28, 3598, 9166,<br>2475, 1900, 9962,<br>1813, 4046, 4215]   |   |
| [2656, 1434, 8664,<br>7996, 7564, 6664,<br>223, 6073, 157,<br>8510, 1679, 5420,<br>4711, 467, 9801,<br>818, 1669, 8771,<br>9113, 4313, 3985,<br>4308, 264, 5489,<br>1458, 78, 6659,<br>2521, 3845, 5738,<br>6780, 8167, 512,<br>1897, 4608, 6503,<br>163, 2473, 2360,<br>888, 7984, 4996,<br>9203] | [2656, 1434, 5738,<br>6780, 8167, 512,<br>1897, 4608, 6503,<br>163, 2473, 2360,<br>888, 7984, 4996,<br>8664, 7996, 7564,<br>6664, 223, 6073,<br>157, 8510, 1679,<br>5420, 4711, 467,<br>9801, 818, 1669,<br>8771, 9113, 4313,<br>3985, 4308, 264,<br>5489, 1458, 78,<br>6659, 2521, 3845,<br>9203] | 3 |
| [8322, 9708, 5945,<br>7652, 717, 566,<br>9471, 5960, 2047,   | [2642, 4123, 1699,<br>1279, 4520, 1481,<br>3433, 2691, 1268,   | 4 |



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| 951, 1495, 6523,<br>5316, 7035, 2642,<br>4123, 1699, 1279,<br>6275, 9581, 1134,<br>3051, 805, 2639,<br>3082, 3843, 7008,<br>1342, 1008, 4520,<br>1481, 3433, 2691,<br>1268, 3943, 7478,<br>3314, 4422, 7197,<br>6019, 7729, 1770,<br>5109, 9551] | 3943, 6275, 7478,<br>3314, 4422, 7197,<br>6019, 7729, 1770,<br>5109, 8322, 9581,<br>1134, 3051, 805,<br>2639, 3082, 3843,<br>7008, 1342, 1008,<br>9708, 5945, 7652,<br>717, 566, 9471,<br>5960, 2047, 951,<br>1495, 6523, 5316,<br>7035, 9551] |   |
| [5619, 1597, 3161,<br>1290, 2139, 9984,<br>3992, 7242, 324,<br>7466, 5399, 5391,<br>4188, 5731, 8150,<br>650, 5880, 2382,<br>2149, 4473, 8549,<br>8583, 6150, 5174,<br>187, 2862, 4036,<br>2914, 7606, 354,<br>8837, 9244, 6600,                 | [354, 5619, 1597,<br>3161, 1290, 2139,<br>8150, 650, 5880,<br>2382, 2149, 4473,<br>8549, 8583, 6150,<br>5174, 187, 2862,<br>4036, 2914, 7606,<br>8837, 9244, 6600,<br>9969, 7052, 7334,<br>5577, 2319, 1698,<br>8457, 2752, 3045,              | 4 |

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| 9969, 7052, 7334,<br>5577, 2319, 1698,<br>8457, 2752, 3045,<br>5382, 3015, 8631]   | 5382, 3015, 9984,<br>3992, 7242, 324,<br>7466, 5399, 5391,<br>4188, 5731, 8631]  |   |
| [9292, 9858, 9362,<br>3690, 4138, 6416,<br>572, 5504, 9948,<br>7565, 8398, 2718,<br>3765, 1773, 2253,<br>3048, 790, 6911,<br>1097, 2729, 3535,<br>6658, 7880, 5028,<br>5284, 6584, 915,<br>5868, 9027, 4618,<br>9343, 337, 3701,<br>6636, 2159, 4124,<br>1683, 5091, 1960,<br>3822, 3836, 964,<br>8709, 5492, 8804,<br>6351] | [337, 3048, 790,<br>3701, 6636, 2159,<br>4124, 1683, 5091,<br>1960, 3822, 3836,<br>964, 6911, 1097,<br>2729, 3535, 6658,<br>7880, 5028, 5284,<br>6584, 915, 5868,<br>8709, 5492, 8804,<br>9027, 4618, 9292,<br>9343, 9858, 9362,<br>3690, 4138, 6416,<br>572, 5504, 9948,<br>7565, 8398, 2718,<br>3765, 1773, 2253,<br>6351] | 3 |
| [6092, 3309, 3502,<br>4107, 8976, 8910,<br>9166, 6787, 2232,   | [3899, 6092, 3309,<br>3502, 4107, 6178,<br>7423, 1124, 4471,   | 3 |

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| 6934, 6056, 8082,<br>1745, 1390, 3981,<br>3899, 7423, 1124,<br>4471, 6301, 3786,<br>5608, 2402, 5909,<br>8086, 581, 590, 740,<br>4963, 1828, 7906,<br>6178, 8471, 9998,<br>7396, 1282, 1272,<br>7089, 7526, 872,<br>9983, 85, 3683,<br>8937, 7065, 7007,<br>4730] | 6301, 3786, 5608,<br>2402, 5909, 8086,<br>581, 590, 740, 4963,<br>1828, 7906, 8471,<br>8976, 8910, 9166,<br>6787, 2232, 6934,<br>6056, 8082, 1745,<br>1390, 3981, 9998,<br>7396, 1282, 1272,<br>7089, 7526, 872,<br>9983, 85, 3683,<br>8937, 7065, 7007,<br>4730] |   |
| [3714, 3984, 5158,<br>58, 7212, 1817, 836,<br>4703, 9070, 4847,<br>9054, 731, 6291,<br>1616, 9320, 2024,<br>8286, 7110, 4307,<br>477, 7067, 4745,<br>2409, 304, 7576,<br>8867, 5626, 7388,<br>740, 4133, 7447,  | [2024, 3714, 3984,<br>5158, 58, 6355,<br>7212, 1817, 836,<br>4703, 8286, 7110,<br>4307, 477, 7067,<br>4745, 2409, 304,<br>7576, 8710, 6040,<br>6191, 3557, 1041,<br>4966, 5705, 6321,<br>6167, 7353, 1025,  | 4 |

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| 6355, 8710, 6040,<br>6191, 3557, 1041,<br>4966, 5705, 6321,<br>6167, 7353, 1025,<br>9418, 332, 8724,<br>1526, 3134]  | 8867, 5626, 7388,<br>740, 4133, 7447,<br>9070, 4847, 9054,<br>731, 6291, 1616,<br>9320, 9418, 332,<br>8724, 1526, 3134]  |   |
| [7708, 4481, 3620,<br>5396, 3407, 1755,<br>9821, 4676, 6955,<br>1374, 8125, 8268,<br>91, 5803, 638, 7727,<br>3232, 5984, 1401,<br>9936, 5541, 3703,<br>382, 2176, 8487,<br>2702, 6, 3684, 8884,<br>871, 3511, 7003,<br>8099, 6737, 9368,<br>4975, 5557, 1959,<br>1942, 9913, 1530,<br>902, 3430, 4826,<br>2439, 9461, 6011,<br>8743, 5782] | [3232, 5984, 1401,<br>6737, 7708, 4481,<br>3620, 5396, 3407,<br>1755, 9368, 4975,<br>5557, 1959, 1942,<br>9821, 4676, 6955,<br>1374, 8125, 8268,<br>91, 5803, 638, 7727,<br>9913, 1530, 902,<br>3430, 4826, 2439,<br>9461, 6011, 8743,<br>9936, 5541, 3703,<br>382, 2176, 8487,<br>2702, 6, 3684, 8884,<br>871, 3511, 7003,<br>8099, 5782] | 3 |

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| [960, 7546, 4340, 703, 9638, 1005, 9285, 4246, 1669, 3557, 6273, 8517, 9313, 9075, 4888, 2811, 9244, 3641, 3910, 2085, 611, 1196, 5240, 5212, 8373, 3580, 2975, 5471, 3626, 1736, 7555, 7330, 97, 6508, 6553, 8135, 7210, 7980, 152, 8589, 4245, 4357, 6264, 9110, 7067, 3522, 7372, 7661, 6588, 877] | [960, 6508, 6553, 7546, 4340, 703, 8135, 7210, 7980, 152, 8589, 4245, 4357, 6264, 9110, 7067, 3522, 7372, 7661, 6588, 9244, 3641, 3910, 2085, 611, 1196, 5240, 5212, 8373, 3580, 2975, 5471, 3626, 1736, 7555, 7330, 97, 9638, 1005, 9285, 4246, 1669, 3557, 6273, 8517, 9313, 9075, 4888, 2811, 877] | 3 |
| [9842, 2103, 4104, 438, 3673, 7145, 5618, 201, 498, 1259, 9649, 7483, 6106, 7468, 665, 5285, 3766, 4454,  | [2500, 590, 3766, 4454, 923, 7684, 1072, 6355, 9566, 4787, 2330, 9221, 35, 8124, 4116, 6180, 1661, 4596,  | 3 |

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| 923, 7684, 1072,<br>6355, 9640, 5744,<br>146, 3855, 5515,<br>8123, 7760, 4320,<br>9799, 637, 6747,<br>2500, 590, 9566,<br>4787, 2330, 9221,<br>35, 8124, 4116,<br>6180, 1661, 4596,<br>1018, 226, 8766,<br>5044, 7891, 880]                              | 1018, 226, 8766,<br>5044, 7891, 9640,<br>5744, 146, 3855,<br>5515, 8123, 7760,<br>4320, 9799, 637,<br>6747, 9842, 2103,<br>4104, 438, 3673,<br>7145, 5618, 201,<br>498, 1259, 9649,<br>7483, 6106, 7468,<br>665, 5285, 880]                              |   |
| [5229, 9366, 6544,<br>6277, 7868, 7350,<br>9257, 4410, 1192,<br>379, 2460, 1895,<br>4832, 1544, 1779,<br>9358, 7210, 3646,<br>3766, 9445, 2179,<br>2917, 4433, 3002,<br>4182, 9786, 6966,<br>4483, 8654, 2395,<br>8918, 5555, 2767,<br>5073, 7852, 1796, | [1796, 3646, 3766,<br>4306, 3645, 5229,<br>6827, 5265, 8703,<br>1654, 3146, 2338,<br>6032, 3026, 3452,<br>9366, 6544, 6277,<br>7868, 7350, 9257,<br>4410, 1192, 379,<br>2460, 1895, 4832,<br>1544, 1779, 9358,<br>7210, 9445, 2179,<br>2917, 4433, 3002, | 3 |

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| 4306, 3645, 6827,<br>5265, 8703, 1654,<br>3146, 2338, 6032,<br>3026, 3452, 9758,<br>7971, 6339, 5845,<br>5772]   | 4182, 9758, 7971,<br>6339, 5845, 9786,<br>6966, 4483, 8654,<br>2395, 8918, 5555,<br>2767, 5073, 7852,<br>5772]  |   |
| [6385, 7652, 5914,<br>9963, 925, 3924,<br>1224, 6659, 79,<br>1394, 4087, 5179,<br>113, 3098, 368,<br>7517, 5449, 7742,<br>6925, 6262, 9209,<br>2425, 9905, 7042,<br>6387, 160, 7112,<br>3976, 7953, 2746,<br>2655, 9665, 4756,<br>4209, 5575, 9743,<br>9276, 282, 9398,<br>892, 519, 1633,<br>6031, 3888, 6893,<br>8296, 9411, 6744, | [6385, 7652, 5914,<br>7742, 6925, 6262,<br>9209, 2425, 9743,<br>9276, 282, 9398,<br>892, 519, 1633,<br>6031, 3888, 6893,<br>8296, 9411, 6744,<br>2347, 226, 456,<br>7347, 9905, 7042,<br>6387, 160, 7112,<br>3976, 7953, 2746,<br>2655, 9665, 4756,<br>4209, 5575, 9963,<br>925, 3924, 1224,<br>6659, 79, 1394,<br>4087, 5179, 113, | 3 |

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| 2347, 226, 456,<br>7347, 4462]   | 3098, 368, 7517,<br>5449, 4462]  |   |
| [5627, 2121, 3902,<br>3171, 3787, 2894,<br>9794, 4764, 8234,<br>9677, 6268, 8982,<br>4646, 5441, 7854,<br>8121, 3154, 8490,<br>3301, 7039, 737,<br>2389, 5882, 1465,<br>2084, 1694, 4765,<br>5630, 1857, 4403,<br>6830, 2181, 5221,<br>2715, 7262, 1542,<br>2154, 1478, 598,<br>4748, 7500, 390,<br>2709, 1405, 2888,<br>9151, 5408, 2317,<br>3399, 7963, 6454,<br>4591, 2042, 9650] | [1542, 2154, 1478,<br>598, 4748, 5627,<br>2121, 3902, 3171,<br>3787, 2894, 7500,<br>390, 2709, 1405,<br>2888, 8490, 3301,<br>7039, 737, 2389,<br>5882, 1465, 2084,<br>1694, 4765, 5630,<br>1857, 4403, 6830,<br>2181, 5221, 2715,<br>7262, 9151, 5408,<br>2317, 3399, 7963,<br>6454, 4591, 2042,<br>9794, 4764, 8234,<br>9677, 6268, 8982,<br>4646, 5441, 7854,<br>8121, 3154, 9650] | 3 |
| [5426, 5390, 4134,<br>856, 7780, 6587,<br>2498, 7990, 1393,  | [3322, 5426, 5390,<br>4134, 856, 7725,<br>2058, 2243, 5565,  | 4 |



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| 9896, 654, 7694,<br>682, 9013, 918,<br>6857, 7067, 216,<br>7959, 4131, 2565,<br>9490, 3042, 2586,<br>6350, 992, 4591,<br>1442, 7670, 6015,<br>3523, 9309, 5150,<br>7268, 5141, 5769,<br>6741, 3322, 7725,<br>2058, 2243, 5565,<br>5167, 5530, 6937,<br>8215, 7607, 6334,<br>8248, 521, 3588,<br>8235, 5858, 7517,<br>1082] | 5167, 5530, 6937,<br>7780, 6587, 2498,<br>7959, 4131, 2565,<br>7990, 1393, 8215,<br>7607, 6334, 8248,<br>521, 3588, 8235,<br>5858, 7517, 9490,<br>3042, 2586, 6350,<br>992, 4591, 1442,<br>7670, 6015, 3523,<br>9309, 5150, 7268,<br>5141, 5769, 6741,<br>9896, 654, 7694,<br>682, 9013, 918,<br>6857, 7067, 216,<br>1082] |   |
| [6008, 7454, 6473,<br>6866, 5014, 2415,<br>3735, 565, 1710,<br>519, 8898, 9594,<br>3929, 6280, 4595,<br>9452, 5222, 8956,<br>1421, 255, 4391,  | [904, 830, 1421,<br>255, 4391, 5253,<br>1366, 2692, 525,<br>3255, 6008, 7454,<br>6473, 6866, 5014,<br>2415, 3735, 565,<br>1710, 519, 7656,   | 3 |

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| 5253, 1366, 2692,<br>525, 3255, 8215,<br>6619, 5894, 7365,<br>5958, 392, 1923,<br>8329, 898, 1385,<br>3391, 904, 830,<br>7656, 7741, 7062,<br>6354, 236, 2529,<br>3013, 4286, 9764,<br>9410, 3940, 1200,<br>6743, 6606, 4070,<br>6872, 2981] | 7741, 7062, 6354,<br>236, 2529, 3013,<br>4286, 8215, 6619,<br>5894, 7365, 5958,<br>392, 1923, 8329,<br>898, 1385, 3391,<br>8898, 9594, 3929,<br>6280, 4595, 9452,<br>5222, 8956, 9764,<br>9410, 3940, 1200,<br>6743, 6606, 4070,<br>6872, 2981] |   |
| [7823, 9567, 7354,<br>3075, 5532, 5542,<br>2100, 4533, 6147,<br>4184, 4065, 4796,<br>6517, 5338, 7197,<br>2226, 8835, 8673,<br>7210, 836, 5688, 5,<br>5858, 8160, 7094,<br>2435, 9070, 5406,<br>1430, 8274, 9958,<br>996, 5466, 1960,        | [7210, 836, 5688, 5,<br>5858, 7823, 8062,<br>5584, 8160, 7094,<br>2435, 8937, 574,<br>3057, 5583, 306,<br>8497, 8827, 3388,<br>9070, 5406, 1430,<br>8274, 9118, 6967,<br>3777, 9475, 3417,<br>4454, 6766, 3432,<br>8774, 9567, 7354,            | 3 |

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| 3498, 4468, 9734,<br>8062, 5584, 8937,<br>574, 3057, 5583,<br>306, 8497, 8827,<br>3388, 9118, 6967,<br>3777, 9475, 3417,<br>4454, 6766, 3432,<br>8774, 6827]   | 3075, 5532, 5542,<br>2100, 4533, 6147,<br>4184, 4065, 4796,<br>6517, 5338, 7197,<br>2226, 8835, 8673,<br>9958, 996, 5466,<br>1960, 3498, 4468,<br>9734, 6827]  |   |
| [5281, 9006, 3581,<br>7816, 7506, 8200,<br>1126, 2937, 3578,<br>8174, 6103, 779,<br>9043, 2243, 907,<br>7646, 3054, 1028,<br>2148, 4826, 3700,<br>2307, 9506, 193,<br>7471, 965, 2100,<br>9572, 330, 712,<br>7614, 4936, 3382,<br>953, 2396, 8874,<br>2318, 9830, 9638,<br>4097, 397, 9951,<br>9844, 2339, 4591, | [4097, 397, 4826,<br>3700, 2307, 5281,<br>9006, 3581, 7816,<br>7506, 8200, 1126,<br>2937, 3578, 8174,<br>6103, 779, 9043,<br>2243, 907, 7646,<br>3054, 1028, 2148,<br>9506, 193, 7471,<br>965, 2100, 9572,<br>330, 712, 7614,<br>4936, 3382, 953,<br>2396, 8874, 2318,<br>9830, 9638, 9951,<br>9844, 2339, 4591, | 3 |

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| 9186, 692, 347, 645,<br>9176, 7274, 1769,<br>7037, 4746, 7511,<br>9882, 6610, 5463]  | 9186, 692, 347, 645,<br>9176, 7274, 1769,<br>7037, 4746, 7511,<br>9882, 6610, 5463]   |   |
| [5421, 8713, 3103,<br>9290, 6401, 3830,<br>3242, 6360, 5698,<br>7414, 8014, 2663,<br>2970, 5052, 5689,<br>5062, 7506, 3319,<br>24, 9720, 3179, 507,<br>2368, 1378, 7498,<br>5908, 9599, 1080,<br>4660, 5177, 6417,<br>5491, 6779, 941,<br>5015, 3110, 423,<br>6460, 4197, 2641,<br>6664, 404, 811,<br>7941, 4970, 7985,<br>3863, 2312, 234,<br>4014, 4344, 1196,<br>7897, 9432, 358, | [2641, 5421, 6664,<br>404, 811, 7941,<br>4970, 7985, 3863,<br>2312, 234, 4014,<br>4344, 1196, 7897,<br>8713, 3103, 9290,<br>6401, 3830, 3242,<br>6360, 5698, 7414,<br>8014, 2663, 2970,<br>5052, 5689, 5062,<br>7506, 3319, 24,<br>9432, 358, 6652,<br>1823, 7365, 9720,<br>3179, 507, 2368,<br>1378, 7498, 5908,<br>9599, 1080, 4660,<br>5177, 6417, 5491,<br>6779, 941, 5015, | 3 |

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| 6652, 1823, 7365,<br>8592]   | 3110, 423, 6460,<br>4197, 8592]  |   |
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| [2482, 4247, 4059,<br>613, 7125, 1327,  | [2482, 3159, 3426,<br>4247, 4059, 613,  | 4 |

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| 8198, 3645, 5406,<br>7178, 860, 5784,<br>8908, 5424, 5844,<br>1563, 1537, 93,<br>4687, 2807, 8742,<br>8882, 8982, 1073,<br>8321, 8637, 6800,<br>7167, 3625, 6042,<br>4713, 2181, 2425,<br>3818, 7312, 4032,<br>9667, 1858, 4944,<br>1187, 4887, 3159,<br>3426, 4785, 9908,<br>3513, 288, 218,<br>2062, 7869, 76, 633,<br>8385, 6528, 210,<br>2157, 661, 3880,<br>5740, 1175, 7218,<br>9037] | 4785, 7125, 1327,<br>8198, 3645, 5406,<br>7178, 860, 5784,<br>8742, 8882, 8908,<br>5424, 5844, 1563,<br>1537, 93, 4687,<br>2807, 8982, 1073,<br>8321, 8637, 6800,<br>7167, 3625, 6042,<br>4713, 2181, 2425,<br>3818, 7312, 4032,<br>9667, 1858, 4944,<br>1187, 4887, 9908,<br>3513, 288, 218,<br>2062, 7869, 76, 633,<br>8385, 6528, 210,<br>2157, 661, 3880,<br>5740, 1175, 7218,<br>9037] |   |
| [4053, 2835, 6886,<br>4440, 7424, 3435,<br>565, 4395, 7674,<br>1384, 736, 2114,   | [585, 4053, 2835,<br>4606, 6147, 3526,<br>3939, 6829, 6886,<br>4440, 7424, 3435,  | 4 |

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| 6365, 2010, 9897,<br>3640, 5430, 2314,<br>7797, 6797, 585,<br>4606, 6147, 3526,<br>3939, 6829, 7901,<br>5909, 2177, 9747,<br>7645, 4411, 559,<br>6935, 6178, 603,<br>3587, 7292, 8754,<br>6481, 2572, 8341,<br>9906, 1379, 3093,<br>5404, 4932, 3063,<br>1086, 2756, 528,<br>8021, 973, 5869,<br>630, 7806, 7344,<br>1753, 2082, 5101,<br>8710, 8813, 7009] | 565, 4395, 7674,<br>1384, 736, 2114,<br>6365, 2010, 7901,<br>5909, 2177, 8341,<br>9747, 7645, 4411,<br>559, 6935, 6178,<br>603, 3587, 7292,<br>8754, 6481, 2572,<br>9897, 3640, 5430,<br>2314, 7797, 6797,<br>9906, 1379, 3093,<br>5404, 4932, 3063,<br>1086, 2756, 528,<br>8021, 973, 5869,<br>630, 7806, 7344,<br>1753, 2082, 5101,<br>8710, 8813, 7009] |   |
| [6189, 6959, 5561,<br>5252, 7339, 1666,<br>8348, 4195, 3661,<br>3342, 5745, 3988,<br>4371, 9858, 2719,<br>2092, 1501, 1824,   | [6189, 6959, 5561,<br>5252, 7339, 1666,<br>8348, 4195, 3661,<br>3342, 5745, 3988,<br>4371, 8831, 5999,<br>1455, 1455, 6817,  | 6 |



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| 8800, 1140, 5998,<br>8831, 5999, 1455,<br>1455, 6817, 3176,<br>9884, 2375, 5237,<br>1339, 135, 9785,<br>4126, 9377, 9237,<br>2991, 9283, 850,<br>6176, 102, 9064,<br>5174, 9215, 9513,<br>2972, 6602, 6713,<br>2834, 8661, 54, 699,<br>2959, 2889, 845,<br>969, 3490, 7966,<br>5236, 7090, 4731,<br>21, 9030, 2871] | 3176, 9215, 9513,<br>2972, 6602, 6713,<br>2834, 8661, 54, 699,<br>2959, 2889, 845,<br>969, 3490, 7966,<br>5236, 7090, 4731,<br>21, 9030, 9858,<br>2719, 2092, 1501,<br>1824, 8800, 1140,<br>5998, 9884, 2375,<br>5237, 1339, 135,<br>9785, 4126, 9377,<br>9237, 2991, 9283,<br>850, 6176, 102,<br>9064, 5174, 2871] |   |
| [7545, 3218, 2471,<br>7900, 1983, 2431,<br>9480, 3936, 2436,<br>9106, 554, 1994,<br>6846, 9884, 9511,<br>693, 3407, 4595,<br>6781, 445, 7216,<br>9170, 524, 6378,   | [606, 7545, 3218,<br>2471, 7900, 1983,<br>2431, 8648, 2568,<br>2636, 8645, 955,<br>6307, 1599, 721,<br>4857, 3762, 1127,<br>4842, 7259, 5500,<br>6798, 340, 1570,   | 4 |

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| 2621, 2847, 1651,<br>7964, 4178, 8622,<br>6790, 4856, 8741,<br>6308, 8514, 2883,<br>979, 9935, 1492,<br>6043, 8687, 3748,<br>935, 606, 8648,<br>2568, 2636, 8645,<br>955, 6307, 1599,<br>721, 4857, 3762,<br>1127, 4842, 7259,<br>5500, 6798, 340,<br>1570, 7736, 9330,<br>9522, 5107] | 7736, 9170, 524,<br>6378, 2621, 2847,<br>1651, 7964, 4178,<br>8622, 6790, 4856,<br>8741, 6308, 8514,<br>2883, 979, 9330,<br>9480, 3936, 2436,<br>9106, 554, 1994,<br>6846, 9522, 9884,<br>9511, 693, 3407,<br>4595, 6781, 445,<br>7216, 9935, 1492,<br>6043, 8687, 3748,<br>935, 5107] |   |
| [4685, 3532, 8767,<br>1028, 3449, 1807,<br>9323, 2112, 2486,<br>7715, 3506, 6049,<br>1370, 370, 1748,<br>143, 9694, 3938,<br>9280, 819, 6657,<br>1941, 82, 7201,<br>6414, 1869, 2223,  | [1941, 82, 3489,<br>4685, 3532, 7201,<br>6414, 1869, 2223,<br>8310, 1355, 8767,<br>1028, 3449, 1807,<br>9028, 3023, 2542,<br>4387, 1435, 2010,<br>5417, 231, 5153,<br>6086, 4590, 9323,  | 4 |

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| 8310, 1355, 9028,<br>3023, 2542, 4387,<br>1435, 2010, 5417,<br>231, 5153, 6086,<br>4590, 9568, 2950,<br>1024, 3489, 9464,<br>6913, 4968, 5329,<br>2634, 2191, 1282,<br>7813, 2375, 2061,<br>1306, 1945, 5291,<br>4248, 4568, 3571,<br>9071, 834, 836,<br>1099, 2368, 4024] | 2112, 2486, 7715,<br>3506, 6049, 1370,<br>370, 1748, 143,<br>9464, 6913, 4968,<br>5329, 2634, 2191,<br>1282, 7813, 2375,<br>2061, 1306, 1945,<br>5291, 4248, 4568,<br>3571, 9071, 834,<br>836, 1099, 2368,<br>9568, 2950, 1024,<br>9694, 3938, 9280,<br>819, 6657, 4024] |   |
| [940, 6282, 367,<br>9458, 7972, 466,<br>154, 8282, 893, 414,<br>2860, 6897, 5993,<br>571, 9457, 8798,<br>9294, 1864, 3804,<br>3784, 4281, 682,<br>5516, 5366, 4661,<br>2611, 3308, 133,<br>1164, 531, 4794,  | [940, 1317, 937,<br>4086, 5516, 5366,<br>4661, 2611, 3308,<br>133, 1164, 531,<br>4794, 2682, 6282,<br>367, 6828, 768,<br>6779, 4153, 4878,<br>3778, 1389, 469,<br>1027, 5122, 3165,<br>1993, 1840, 7756,   | 4 |

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| 2682, 6828, 768,<br>6779, 4153, 4878,<br>3778, 1389, 469,<br>1027, 5122, 3165,<br>1993, 1840, 1317,<br>937, 4086, 7756,<br>6771, 3896, 6446,<br>5800, 3996, 5225,<br>7313, 7198, 6765,<br>4858, 3813, 1532,<br>7519, 2587, 3915,<br>5587, 402, 2450] | 6771, 3896, 6446,<br>5800, 3996, 5225,<br>7313, 7198, 6765,<br>4858, 3813, 1532,<br>7519, 2587, 3915,<br>5587, 402, 9458,<br>7972, 466, 154,<br>8282, 893, 414,<br>2860, 6897, 5993,<br>571, 9457, 8798,<br>9294, 1864, 3804,<br>3784, 4281, 682,<br>2450] |   |
| [7407, 4955, 7192,<br>9631, 4161, 2906,<br>3684, 2050, 7074,<br>2245, 5477, 9836,<br>737, 8518, 5182,<br>8436, 7047, 5374,<br>2168, 1771, 1759,<br>9820, 2377, 9042,<br>266, 2191, 8439,<br>7578, 2113, 7769,  | [2377, 3601, 7407,<br>4955, 7192, 7521,<br>1574, 5162, 4612,<br>7941, 648, 1033,<br>6503, 9042, 266,<br>2191, 8439, 7578,<br>2113, 7769, 3416,<br>8731, 1661, 148,<br>5836, 4922, 6356,<br>2025, 8253, 4021,   | 4 |

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| 3416, 8731, 1661,<br>148, 5836, 4922,<br>6356, 2025, 8253,<br>4021, 8516, 3503,<br>5125, 2593, 4853,<br>3601, 7521, 1574,<br>5162, 4612, 7941,<br>648, 1033, 6503,<br>9104, 9546, 9387,<br>2715, 3825, 6350,<br>1254, 8565, 2426,<br>9808, 9785, 657,<br>4532, 2052] | 8516, 3503, 5125,<br>2593, 4853, 9104,<br>9546, 9387, 2715,<br>3825, 6350, 1254,<br>8565, 2426, 9631,<br>4161, 2906, 3684,<br>2050, 7074, 2245,<br>5477, 9808, 9785,<br>657, 4532, 9836,<br>737, 8518, 5182,<br>8436, 7047, 5374,<br>2168, 1771, 1759,<br>9820, 2052] |   |
| [6407, 1913, 1524,<br>1949, 6967, 5703,<br>9260, 7632, 3819,<br>4136, 293, 295, 801,<br>609, 5451, 410,<br>2583, 6934, 2681,<br>5659, 4274, 8168,<br>1143, 6401, 3199,<br>7807, 5057, 9928,<br>4459, 473, 9498,  | [1143, 6401, 3199,<br>6407, 1913, 1524,<br>1949, 6967, 5703,<br>7807, 5057, 8718,<br>2995, 4984, 7904,<br>7138, 6620, 3966,<br>5061, 4639, 7552,<br>2746, 7703, 8272,<br>5012, 8939, 1565,<br>4613, 9260, 7632,   | 4 |

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| 9495, 4321, 4578,<br>6737, 1538, 9043,<br>8884, 3811, 2592,<br>1211, 4192, 545,<br>6112, 8242, 8718,<br>2995, 4984, 7904,<br>7138, 6620, 3966,<br>5061, 4639, 7552,<br>2746, 7703, 8272,<br>5012, 8939, 1565,<br>4613, 9414, 4938,<br>9692, 1131, 3213,<br>5788, 96] | 3819, 4136, 293,<br>295, 801, 609, 5451,<br>410, 2583, 6934,<br>2681, 5659, 4274,<br>8168, 9414, 4938,<br>9692, 1131, 3213,<br>5788, 9928, 4459,<br>473, 9498, 9495,<br>4321, 4578, 6737,<br>1538, 9043, 8884,<br>3811, 2592, 1211,<br>4192, 545, 6112,<br>8242, 96] |   |
| [5183, 7169, 8795,<br>7421, 4180, 5869,<br>4439, 502, 851,<br>6868, 3049, 4686,<br>3314, 514, 2185,<br>7853, 2008, 4373,<br>8545, 4101, 1840,<br>9308, 2289, 8485,<br>6348, 4350, 820,<br>7230, 2860, 5278,  | [5183, 7169, 7489,<br>8410, 2621, 7246,<br>6848, 566, 8485,<br>6348, 4350, 820,<br>7230, 2860, 5278,<br>6067, 4213, 2224,<br>6350, 5080, 3496,<br>2986, 4402, 758,<br>8795, 7421, 4180,<br>5869, 4439, 502,  | 4 |

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| 6067, 4213, 2224,<br>6350, 5080, 3496,<br>2986, 4402, 758,<br>9333, 4407, 9222,<br>5271, 2967, 1839,<br>7266, 8102, 7489,<br>8410, 2621, 7246,<br>6848, 566, 9968,<br>5490, 4109, 2743,<br>9612, 7727, 9536,<br>5694, 8878, 6575,<br>2523, 1422, 3602,<br>8431, 2838, 3066,<br>3127] | 851, 6868, 3049,<br>4686, 3314, 514,<br>2185, 7853, 2008,<br>4373, 8545, 4101,<br>1840, 9308, 2289,<br>9333, 4407, 9222,<br>5271, 2967, 1839,<br>7266, 8102, 9968,<br>5490, 4109, 2743,<br>9612, 7727, 9536,<br>5694, 8878, 6575,<br>2523, 1422, 3602,<br>8431, 2838, 3066,<br>3127] |   |
| [3380, 7990, 578,<br>7442, 3225, 2372,<br>960, 4788, 6795,<br>7547, 3006, 240,<br>441, 8290, 8379,<br>632, 9654, 6059,<br>6350, 9127, 994,<br>1562, 201, 4965,<br>4344, 3818, 9681,  | [2716, 3380, 4965,<br>4344, 3818, 5958,<br>7927, 7990, 578,<br>7442, 3225, 2372,<br>960, 4788, 6795,<br>7547, 3006, 240,<br>441, 8290, 8379,<br>632, 9047, 9288,<br>5173, 6148, 4356,  | 4 |

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| 2566, 7817, 1197,<br>2589, 4036, 3448,<br>5699, 7118, 302,<br>471, 3181, 798,<br>9841, 7250, 8641,<br>8747, 9334, 4474,<br>3121, 9382, 2716,<br>5958, 7927, 9047,<br>9288, 5173, 6148,<br>4356, 570, 9238,<br>2234, 466, 6577,<br>6956, 2214, 8827,<br>7970, 7708, 8722,<br>8960, 9045, 7017,<br>8025, 4417] | 570, 9238, 2234,<br>466, 6577, 6956,<br>2214, 8827, 7970,<br>7708, 8722, 8960,<br>9045, 7017, 8025,<br>9654, 6059, 6350,<br>9127, 994, 1562,<br>201, 9681, 2566,<br>7817, 1197, 2589,<br>4036, 3448, 5699,<br>7118, 302, 471,<br>3181, 798, 9841,<br>7250, 8641, 8747,<br>9334, 4474, 3121,<br>9382, 4417] |   |
| [6960, 2978, 1821,<br>4074, 4472, 2138,<br>1157, 9552, 5413,<br>1176, 347, 8205,<br>646, 8496, 2950,<br>8008, 3269, 9490,<br>4034, 5497, 5900,<br>7713, 1881, 9227,  | [3949, 1182, 6960,<br>2978, 1821, 4074,<br>4472, 2138, 1157,<br>7858, 828, 285, 493,<br>6704, 4077, 5878,<br>7150, 1633, 1769,<br>477, 9227, 775,<br>2967, 988, 5907,  | 4 |



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| 775, 2967, 988,<br>5907, 6300, 4855,<br>1890, 9520, 9529,<br>8627, 5173, 6755,<br>1613, 9903, 4568,<br>2273, 6762, 453,<br>4381, 2214, 6217,<br>1179, 2279, 3949,<br>1182, 7858, 828,<br>285, 493, 6704,<br>4077, 5878, 7150,<br>1633, 1769, 477,<br>9933, 5193, 7646,<br>5683, 3173, 6141,<br>9985, 45, 9181,<br>1762, 6177, 1104] | 6300, 4855, 1890,<br>9520, 9529, 8627,<br>5173, 6755, 1613,<br>9552, 5413, 1176,<br>347, 8205, 646,<br>8496, 2950, 8008,<br>3269, 9490, 4034,<br>5497, 5900, 7713,<br>1881, 9903, 4568,<br>2273, 6762, 453,<br>4381, 2214, 6217,<br>1179, 2279, 9933,<br>5193, 7646, 5683,<br>3173, 6141, 9985,<br>45, 9181, 1762,<br>6177, 1104] |   |
| [5347, 3462, 8135,<br>491, 409, 9886,<br>2336, 6841, 8510,<br>5472, 1886, 5831,<br>1710, 6994, 5036,<br>5507, 9564, 8946,<br>5232, 8982, 3663,  | [2362, 3064, 1819,<br>2689, 5347, 3462,<br>5746, 5355, 5991,<br>8135, 491, 409,<br>9210, 6601, 3618,<br>9304, 7651, 2540,<br>4969, 8294, 2864,  | 4 |

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| 151, 518, 9892,<br>2362, 3064, 1819,<br>2689, 9761, 5388,<br>8391, 8709, 297,<br>1009, 8447, 6243,<br>7327, 3265, 8137,<br>8759, 7228, 1826,<br>3521, 9694, 599,<br>861, 3340, 2251,<br>3803, 5746, 5355,<br>5991, 9210, 6601,<br>3618, 9304, 7651,<br>2540, 4969, 8294,<br>2864, 7667, 8739,<br>7930, 4051, 1200,<br>8126, 935, 5234,<br>3644, 5354, 877,<br>5392] | 7667, 8739, 7930,<br>4051, 1200, 8126,<br>935, 5234, 3644,<br>5354, 877, 9761,<br>5388, 8391, 8709,<br>297, 1009, 8447,<br>6243, 7327, 3265,<br>8137, 8759, 7228,<br>1826, 3521, 9694,<br>599, 861, 3340,<br>2251, 3803, 9886,<br>2336, 6841, 8510,<br>5472, 1886, 5831,<br>1710, 6994, 5036,<br>5507, 9564, 8946,<br>5232, 8982, 3663,<br>151, 518, 9892,<br>5392] |   |
| [946, 781, 4923,<br>670, 2571, 8230,<br>4886, 8962, 5705,<br>9312, 2632, 2455,<br>631, 2410, 2954,  | [946, 781, 1621,<br>885, 4923, 670,<br>2571, 7632, 5212,<br>7737, 1483, 7853,<br>8230, 4886, 8542,  | 4 |

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| 9061, 545, 5237,<br>7652, 7699, 9169,<br>2637, 6244, 2361,<br>7737, 1483, 9822,<br>7627, 5336, 2011,<br>2852, 4371, 2454,<br>4682, 3894, 4061,<br>4530, 8530, 2363,<br>4682, 9791, 8552,<br>5520, 669, 2010,<br>4709, 7280, 1002,<br>351, 1621, 885,<br>7632, 5212, 7853,<br>8542, 1524, 9926,<br>7104, 3649, 6624,<br>1867, 8483, 675,<br>540, 4344, 511,<br>1702, 8140, 9436,<br>951, 2738, 6681,<br>2876, 491] | 1524, 8962, 5705,<br>9312, 2632, 2455,<br>631, 2410, 2954,<br>9061, 545, 5237,<br>7652, 7699, 9169,<br>2637, 6244, 2361,<br>9822, 7627, 5336,<br>2011, 2852, 4371,<br>2454, 4682, 3894,<br>4061, 4530, 8530,<br>2363, 4682, 9791,<br>8552, 5520, 669,<br>2010, 4709, 7280,<br>1002, 351, 9926,<br>7104, 3649, 6624,<br>1867, 8483, 675,<br>540, 4344, 511,<br>1702, 8140, 9436,<br>951, 2738, 6681,<br>2876, 491] |   |
| [2295, 3589, 5256,<br>8989, 594, 5657,<br>3598, 162, 9135,  | [1396, 2295, 3589,<br>5256, 7236, 7498,<br>1819, 411, 5888,   | 4 |

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| 5729, 334, 4506,<br>1581, 5611, 7134,<br>4003, 6952, 4043,<br>446, 3035, 515,<br>9123, 4671, 9525,<br>7236, 8897, 895,<br>1791, 7012, 5689,<br>4360, 9585, 9927,<br>645, 3035, 6072,<br>4153, 5754, 294, 99,<br>6266, 9213, 9982,<br>606, 2300, 3078,<br>7097, 1005, 826,<br>1396, 7498, 1819,<br>411, 5888, 4322,<br>4485, 407, 4790,<br>4501, 768, 5289,<br>1282, 2012, 7954,<br>2566, 2663, 1065,<br>6367, 1085, 102,<br>4976, 7714, 5471,<br>7773, 7123] | 4322, 4485, 407,<br>4790, 4501, 768,<br>5289, 1282, 2012,<br>7954, 2566, 2663,<br>1065, 6367, 1085,<br>102, 4976, 7714,<br>5471, 7773, 8897,<br>895, 1791, 7012,<br>5689, 4360, 8989,<br>594, 5657, 3598,<br>162, 9135, 5729,<br>334, 4506, 1581,<br>5611, 7134, 4003,<br>6952, 4043, 446,<br>3035, 515, 9123,<br>4671, 9525, 9585,<br>9927, 645, 3035,<br>6072, 4153, 5754,<br>294, 99, 6266, 9213,<br>9982, 606, 2300,<br>3078, 7097, 1005,<br>826, 7123] |  |
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| [2047, 5041, 1854,<br>4846, 7366, 6319,<br>1585, 4197, 5035,<br>1348, 7148, 9787,<br>9652, 2151, 3970,<br>9525, 4419, 7848,<br>3579, 3662, 4757,<br>6460, 163, 7676,<br>938, 1925, 2516,<br>546, 5253, 8197,<br>9720, 2871, 8774,<br>484, 8713, 1015,<br>6614, 3809, 5516,<br>5401, 1843, 645,<br>2527, 7617, 2493,<br>1662, 5982, 2759,<br>7168, 2378, 476,<br>2743, 3427, 3346,<br>591, 1482, 5968,<br>1850, 5661, 2742,<br>933, 4150, 1366,<br>8625, 9691, 558,<br>978, 4603, 6549, | [1925, 2047, 2516,<br>546, 2743, 3427,<br>3346, 591, 1482,<br>5041, 1854, 4846,<br>5253, 5968, 1850,<br>5661, 2742, 933,<br>4150, 1366, 7366,<br>6319, 1585, 4197,<br>5035, 1348, 7148,<br>8197, 8625, 9691,<br>558, 978, 4603,<br>6549, 1925, 9720,<br>2871, 8774, 484,<br>8713, 1015, 6614,<br>3809, 5516, 5401,<br>1843, 645, 2527,<br>7617, 2493, 1662,<br>5982, 2759, 7168,<br>2378, 476, 9787,<br>9652, 2151, 3970,<br>9525, 4419, 7848,<br>3579, 3662, 4757,<br>6460, 163, 7676, | 4 |
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| 1925, 9949, 2413,<br>2682, 1335, 4959,<br>9964]  | 938, 9949, 2413,<br>2682, 1335, 4959,<br>9964]   |   |
| [279, 7458, 65,<br>6371, 8559, 5670,<br>1485, 1056, 5060,<br>8751, 1093, 4781,<br>9995, 7907, 5511,<br>130, 7242, 2359,<br>7648, 6697, 4981,<br>5223, 9278, 1906,<br>2634, 326, 4106,<br>8520, 1418, 5554,<br>7926, 1812, 7945,<br>779, 2387, 5585,<br>487, 229, 5591,<br>2159, 3328, 6461,<br>204, 1852, 1137,<br>2857, 3052, 4112,<br>8172, 1810, 3196,<br>5847, 8254, 8454,<br>4791, 4820, 2910,<br>9689, 1373, 6228, | [279, 326, 4106,<br>5847, 7458, 65,<br>6371, 8254, 8454,<br>4791, 4820, 2910,<br>8520, 1418, 5554,<br>7926, 1812, 7945,<br>779, 2387, 5585,<br>487, 229, 5591,<br>2159, 3328, 6461,<br>204, 1852, 1137,<br>2857, 3052, 4112,<br>8172, 1810, 3196,<br>8559, 5670, 1485,<br>1056, 5060, 8751,<br>1093, 4781, 9689,<br>1373, 6228, 4265,<br>2845, 5451, 3745,<br>3004, 3890, 1581,<br>3769, 9969, 4895,<br>3392, 750, 9567, | 5 |

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| 4265, 2845, 5451,<br>3745, 3004, 3890,<br>1581, 3769, 9969,<br>4895, 3392, 750,<br>9567, 1281, 1693,<br>5119, 3707]   | 1281, 1693, 5119,<br>9995, 7907, 5511,<br>130, 7242, 2359,<br>7648, 6697, 4981,<br>5223, 9278, 1906,<br>2634, 3707]   |   |
| [1331, 883, 1686,<br>915, 8047, 2341,<br>9587, 2700, 5028,<br>2004, 5306, 8617,<br>1721, 365, 1720,<br>9792, 2929, 406,<br>6411, 632, 5615,<br>2133, 3507, 4678,<br>1451, 6035, 4356,<br>4920, 4581, 5183,<br>61, 6065, 7066,<br>1077, 7150, 9702,<br>406, 800, 7877,<br>2168, 2665, 8717,<br>6458, 9731, 9148,<br>5555, 396, 1686,<br>4629, 672, 6059, | [1331, 883, 1686,<br>915, 5813, 265,<br>3765, 2135, 6035,<br>4356, 4920, 4581,<br>5183, 61, 6065,<br>6332, 3554, 7066,<br>1077, 7150, 7973,<br>6105, 3732, 3217,<br>1066, 304, 7226,<br>6742, 89, 8047,<br>2341, 8703, 9198,<br>941, 9527, 7126,<br>7322, 9259, 507,<br>8669, 4964, 2954,<br>9587, 2700, 5028,<br>2004, 5306, 8617,<br>1721, 365, 1720, | 4 |

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| 5813, 265, 3765,<br>2135, 6332, 3554,<br>7973, 6105, 3732,<br>3217, 1066, 304,<br>7226, 6742, 89,<br>8703, 9198, 941,<br>9527, 7126, 7322,<br>9259, 507, 8669,<br>4964, 2954, 6646]  | 9702, 406, 800,<br>7877, 2168, 2665,<br>8717, 6458, 9731,<br>9148, 5555, 396,<br>1686, 4629, 672,<br>6059, 9792, 2929,<br>406, 6411, 632,<br>5615, 2133, 3507,<br>4678, 1451, 6646]  |   |
| [5176, 4293, 9714,<br>208, 4535, 3963,<br>3177, 3125, 669,<br>2843, 2267, 8672,<br>6420, 1851, 2301,<br>8359, 1455, 1328,<br>4446, 2151, 1841,<br>3875, 3807, 865,<br>188, 2249, 9045,<br>9029, 7931, 67, 685,<br>7502, 4356, 8771,<br>9055, 751, 984,<br>7537, 9014, 1020,<br>9342, 6173, 3295, | [4173, 338, 5176,<br>4293, 6854, 7440,<br>7855, 9045, 9029,<br>7931, 67, 685, 7502,<br>4356, 8771, 9055,<br>751, 984, 7537,<br>9014, 1020, 9197,<br>6484, 301, 6762,<br>8138, 8915, 3752,<br>4170, 3701, 5651,<br>151, 7728, 2393,<br>722, 2064, 1704,<br>2517, 5679, 7985,<br>4154, 9342, 6173, | 5 |



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| 9211, 4095, 9397,<br>6271, 236, 8339,<br>2089, 6138, 2040,<br>2123, 4173, 338,<br>6854, 7440, 7855,<br>9197, 6484, 301,<br>6762, 8138, 8915,<br>3752, 4170, 3701,<br>5651, 151, 7728,<br>2393, 722, 2064,<br>1704, 2517, 5679,<br>7985, 4154, 2290] | 3295, 9211, 4095,<br>9397, 6271, 236,<br>8339, 2089, 6138,<br>2040, 2123, 9714,<br>208, 4535, 3963,<br>3177, 3125, 669,<br>2843, 2267, 8672,<br>6420, 1851, 2301,<br>8359, 1455, 1328,<br>4446, 2151, 1841,<br>3875, 3807, 865,<br>188, 2249, 2290] |  |
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Algorithm 4:

Dividing the arrays into  $1/4$  and  $3/4$  parts

MergeSort(arr[], l, r)

If  $r > l$

1. Find the  $1/4^{\text{rd}}$  point to divide the array into two halves:

$$\text{mid } m = l + (r-l)/4$$

2. Call mergeSort for first half:

Call mergeSort(arr, l, m)

3. Call mergeSort for second half:

Call mergeSort(arr, m+1, r)

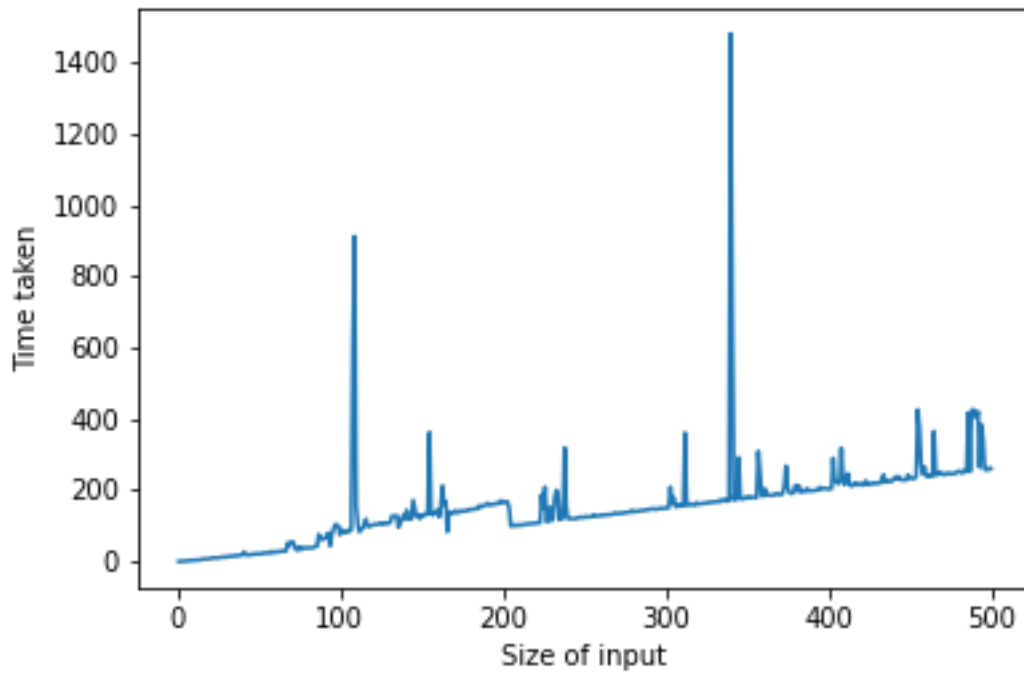
4. Merge the two halves sorted in step 2 and 3:

Call merge(arr, l, m, r)

Time complexity:

$$T(n) = T(n/4) + T(3n/4) + O(n)$$

$$\Rightarrow O(n \cdot \log_{4/3}(n))$$



| Input                                | Output                               | Time taken |
|--------------------------------------|--------------------------------------|------------|
| [7885]                               | [7885]                               | 0          |
| [485, 2350]                          | [485, 2350]                          | 0          |
| [5458, 1807, 4926]                   | [1807, 4926, 5458]                   | 1          |
| [4957, 2206, 8923, 4260]             | [2206, 4260, 4957, 8923]             | 1          |
| [4458, 6375, 1603, 7221, 754]        | [754, 1603, 4458, 6375, 7221]        | 1          |
| [7604, 4817, 3615, 9414, 7025, 1246] | [1246, 3615, 4817, 7025, 7604, 9414] | 2          |

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| [778, 206, 4247,<br>1890, 476, 2413,<br>3627]                                 | [206, 476, 778,<br>1890, 2413, 3627,<br>4247]                                 | 2 |
| [3261, 3400, 7799,<br>6886, 2965, 2839,<br>5793, 3157]                        | [2839, 2965, 3157,<br>3261, 3400, 5793,<br>6886, 7799]                        | 3 |
| [9233, 1721, 3288,<br>3249, 6646, 141,<br>9333, 6273, 6559]                   | [141, 1721, 3249,<br>3288, 6273, 6559,<br>6646, 9233, 9333]                   | 3 |
| [5423, 4784, 943,<br>1539, 6754, 4434,<br>7113, 4610, 7679,<br>7855]          | [943, 1539, 4434,<br>4610, 4784, 5423,<br>6754, 7113, 7679,<br>7855]          | 3 |
| [7369, 8191, 7244,<br>6451, 567, 741,<br>7552, 652, 9276,<br>1507, 8054]      | [567, 652, 741,<br>1507, 6451, 7244,<br>7369, 7552, 8054,<br>8191, 9276]      | 4 |
| [1529, 8571, 809,<br>5873, 7361, 8108,<br>872, 959, 519, 1112,<br>8917, 6896] | [519, 809, 872, 959,<br>1112, 1529, 5873,<br>6896, 7361, 8108,<br>8571, 8917] | 4 |
| [2589, 7740, 9694,<br>5704, 3383, 1335,                                       | [1335, 1648, 1937,<br>2589, 3383, 5254,                                       | 4 |

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|---|---|---|
| 1648, 8531, 1937,<br>5254, 7561, 6121,<br>8531]   | 5704, 6121, 7561,<br>7740, 8531, 8531,<br>9694]   |   |
| [1347, 9401, 499,<br>116, 5178, 3502,<br>8189, 1581, 2748,<br>5424, 1675, 9711,<br>134, 1434]                   | [116, 134, 499,<br>1347, 1434, 1581,<br>1675, 2748, 3502,<br>5178, 5424, 8189,<br>9401, 9711]                   | 5 |
| [2641, 8423, 9556,<br>7035, 7518, 3649,<br>7747, 2684, 1225,<br>476, 5237, 7314,<br>4527, 2604, 7784]           | [476, 1225, 2604,<br>2641, 2684, 3649,<br>4527, 5237, 7035,<br>7314, 7518, 7747,<br>7784, 8423, 9556]           | 5 |
| [2390, 2587, 2101,<br>1049, 2819, 4167,<br>6903, 4485, 5759,<br>9937, 9589, 8496,<br>5166, 2754, 1498,<br>4665] | [1049, 1498, 2101,<br>2390, 2587, 2754,<br>2819, 4167, 4485,<br>4665, 5166, 5759,<br>6903, 8496, 9589,<br>9937] | 7 |
| [6052, 8523, 9534,<br>1406, 2474, 9729,<br>7141, 9932, 6259,<br>412, 7705, 2730,                                | [412, 1406, 2474,<br>2730, 2958, 2982,<br>3097, 6052, 6259,<br>7141, 7705, 7882,                                | 7 |

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| 9134, 7882, 3097,<br>2982, 2958]  | 8523, 9134, 9534,<br>9729, 9932]  |   |
| [5065, 8386, 5888,<br>8841, 8740, 5885,<br>8006, 2974, 1869,<br>4201, 5295, 1931,<br>7148, 4651, 6252,<br>2030, 1047, 5347]           | [1047, 1869, 1931,<br>2030, 2974, 4201,<br>4651, 5065, 5295,<br>5347, 5885, 5888,<br>6252, 7148, 8006,<br>8386, 8740, 8841]           | 7 |
| [6524, 6602, 4227,<br>3632, 5247, 9596,<br>1609, 3142, 7789,<br>5070, 1837, 7423,<br>3624, 6363, 1083,<br>7457, 4911, 1284,<br>5427]  | [1083, 1284, 1609,<br>1837, 3142, 3624,<br>3632, 4227, 4911,<br>5070, 5247, 5427,<br>6363, 6524, 6602,<br>7423, 7457, 7789,<br>9596]  | 7 |
| [6095, 1301, 7731,<br>8263, 146, 9921,<br>815, 529, 9721, 359,<br>7327, 8363, 6206,<br>375, 1218, 2729,<br>6155, 1092, 3150,<br>6729] | [146, 359, 375, 529,<br>815, 1092, 1218,<br>1301, 2729, 3150,<br>6095, 6155, 6206,<br>6729, 7327, 7731,<br>8263, 8363, 9721,<br>9921] | 8 |

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| [8172, 2760, 7352, 7887, 983, 4470, 5892, 5578, 7162, 0, 2700, 6459, 9028, 842, 2198, 6967, 2695, 9215, 2881, 1291, 4188]              | [0, 842, 983, 1291, 2198, 2695, 2700, 2760, 2881, 4188, 4470, 5578, 5892, 6459, 6967, 7162, 7352, 7887, 8172, 9028, 9215]              | 9  |
| [2738, 9489, 7727, 2999, 8487, 9628, 3518, 6364, 8548, 803, 7860, 4722, 4514, 6949, 1321, 6104, 8424, 8880, 3662, 8662, 330, 2681]     | [330, 803, 1321, 2681, 2738, 2999, 3518, 3662, 4514, 4722, 6104, 6364, 6949, 7727, 7860, 8424, 8487, 8548, 8662, 8880, 9489, 9628]     | 11 |
| [629, 340, 622, 9198, 8774, 432, 1151, 1771, 6079, 5228, 4517, 1178, 3804, 7159, 4757, 6638, 4823, 3917, 6213, 1553, 1730, 5265, 3827] | [340, 432, 622, 629, 1151, 1178, 1553, 1730, 1771, 3804, 3827, 3917, 4517, 4757, 4823, 5228, 5265, 6079, 6213, 6638, 7159, 8774, 9198] | 10 |

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| [6332, 1218, 2042, 5910, 552, 2318, 3659, 6213, 4019, 6681, 9848, 8311, 5605, 1884, 2486, 1003, 6019, 8103, 6946, 7112, 5715, 5897, 661, 375]        | [375, 552, 661, 1003, 1218, 1884, 2042, 2318, 2486, 3659, 4019, 5605, 5715, 5897, 5910, 6019, 6213, 6332, 6681, 6946, 7112, 8103, 8311, 9848]        | 10 |
| [8561, 4207, 9862, 832, 3986, 5241, 5584, 6003, 3943, 2147, 7749, 1033, 9556, 5939, 2708, 793, 8241, 2686, 2599, 8030, 7249, 9136, 4064, 6873, 6738] | [793, 832, 1033, 2147, 2599, 2686, 2708, 3943, 3986, 4064, 4207, 5241, 5584, 5939, 6003, 6738, 6873, 7249, 7749, 8030, 8241, 8561, 9136, 9556, 9862] | 10 |
| [1595, 373, 2852, 3236, 6255, 1561, 7671, 7677, 252, 2173, 6670, 4572, 7172, 7543, 7482, 9724, 9700, 6338,   | [252, 373, 1149, 1561, 1595, 2173, 2852, 3052, 3236, 3556, 4572, 4973, 5033, 5830, 6255, 6338, 6670, 7111,   | 11 |



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| 7111, 3052, 3556,<br>5830, 7278, 1149,<br>4973, 5033]   | 7172, 7278, 7482,<br>7543, 7671, 7677,<br>9700, 9724]  |    |
| [3116, 4011, 5243,<br>5382, 8003, 2703,<br>6275, 701, 6047,<br>1764, 694, 1228,<br>3500, 7770, 7030,<br>8524, 1670, 2135,<br>937, 5246, 9232,<br>2356, 6028, 616,<br>6681, 7159, 1610]          | [616, 694, 701, 937,<br>1228, 1610, 1670,<br>1764, 2135, 2356,<br>2703, 3116, 3500,<br>4011, 5243, 5246,<br>5382, 6028, 6047,<br>6275, 6681, 7030,<br>7159, 7770, 8003,<br>8524, 9232]       | 12 |
| [7435, 1708, 4509,<br>893, 519, 1656,<br>3659, 2324, 2737,<br>927, 2500, 8422,<br>1123, 7458, 4445,<br>6277, 6037, 3085,<br>1359, 2406, 7979,<br>5759, 6157, 129,<br>7182, 3357, 2023,<br>8772] | [129, 519, 893, 927,<br>1123, 1359, 1656,<br>1708, 2023, 2324,<br>2406, 2500, 2737,<br>3085, 3357, 3659,<br>4445, 4509, 5759,<br>6037, 6157, 6277,<br>7182, 7435, 7458,<br>7979, 8422, 8772] | 13 |

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| [7552, 1496, 4814, 1180, 9706, 1259, 4362, 1591, 9352, 9881, 9080, 5444, 1272, 5015, 679, 2572, 5150, 7062, 9541, 869, 1212, 20, 2469, 5268, 7600, 9779, 5701, 2979, 6846]        | [20, 679, 869, 1180, 1212, 1259, 1272, 1496, 1591, 2469, 2572, 2979, 4362, 4814, 5015, 5150, 5268, 5444, 5701, 6846, 7062, 7552, 7600, 9080, 9352, 9541, 9706, 9779, 9881]        | 12 |
| [2026, 413, 9363, 6576, 2522, 6842, 3524, 5371, 2100, 9947, 3698, 4292, 1545, 8283, 6002, 2835, 5234, 7761, 1518, 7063, 4049, 437, 8045, 2521, 9656, 3860, 8295, 309, 2089, 2182] | [309, 413, 437, 1518, 1545, 2026, 2089, 2100, 2182, 2521, 2522, 2835, 3524, 3698, 3860, 4049, 4292, 5234, 5371, 6002, 6576, 6842, 7063, 7761, 8045, 8283, 8295, 9363, 9656, 9947] | 13 |
| [9591, 1047, 3005, 2413, 7490, 8514, 1640, 6417, 6231,  | [101, 148, 1047, 1489, 1629, 1640, 1960, 2010, 2260,  | 13 |

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| 3239, 2605, 2010,<br>7639, 2260, 4079,<br>1629, 5575, 9195,<br>9384, 8538, 148,<br>5300, 4061, 101,<br>3254, 6277, 8481,<br>4260, 2424, 1489,<br>1960]   | 2413, 2424, 2605,<br>3005, 3239, 3254,<br>4061, 4079, 4260,<br>5300, 5575, 6231,<br>6277, 6417, 7490,<br>7639, 8481, 8514,<br>8538, 9195, 9384,<br>9591]   |    |
| [7673, 3015, 7135,<br>6895, 7185, 6632,<br>3885, 1019, 4603,<br>5375, 7125, 4607,<br>8333, 7630, 1567,<br>4131, 132, 3147,<br>1590, 865, 6538,<br>7765, 9695, 1952,<br>4925, 2120, 2103,<br>5815, 2205, 4078,<br>3453, 3418] | [132, 865, 1019,<br>1567, 1590, 1952,<br>2103, 2120, 2205,<br>3015, 3147, 3418,<br>3453, 3885, 4078,<br>4131, 4603, 4607,<br>4925, 5375, 5815,<br>6538, 6632, 6895,<br>7125, 7135, 7185,<br>7630, 7673, 7765,<br>8333, 9695] | 15 |
| [3830, 8168, 8544,<br>1593, 2623, 8526,<br>138, 970, 4818, 596,<br>2461, 2147, 7133,   | [138, 373, 596, 606,<br>884, 970, 1127,<br>1593, 1624, 1778,<br>2138, 2147, 2341,  | 14 |

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| 606, 8525, 7564,<br>1624, 2341, 4575,<br>373, 6793, 8538,<br>2543, 4564, 884,<br>2138, 5704, 6578,<br>1127, 1778, 8208,<br>4166, 2965]   | 2461, 2543, 2623,<br>2965, 3830, 4166,<br>4564, 4575, 4818,<br>5704, 6578, 6793,<br>7133, 7564, 8168,<br>8208, 8525, 8526,<br>8538, 8544]  |    |
| [1845, 6482, 8897,<br>8128, 1468, 4416,<br>6556, 5596, 7245,<br>9688, 8255, 898,<br>5600, 8070, 6692,<br>1827, 1421, 4315,<br>2508, 302, 9354,<br>5837, 9648, 3540,<br>2676, 5023, 218,<br>9801, 6764, 1922,<br>3892, 4205, 9316,<br>1003] | [218, 302, 898,<br>1003, 1421, 1468,<br>1827, 1845, 1922,<br>2508, 2676, 3540,<br>3892, 4205, 4315,<br>4416, 5023, 5596,<br>5600, 5837, 6482,<br>6556, 6692, 6764,<br>7245, 8070, 8128,<br>8255, 8897, 9316,<br>9354, 9648, 9688,<br>9801] | 15 |
| [5137, 1836, 6473,<br>8023, 9291, 595,<br>2547, 5325, 7101,<br>852, 1595, 7603,  | [87, 103, 192, 595,<br>852, 862, 894, 1118,<br>1299, 1579, 1583,<br>1595, 1836, 1900,  | 15 |

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| 5810, 1579, 3293,<br>9220, 862, 6802,<br>894, 192, 2476,<br>4643, 1583, 9620,<br>87, 1900, 1299,<br>2155, 8732, 103,<br>6653, 7173, 7775,<br>7850, 1118]  | 2155, 2476, 2547,<br>3293, 4643, 5137,<br>5325, 5810, 6473,<br>6653, 6802, 7101,<br>7173, 7603, 7775,<br>7850, 8023, 8732,<br>9220, 9291, 9620]   |    |
| [9192, 9902, 8589,<br>8366, 6436, 2916,<br>6954, 6904, 5915,<br>5663, 6842, 3803,<br>3777, 8467, 301,<br>4861, 4224, 9231,<br>9994, 275, 9599,<br>6833, 6440, 6975,<br>7236, 1270, 27,<br>5641, 6136, 1573,<br>4548, 4002, 3082,<br>2797, 7938, 6740] | [27, 275, 301, 1270,<br>1573, 2797, 2916,<br>3082, 3777, 3803,<br>4002, 4224, 4548,<br>4861, 5641, 5663,<br>5915, 6136, 6436,<br>6440, 6740, 6833,<br>6842, 6904, 6954,<br>6975, 7236, 7938,<br>8366, 8467, 8589,<br>9192, 9231, 9599,<br>9902, 9994] | 17 |
| [630, 8299, 7902,<br>8094, 4263, 3441,<br>1462, 7903, 3018,   | [73, 115, 380, 428,<br>630, 1348, 1462,<br>1594, 2346, 2406,  | 16 |

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| 115, 6311, 6752,<br>2406, 5315, 8816,<br>5879, 73, 6704,<br>7333, 5337, 1348,<br>8843, 4001, 9936,<br>2346, 4122, 9040,<br>9214, 4549, 7136,<br>428, 8816, 1594,<br>380, 9430, 9990,<br>8062]  | 3018, 3441, 4001,<br>4122, 4263, 4549,<br>5315, 5337, 5879,<br>6311, 6704, 6752,<br>7136, 7333, 7902,<br>7903, 8062, 8094,<br>8299, 8816, 8816,<br>8843, 9040, 9214,<br>9430, 9936, 9990]   |    |
| [8321, 3336, 5186,<br>8056, 8966, 776,<br>7551, 4440, 879,<br>7151, 1860, 537,<br>8780, 5530, 4489,<br>1140, 2465, 4401,<br>3369, 5269, 4150,<br>7175, 169, 5377,<br>8527, 194, 8680,<br>792, 190, 4939,<br>1207, 5192, 3159,<br>6551, 955, 7778,<br>8245, 3911] | [169, 190, 194, 537,<br>776, 792, 879, 955,<br>1140, 1207, 1860,<br>2465, 3159, 3336,<br>3369, 3911, 4150,<br>4401, 4440, 4489,<br>4939, 5186, 5192,<br>5269, 5377, 5530,<br>6551, 7151, 7175,<br>7551, 7778, 8056,<br>8245, 8321, 8527,<br>8680, 8780, 8966] | 17 |

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| [9265, 4193, 9755, 1693, 1857, 9960, 4974, 3489, 6326, 186, 6833, 3187, 1645, 3216, 4913, 3537, 3004, 1511, 9026, 8187, 2293, 8537, 3289, 7637, 1386, 2157, 8331, 4781, 4083, 4385, 9542, 2974, 463, 2454, 2223, 1491, 9687, 8924, 2796] | [186, 463, 1386, 1491, 1511, 1645, 1693, 1857, 2157, 2223, 2293, 2454, 2796, 2974, 3004, 3187, 3216, 3289, 3489, 3537, 4083, 4193, 4385, 4781, 4913, 4974, 6326, 6833, 7637, 8187, 8331, 8537, 8924, 9026, 9265, 9542, 9687, 9755, 9960] | 18 |
| [6864, 5465, 3456, 6931, 8510, 5107, 580, 803, 4214, 414, 1358, 2673, 8784, 3022, 147, 6373, 6700, 8423, 7926, 2358, 6816, 1922, 6155, 4515, 2883, 7968, 9713, 3316, 713, 1038, 5791,  | [147, 414, 580, 713, 740, 803, 1038, 1224, 1358, 1922, 2358, 2571, 2673, 2883, 3022, 3081, 3316, 3456, 3918, 4214, 4515, 5107, 5465, 5791, 6155, 6373, 6700, 6816, 6864, 6931, 7044,   | 18 |

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| 9824, 8352, 3081,<br>3918, 8656, 2571,<br>7044, 1224, 740]   | 7926, 7968, 8352,<br>8423, 8510, 8656,<br>8784, 9713, 9824]  |    |
| [6797, 3352, 4719,<br>9956, 5945, 1644,<br>7025, 666, 39, 4005,<br>1162, 5742, 6569,<br>2623, 6378, 7650,<br>5599, 6861, 617,<br>8976, 5879, 6237,<br>2233, 2000, 6617,<br>1375, 395, 4350,<br>5458, 9848, 628,<br>7548, 2080, 6562,<br>1089, 5043, 4286,<br>806, 1112, 8528,<br>9839] | [39, 395, 617, 628,<br>666, 806, 1089,<br>1112, 1162, 1375,<br>1644, 2000, 2080,<br>2233, 2623, 3352,<br>4005, 4286, 4350,<br>4719, 5043, 5458,<br>5599, 5742, 5879,<br>5945, 6237, 6378,<br>6562, 6569, 6617,<br>6797, 6861, 7025,<br>7548, 7650, 8528,<br>8976, 9839, 9848,<br>9956] | 27 |
| [845, 1921, 973,<br>304, 8355, 7189,<br>1805, 9049, 6013,<br>2278, 7132, 1397,<br>3020, 3232, 9798,<br>6291, 3571, 6943,   | [275, 304, 550, 845,<br>973, 1111, 1269,<br>1397, 1805, 1921,<br>2173, 2278, 2383,<br>2391, 3020, 3232,<br>3333, 3571, 4362,   | 20 |



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| 1111, 7915, 550,<br>7584, 8579, 7893,<br>275, 9660, 2391,<br>8006, 3333, 7666,<br>2383, 8716, 9910,<br>7188, 6985, 2173,<br>9317, 1269, 4362,<br>5435, 5321, 7665]  | 5321, 5435, 6013,<br>6291, 6943, 6985,<br>7132, 7188, 7189,<br>7584, 7665, 7666,<br>7893, 7915, 8006,<br>8355, 8579, 8716,<br>9049, 9317, 9660,<br>9798, 9910]  |    |
| [7697, 6794, 6533,<br>1550, 361, 9045,<br>1148, 9010, 2482,<br>4734, 1894, 8661,<br>2321, 8037, 1284,<br>1016, 1830, 6426,<br>3920, 2486, 255,<br>6326, 3193, 9178,<br>6396, 1447, 6958,<br>6305, 3843, 2923,<br>2936, 513, 1493,<br>1184, 3789, 8794,<br>9824, 2520, 9379,<br>7276, 5686, 1362,<br>5729] | [255, 361, 513,<br>1016, 1148, 1184,<br>1284, 1362, 1447,<br>1493, 1550, 1830,<br>1894, 2321, 2482,<br>2486, 2520, 2923,<br>2936, 3193, 3789,<br>3843, 3920, 4734,<br>5686, 5729, 6305,<br>6326, 6396, 6426,<br>6533, 6794, 6958,<br>7276, 7697, 8037,<br>8661, 8794, 9010,<br>9045, 9178, 9379,<br>9824] | 18 |

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| [970, 1790, 7815,<br>4636, 5438, 714,<br>6755, 4673, 4684,<br>233, 1061, 2013,<br>1499, 9341, 9752,<br>6293, 4369, 1599,<br>1186, 803, 414,<br>6865, 4333, 4751,<br>1581, 997, 325,<br>1791, 8278, 9933,<br>1137, 5775, 7704,<br>8370, 5733, 6404,<br>5669, 73, 3015,<br>7869, 9453, 6003,<br>2816, 2107] | [73, 233, 325, 414,<br>714, 803, 970, 997,<br>1061, 1137, 1186,<br>1499, 1581, 1599,<br>1790, 1791, 2013,<br>2107, 2816, 3015,<br>4333, 4369, 4636,<br>4673, 4684, 4751,<br>5438, 5669, 5733,<br>5775, 6003, 6293,<br>6404, 6755, 6865,<br>7704, 7815, 7869,<br>8278, 8370, 9341,<br>9453, 9752, 9933] | 18 |
| [1920, 4100, 1062,<br>8051, 2542, 9046,<br>8632, 1890, 4961,<br>302, 8362, 1249,<br>8142, 1215, 5873,<br>5704, 6552, 6414,<br>6977, 1463, 2597,<br>1814, 101, 3683,   | [10, 101, 302, 432,<br>671, 1062, 1215,<br>1215, 1249, 1463,<br>1814, 1890, 1920,<br>2064, 2542, 2597,<br>2925, 3683, 3704,<br>4086, 4100, 4219,<br>4689, 4961, 5422,  | 20 |

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| 5845, 2925, 5422,<br>7662, 6992, 4086,<br>4689, 9611, 671,<br>3704, 10, 2064,<br>1215, 432, 9637,<br>7420, 7601, 5811,<br>7742, 4219, 6181]   | 5704, 5811, 5845,<br>5873, 6181, 6414,<br>6552, 6977, 6992,<br>7420, 7601, 7662,<br>7742, 8051, 8142,<br>8362, 8632, 9046,<br>9611, 9637]   |    |
| [646, 247, 3928,<br>8024, 1, 6923, 8562,<br>5467, 6400, 5200,<br>4594, 7031, 8732,<br>1010, 76, 813, 6603,<br>6814, 2308, 2147,<br>3171, 812, 5571,<br>8556, 1141, 8385,<br>9642, 9782, 1079,<br>4835, 5846, 7787,<br>3362, 4334, 1365,<br>8320, 2014, 6902,<br>5784, 1138, 2010,<br>8510, 1049, 9985,<br>3408, 1929] | [1, 76, 247, 646,<br>812, 813, 1010,<br>1049, 1079, 1138,<br>1141, 1365, 1929,<br>2010, 2014, 2147,<br>2308, 3171, 3362,<br>3408, 3928, 4334,<br>4594, 4835, 5200,<br>5467, 5571, 5784,<br>5846, 6400, 6603,<br>6814, 6902, 6923,<br>7031, 7787, 8024,<br>8320, 8385, 8510,<br>8556, 8562, 8732,<br>9642, 9782, 9985] | 19 |

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| [6846, 6045, 5736, 2528, 5615, 3201, 5660, 8339, 5989, 4349, 8317, 6723, 7363, 1577, 5780, 4351, 9114, 7286, 5195, 2221, 103, 4455, 1293, 2428, 6480, 512, 9658, 4551, 447, 2398, 2080, 989, 8813, 4519, 9271, 9439, 7667, 9315, 1851, 7049, 2605, 6155, 3008, 6308, 2112, 2753, 497] | [103, 447, 497, 512, 989, 1293, 1577, 1851, 2080, 2112, 2221, 2398, 2428, 2528, 2605, 2753, 3008, 3201, 4349, 4351, 4455, 4519, 4551, 5195, 5615, 5660, 5736, 5780, 5989, 6045, 6155, 6308, 6480, 6723, 6846, 7049, 7286, 7363, 7667, 8317, 8339, 8813, 9114, 9271, 9315, 9439, 9658] | 20 |
| [1659, 2718, 624, 345, 2269, 1559, 8678, 2054, 6899, 8642, 575, 2122, 9347, 1212, 6115, 4628, 5044, 1456, 5219, 7822, 3890,   | [345, 566, 575, 624, 1098, 1200, 1212, 1456, 1559, 1569, 1659, 1844, 1996, 2054, 2122, 2269, 2682, 2718, 3313, 3318, 3558, 3748,  | 22 |

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| 4857, 1200, 6104,<br>3748, 9348, 9309,<br>3558, 1996, 4745,<br>5542, 566, 6175,<br>7226, 8753, 8612,<br>6038, 8173, 7395,<br>1569, 8836, 4903,<br>3318, 3313, 9353,<br>1098, 2682, 1844] | 3890, 4628, 4745,<br>4857, 4903, 5044,<br>5219, 5542, 6038,<br>6104, 6115, 6175,<br>6899, 7226, 7395,<br>7822, 8173, 8612,<br>8642, 8678, 8753,<br>8836, 9309, 9347,<br>9348, 9353] |  |
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Algorithm 5:

Dividing the arrays into 1/5 and 4/5 parts

MergeSort(arr[], l, r)

If  $r > l$

1. Find the 1/5<sup>th</sup> point to divide the array into two halves:

$$\text{mid } m = l + (r-l)/5$$

2. Call mergeSort for first half:

Call mergeSort(arr, l, m)

3. Call mergeSort for second half:

Call mergeSort(arr, m+1, r)

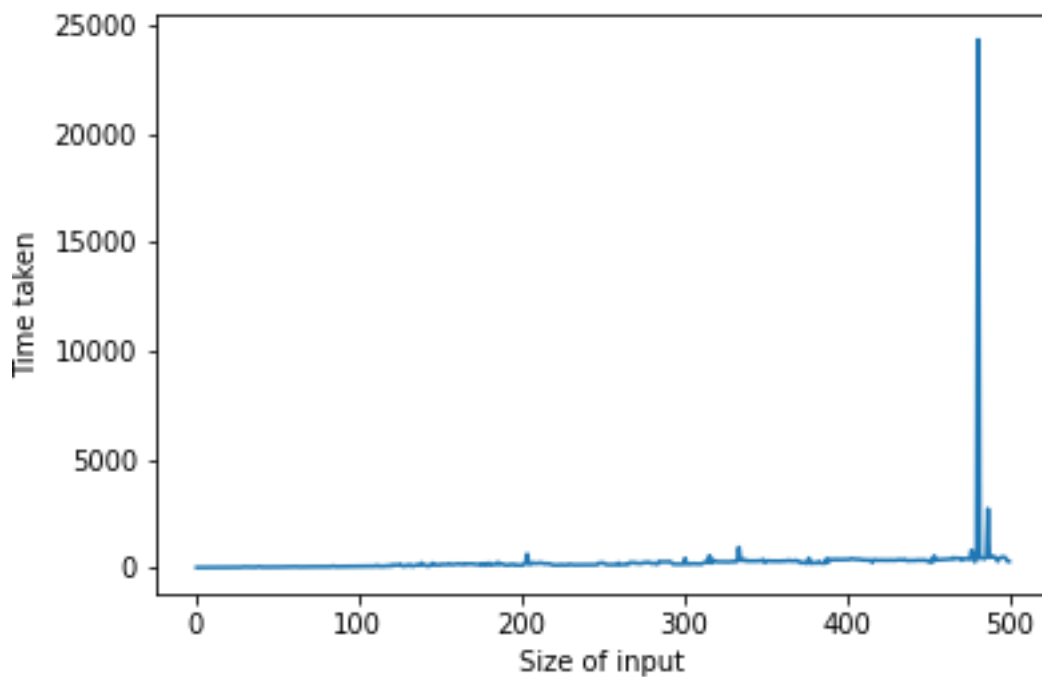
4. Merge the two halves sorted in step 2 and 3:

Call merge(arr, l, m, r)

Time complexity:

$$T(n) = T(n/5) + T(4n/5) + O(n)$$

$$\Rightarrow O(n \cdot \log_{5/4}(n))$$



| Input                                      | Output                                     | Time taken |
|--|--|------------|
| [5798]                                     | [5798]                                     | 0          |
| [2103, 9753]                               | [2103, 9753]                               | 0          |
| [9205, 968, 4188]                          | [968, 4188, 9205]                          | 0          |
| [7724, 4536, 416, 3409]                    | [416, 3409, 4536, 7724]                    | 1          |
| [1405, 8554, 2193, 4595, 1757]             | [1405, 1757, 2193, 4595, 8554]             | 1          |
| [9345, 9839, 7538, 3814, 2520, 7079]       | [2520, 3814, 7079, 7538, 9345, 9839]       | 2          |
| [5593, 4422, 9622, 9871, 7811, 2655, 1142] | [1142, 2655, 4422, 5593, 7811, 9622, 9871] | 2          |

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|---|---|---|
| [8927, 5931, 4846, 6594, 384, 7524, 555, 3472]                              | [384, 555, 3472, 4846, 5931, 6594, 7524, 8927]                              | 2 |
| [3012, 171, 1136, 3954, 1159, 2874, 1070, 3481, 1812]                       | [171, 1070, 1136, 1159, 1812, 2874, 3012, 3481, 3954]                       | 3 |
| [2815, 4604, 4122, 523, 2748, 4850, 500, 1345, 2063, 8309]                  | [500, 523, 1345, 2063, 2748, 2815, 4122, 4604, 4850, 8309]                  | 3 |
| [2432, 7688, 469, 4579, 8234, 9681, 9995, 2865, 2655, 4047, 1157]           | [469, 1157, 2432, 2655, 2865, 4047, 4579, 7688, 8234, 9681, 9995]           | 4 |
| [5939, 5719, 5310, 6210, 4877, 7685, 932, 1664, 8599, 1133, 2150, 1116]     | [932, 1116, 1133, 1664, 2150, 4877, 5310, 5719, 5939, 6210, 7685, 8599]     | 6 |
| [6470, 3878, 5710, 3981, 905, 8176, 6732, 8386, 4688, 2695, 59, 5512, 7364] | [59, 905, 2695, 3878, 3981, 4688, 5512, 5710, 6470, 6732, 7364, 8176, 8386] | 5 |



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| [1464, 8630, 4736, 1987, 7075, 3626, 2369, 7691, 482, 5213, 5050, 7209, 1897, 495]                 | [482, 495, 1464, 1897, 1987, 2369, 3626, 4736, 5050, 5213, 7075, 7209, 7691, 8630]                 | 5 |
| [2298, 8018, 3167, 4736, 7572, 3649, 2380, 6130, 6173, 3666, 1443, 9905, 2760, 1616, 4434]         | [1443, 1616, 2298, 2380, 2760, 3167, 3649, 3666, 4434, 4736, 6130, 6173, 7572, 8018, 9905]         | 6 |
| [5248, 180, 250, 231, 5766, 1140, 1914, 1253, 4809, 8895, 9097, 6088, 1465, 5881, 4285, 7398]      | [180, 231, 250, 1140, 1253, 1465, 1914, 4285, 4809, 5248, 5766, 5881, 6088, 7398, 8895, 9097]      | 6 |
| [81, 1202, 2085, 2262, 5257, 542, 327, 6965, 4127, 9860, 3559, 2758, 7223, 2603, 2267, 8009, 3760] | [81, 327, 542, 1202, 2085, 2262, 2267, 2603, 2758, 3559, 3760, 4127, 5257, 6965, 7223, 8009, 9860] | 6 |

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| [9010, 9516, 496, 777, 9406, 4080, 9534, 8293, 3001, 2182, 3585, 9739, 4345, 9073, 6866, 8768, 9327, 2297]               | [496, 777, 2182, 2297, 3001, 3585, 4080, 4345, 6866, 8293, 8768, 9010, 9073, 9327, 9406, 9516, 9534, 9739]               | 7 |
| [1051, 6329, 2065, 1342, 680, 7052, 7339, 4206, 8368, 6438, 4545, 473, 1190, 482, 7672, 1875, 8171, 1976, 646]           | [473, 482, 646, 680, 1051, 1190, 1342, 1875, 1976, 2065, 4206, 4545, 6329, 6438, 7052, 7339, 7672, 8171, 8368]           | 7 |
| [8427, 8134, 8085, 3622, 6009, 6119, 5402, 8064, 2429, 8696, 6183, 1529, 1653, 9797, 5801, 6167, 5583, 1214, 2801, 7576] | [1214, 1529, 1653, 2429, 2801, 3622, 5402, 5583, 5801, 6009, 6119, 6167, 6183, 7576, 8064, 8085, 8134, 8427, 8696, 9797] | 9 |
| [6272, 7242, 4999, 1668, 6884, 1918, 2543, 9135, 3848,   | [76, 139, 1505, 1668, 1918, 2543, 3096, 3848, 4999,  | 8 |

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| 5727, 139, 9027,<br>8323, 7908, 1505,<br>8686, 76, 9551,<br>7982, 5576, 3096]  | 5576, 5727, 6272,<br>6884, 7242, 7908,<br>7982, 8323, 8686,<br>9027, 9135, 9551]   |   |
| [7614, 2491, 1656,<br>9123, 8717, 7375,<br>7783, 2593, 2590,<br>886, 6837, 9157,<br>4908, 49, 1802, 34,<br>12, 381, 1968, 5153,<br>2196, 8504]               | [12, 34, 49, 381,<br>886, 1656, 1802,<br>1968, 2196, 2491,<br>2590, 2593, 4908,<br>5153, 6837, 7375,<br>7614, 7783, 8504,<br>8717, 9123, 9157]               | 9 |
| [1327, 2258, 2657,<br>1953, 25, 5381,<br>3540, 9472, 2936,<br>2171, 8524, 6710,<br>2996, 713, 9050,<br>9990, 6601, 7038,<br>7313, 3060, 1448,<br>8229, 7917] | [25, 713, 1327,<br>1448, 1953, 2171,<br>2258, 2657, 2936,<br>2996, 3060, 3540,<br>5381, 6601, 6710,<br>7038, 7313, 7917,<br>8229, 8524, 9050,<br>9472, 9990] | 9 |
| [2892, 8157, 6349,<br>5461, 3286, 338,<br>7014, 3796, 6169,<br>1841, 8302, 5284,   | [95, 96, 338, 487,<br>597, 1841, 2303,<br>2892, 3286, 3740,<br>3796, 4430, 5284,   | 9 |

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| 7838, 2303, 4430,<br>8764, 487, 9880,<br>5871, 3740, 95, 597,<br>96, 5829]   | 5461, 5829, 5871,<br>6169, 6349, 7014,<br>7838, 8157, 8302,<br>8764, 9880]   |    |
| [9507, 8757, 5932,<br>9759, 9922, 6107,<br>360, 8309, 1761,<br>6996, 1835, 132,<br>8321, 5708, 9393,<br>1604, 229, 1314,<br>2417, 6102, 3647,<br>1944, 3997, 9695,<br>6875]        | [132, 229, 360,<br>1314, 1604, 1761,<br>1835, 1944, 2417,<br>3647, 3997, 5708,<br>5932, 6102, 6107,<br>6875, 6996, 8309,<br>8321, 8757, 9393,<br>9507, 9695, 9759,<br>9922]        | 11 |
| [5359, 2761, 7443,<br>2750, 5107, 6288,<br>7878, 416, 9603,<br>1412, 3407, 9848,<br>1109, 1157, 7454,<br>1814, 5495, 388,<br>3295, 3095, 3448,<br>3752, 9423, 6404,<br>6936, 2913] | [388, 416, 1109,<br>1157, 1412, 1814,<br>2750, 2761, 2913,<br>3095, 3295, 3407,<br>3448, 3752, 5107,<br>5359, 5495, 6288,<br>6404, 6936, 7443,<br>7454, 7878, 9423,<br>9603, 9848] | 10 |

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| [5598, 9949, 7581, 1291, 6294, 8644, 7543, 6532, 3995, 8092, 5543, 3201, 6740, 7972, 3708, 3502, 7449, 7294, 1277, 502, 2205, 7910, 46, 5490, 8862, 1295, 685]      | [46, 502, 685, 1277, 1291, 1295, 2205, 3201, 3502, 3708, 3995, 5490, 5543, 5598, 6294, 6532, 6740, 7294, 7449, 7543, 7581, 7910, 7972, 8092, 8644, 8862, 9949]      | 11 |
| [292, 2075, 2879, 652, 8759, 597, 9550, 4068, 7791, 2313, 2731, 1047, 1527, 9628, 1776, 983, 4555, 6056, 3287, 2086, 1810, 2951, 1725, 5341, 4241, 445, 1830, 3489] | [292, 445, 597, 652, 983, 1047, 1527, 1725, 1776, 1810, 1830, 2075, 2086, 2313, 2731, 2879, 2951, 3287, 3489, 4068, 4241, 4555, 5341, 6056, 7791, 8759, 9550, 9628] | 11 |
| [4044, 922, 4385, 5682, 717, 944, 1997, 5318, 5738, 6403, 4108, 166,  | [37, 166, 572, 717, 750, 922, 944, 1997, 2202, 2471, 2706, 2999, 3715, 4044,  | 24 |

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| 3715, 9759, 2999,<br>2471, 8905, 750,<br>6611, 572, 37, 9417,<br>2706, 2202, 6600,<br>5614, 6988, 9324,<br>4190]   | 4108, 4190, 4385,<br>5318, 5614, 5682,<br>5738, 6403, 6600,<br>6611, 6988, 8905,<br>9324, 9417, 9759]  |    |
| [3844, 2288, 648,<br>9769, 5435, 2678,<br>6769, 9931, 2903,<br>8567, 8543, 292,<br>4655, 8591, 1932,<br>3549, 9968, 241,<br>2095, 7715, 5640,<br>4875, 4591, 5305,<br>6976, 8428, 9040,<br>4951, 8553, 6404] | [241, 292, 648,<br>1932, 2095, 2288,<br>2678, 2903, 3549,<br>3844, 4591, 4655,<br>4875, 4951, 5305,<br>5435, 5640, 6404,<br>6769, 6976, 7715,<br>8428, 8543, 8553,<br>8567, 8591, 9040,<br>9769, 9931, 9968] | 28 |
| [2082, 1975, 9562,<br>2155, 5563, 4274,<br>5768, 8725, 5105,<br>2646, 1384, 8787,<br>8845, 1211, 7169,<br>8509, 6556, 7750,<br>1462, 4944, 2184,   | [1211, 1384, 1462,<br>1975, 2082, 2125,<br>2155, 2184, 2646,<br>2961, 3053, 3422,<br>4274, 4944, 5105,<br>5563, 5768, 6556,<br>7169, 7368, 7698,   | 26 |

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| 2125, 9986, 7698,<br>7846, 3053, 9908,<br>3422, 2961, 7368,<br>9517]  | 7750, 7846, 8509,<br>8725, 8787, 8845,<br>9517, 9562, 9908,<br>9986]  |    |
| [4908, 8071, 6883,<br>4088, 3999, 5954,<br>7055, 9930, 3926,<br>218, 1237, 9770,<br>5787, 9497, 2408,<br>402, 9920, 5760,<br>2742, 390, 4524,<br>1448, 1423, 6885,<br>6752, 9051, 1945,<br>7646, 2046, 1843,<br>1171, 6437] | [218, 390, 402,<br>1171, 1237, 1423,<br>1448, 1843, 1945,<br>2046, 2408, 2742,<br>3926, 3999, 4088,<br>4524, 4908, 5760,<br>5787, 5954, 6437,<br>6752, 6883, 6885,<br>7055, 7646, 8071,<br>9051, 9497, 9770,<br>9920, 9930] | 18 |
| [2444, 4579, 8009,<br>6630, 85, 4294,<br>4424, 568, 5761,<br>1700, 658, 6310,<br>5159, 220, 147,<br>8218, 9424, 9630,<br>9221, 7323, 7789,<br>584, 7249, 4073,  | [16, 54, 85, 147,<br>220, 568, 584, 658,<br>1700, 2444, 3414,<br>4073, 4251, 4294,<br>4336, 4424, 4579,<br>5159, 5761, 6310,<br>6343, 6630, 7249,<br>7323, 7789, 7804,  | 20 |

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| 4251, 8676, 9383,<br>3414, 54, 16, 4336,<br>6343, 7804]  | 8009, 8218, 8676,<br>9221, 9383, 9424,<br>9630]  |    |
| [4494, 418, 187,<br>4068, 3965, 6116,<br>6043, 3951, 1976,<br>6291, 1971, 6653,<br>7181, 8580, 6352,<br>2467, 1088, 6618,<br>2155, 8780, 3969,<br>1898, 6693, 5725,<br>1099, 1502, 1459,<br>1197, 1023, 7191,<br>6444, 7557, 768,<br>2374] | [187, 418, 768,<br>1023, 1088, 1099,<br>1197, 1459, 1502,<br>1898, 1971, 1976,<br>2155, 2374, 2467,<br>3951, 3965, 3969,<br>4068, 4494, 5725,<br>6043, 6116, 6291,<br>6352, 6444, 6618,<br>6653, 6693, 7181,<br>7191, 7557, 8580,<br>8780] | 24 |
| [1551, 9301, 336,<br>8684, 5515, 9831,<br>3532, 5025, 5978,<br>4183, 1299, 6978,<br>717, 2275, 8653,<br>5870, 1342, 160,<br>7961, 1716, 1762,<br>2782, 5223, 1477,   | [160, 336, 620, 717,<br>1299, 1342, 1355,<br>1477, 1551, 1582,<br>1598, 1716, 1762,<br>1954, 2275, 2415,<br>2782, 3528, 3532,<br>4183, 4717, 4855,<br>5025, 5223, 5515,  | 15 |



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| 7053, 620, 4855,<br>2415, 1355, 1582,<br>1954, 4717, 8540,<br>1598, 3528]  | 5870, 5978, 6978,<br>7053, 7961, 8540,<br>8653, 8684, 9301,<br>9831]   |    |
| [9337, 6623, 9746,<br>2761, 8019, 9650,<br>6893, 4408, 4199,<br>1865, 5383, 8140,<br>3882, 8525, 2593,<br>2601, 6469, 6471,<br>2036, 1088, 149,<br>957, 7626, 722, 577,<br>7564, 304, 9434,<br>8718, 1688, 2633,<br>9035, 7633, 3343,<br>3350, 7815] | [149, 304, 577, 722,<br>957, 1088, 1688,<br>1865, 2036, 2593,<br>2601, 2633, 2761,<br>3343, 3350, 3882,<br>4199, 4408, 5383,<br>6469, 6471, 6623,<br>6893, 7564, 7626,<br>7633, 7815, 8019,<br>8140, 8525, 8718,<br>9035, 9337, 9434,<br>9650, 9746] | 25 |
| [9635, 4260, 9781,<br>3091, 9753, 7755,<br>8872, 3735, 1828,<br>6672, 5368, 2682,<br>1045, 2653, 8953,<br>8797, 934, 491,<br>3983, 7047, 7366,   | [491, 859, 934,<br>1045, 1737, 1828,<br>2078, 2643, 2653,<br>2682, 2737, 3091,<br>3735, 3983, 4260,<br>4843, 4872, 5365,<br>5368, 5484, 5735,  | 16 |

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| 1737, 7457, 7425,<br>7155, 859, 2078,<br>2643, 5484, 5365,<br>9149, 7983, 5735,<br>4872, 5849, 4843,<br>2737]  | 5849, 6672, 7047,<br>7155, 7366, 7425,<br>7457, 7755, 7983,<br>8797, 8872, 8953,<br>9149, 9635, 9753,<br>9781]   |    |
| [8219, 365, 2453,<br>6852, 2542, 7468,<br>9443, 7150, 9547,<br>6772, 1288, 7680,<br>1231, 8388, 5934,<br>819, 9639, 2859,<br>2976, 4306, 6942,<br>3763, 1046, 5460,<br>1478, 7887, 2615,<br>9224, 3109, 2256,<br>1914, 2903, 3266,<br>6334, 4142, 4836,<br>8384, 4805] | [365, 819, 1046,<br>1231, 1288, 1478,<br>1914, 2256, 2453,<br>2542, 2615, 2859,<br>2903, 2976, 3109,<br>3266, 3763, 4142,<br>4306, 4805, 4836,<br>5460, 5934, 6334,<br>6772, 6852, 6942,<br>7150, 7468, 7680,<br>7887, 8219, 8384,<br>8388, 9224, 9443,<br>9547, 9639] | 34 |
| [571, 9911, 5498,<br>2046, 1560, 5738,<br>5311, 928, 7007,<br>6867, 2753, 4102,  | [204, 420, 571, 670,<br>928, 1028, 1482,<br>1560, 1869, 1922,<br>2046, 2753, 2988,   | 39 |

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| 8733, 420, 3544,<br>5682, 5694, 9711,<br>7885, 1922, 6665,<br>670, 3315, 4787,<br>5767, 9586, 7544,<br>1028, 1482, 3162,<br>4701, 2988, 204,<br>4039, 7330, 1869,<br>6517, 4733, 7590]  | 3162, 3315, 3544,<br>4039, 4102, 4701,<br>4733, 4787, 5311,<br>5498, 5682, 5694,<br>5738, 5767, 6517,<br>6665, 6867, 7007,<br>7330, 7544, 7590,<br>7885, 8733, 9586,<br>9711, 9911]   |    |
| [6923, 802, 1021,<br>1661, 2088, 178,<br>2785, 6371, 2754,<br>8946, 2743, 5423,<br>5856, 5147, 7681,<br>9164, 2761, 1546,<br>12, 340, 2005, 2753,<br>3488, 4094, 9016,<br>9997, 9367, 2666,<br>2188, 7592, 7490,<br>6714, 5853, 2607,<br>6680, 1587, 8267,<br>5622, 9120, 3844] | [12, 178, 340, 802,<br>1021, 1546, 1587,<br>1661, 2005, 2088,<br>2188, 2607, 2666,<br>2743, 2753, 2754,<br>2761, 2785, 3488,<br>3844, 4094, 5147,<br>5423, 5622, 5853,<br>5856, 6371, 6680,<br>6714, 6923, 7490,<br>7592, 7681, 8267,<br>8946, 9016, 9120,<br>9164, 9367, 9997] | 39 |

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| [2364, 7914, 5250, 5111, 8673, 1447, 6601, 4277, 5818, 843, 987, 8351, 4603, 3531, 668, 6346, 2353, 9750, 3615, 379, 3952, 1815, 1103, 7891, 8591, 5854, 2365, 700, 167, 6208, 1419, 949, 6055, 6158, 9208, 2603, 1595, 6244, 2509, 4377, 1598] | [167, 379, 668, 700, 843, 949, 987, 1103, 1419, 1447, 1595, 1598, 1815, 2353, 2364, 2365, 2509, 2603, 3531, 3615, 3952, 4277, 4377, 4603, 5111, 5250, 5818, 5854, 6055, 6158, 6208, 6244, 6346, 6601, 7891, 7914, 8351, 8591, 8673, 9208, 9750] | 19 |
| [5539, 2744, 2912, 3006, 3297, 8294, 3338, 9391, 1247, 4087, 2908, 1427, 6283, 1404, 9051, 4008, 1495, 1716, 9040, 3090, 8682, 3176, 5390, 9531, 3686, 7251, 2659,  | [0, 670, 683, 1247, 1353, 1404, 1427, 1495, 1716, 1902, 1990, 2331, 2438, 2659, 2744, 2888, 2908, 2912, 3006, 3090, 3176, 3297, 3338, 3686, 4008, 4087, 5390, 5539,   | 18 |

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| 9160, 1353, 1990,<br>670, 1902, 2888,<br>2331, 0, 9173, 8825,<br>7000, 2438, 683,<br>8256, 5974]   | 5974, 6283, 7000,<br>7251, 8256, 8294,<br>8682, 8825, 9040,<br>9051, 9160, 9173,<br>9391, 9531]   |    |
| [2870, 2188, 1996,<br>2963, 1911, 6833,<br>9698, 725, 8518,<br>5654, 9851, 3856,<br>4199, 961, 2490,<br>9898, 5752, 1983,<br>3120, 7596, 5388,<br>5457, 4899, 1915,<br>8535, 1144, 4188,<br>617, 4805, 6476,<br>8225, 9590, 3056,<br>9891, 1715, 1850,<br>4754, 9792, 1544,<br>503, 3991, 2554,<br>2123] | [503, 617, 725, 961,<br>1144, 1544, 1715,<br>1850, 1911, 1915,<br>1983, 1996, 2123,<br>2188, 2490, 2554,<br>2870, 2963, 3056,<br>3120, 3856, 3991,<br>4188, 4199, 4754,<br>4805, 4899, 5388,<br>5457, 5654, 5752,<br>6476, 6833, 7596,<br>8225, 8518, 8535,<br>9590, 9698, 9792,<br>9851, 9891, 9898] | 18 |
| [7195, 2662, 2671,<br>8242, 4484, 1458,<br>3993, 9024, 3383,   | [95, 107, 129, 131,<br>365, 738, 1179,<br>1366, 1458, 1484,   | 20 |

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| 1788, 7919, 2796,<br>7090, 6540, 4735,<br>131, 4480, 7088,<br>1179, 7818, 365,<br>8131, 3201, 6566,<br>107, 5809, 4239, 95,<br>7284, 4954, 9031,<br>738, 129, 4326,<br>3919, 1366, 1770,<br>2296, 4125, 3841,<br>7679, 4150, 1873,<br>1484] | 1770, 1788, 1873,<br>2296, 2662, 2671,<br>2796, 3201, 3383,<br>3841, 3919, 3993,<br>4125, 4150, 4239,<br>4326, 4480, 4484,<br>4735, 4954, 5809,<br>6540, 6566, 7088,<br>7090, 7195, 7284,<br>7679, 7818, 7919,<br>8131, 8242, 9024,<br>9031] |    |
| [4726, 6679, 1843,<br>1924, 5430, 2494,<br>1662, 8451, 3316,<br>7399, 9629, 3278,<br>1276, 2639, 1222,<br>400, 5186, 8, 5332,<br>9304, 3865, 6525,<br>3657, 5966, 9332,<br>7123, 163, 3483,<br>2011, 545, 9598,<br>617, 7888, 4562,         | [8, 163, 400, 406,<br>545, 617, 1222,<br>1276, 1412, 1662,<br>1695, 1843, 1924,<br>2011, 2139, 2488,<br>2494, 2639, 3278,<br>3316, 3483, 3657,<br>3865, 4562, 4726,<br>5186, 5332, 5430,<br>5966, 6275, 6525,<br>6679, 6883, 7123,           | 19 |

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| 2139, 7673, 6275,<br>2488, 8960, 9684,<br>6883, 7571, 1695,<br>1412, 406]  | 7399, 7571, 7673,<br>7888, 8451, 8960,<br>9304, 9332, 9598,<br>9629, 9684]  |    |
| [3826, 1483, 3956,<br>7914, 3465, 3321,<br>5957, 1116, 387,<br>4996, 5362, 5402,<br>7738, 435, 8390,<br>9412, 7302, 4766,<br>3533, 9224, 4898,<br>4143, 6616, 6863,<br>9557, 8262, 5829,<br>6321, 2767, 768,<br>5055, 1280, 3442,<br>2696, 5937, 4292,<br>8740, 5406, 7201,<br>562, 9762, 744,<br>2091, 563, 582,<br>3814] | [387, 435, 562, 563,<br>582, 744, 768, 1116,<br>1280, 1483, 2091,<br>2696, 2767, 3321,<br>3442, 3465, 3533,<br>3814, 3826, 3956,<br>4143, 4292, 4766,<br>4898, 4996, 5055,<br>5362, 5402, 5406,<br>5829, 5937, 5957,<br>6321, 6616, 6863,<br>7201, 7302, 7738,<br>7914, 8262, 8390,<br>8740, 9224, 9412,<br>9557, 9762] | 20 |
| [7370, 4418, 1772,<br>9050, 14, 3734,<br>2578, 8616, 2523,   | [14, 301, 520, 637,<br>701, 1772, 1772,<br>2008, 2064, 2120,  | 23 |

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| 4705, 9982, 4458,<br>7647, 2008, 8980,<br>8759, 7734, 9188,<br>2120, 6693, 6273,<br>3800, 9425, 1772,<br>2372, 6851, 7823,<br>637, 7903, 520,<br>9503, 9715, 2064,<br>301, 9564, 7209,<br>7366, 7074, 9896,<br>701, 4761, 9890,<br>8299, 4899, 7880,<br>7742, 5146] | 2372, 2523, 2578,<br>3734, 3800, 4418,<br>4458, 4705, 4761,<br>4899, 5146, 6273,<br>6693, 6851, 7074,<br>7209, 7366, 7370,<br>7647, 7734, 7742,<br>7823, 7880, 7903,<br>8299, 8616, 8759,<br>8980, 9050, 9188,<br>9425, 9503, 9564,<br>9715, 9890, 9896,<br>9982] |    |
| [5356, 1971, 2616,<br>3212, 2232, 1339,<br>5501, 985, 5914,<br>3638, 4439, 3237,<br>8572, 999, 562,<br>7452, 6403, 6942,<br>6301, 2845, 2003,<br>3804, 7251, 8252,<br>5014, 3834, 2939,<br>7299, 5561, 2954,  | [176, 325, 562, 812,<br>908, 982, 985, 999,<br>1190, 1339, 1372,<br>1536, 1971, 2003,<br>2072, 2167, 2232,<br>2616, 2845, 2939,<br>2954, 3212, 3237,<br>3638, 3804, 3834,<br>4439, 4933, 5014,<br>5356, 5501, 5561,   | 20 |



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| 1372, 2072, 6328,<br>8653, 7093, 4933,<br>7771, 1190, 812,<br>6292, 176, 1536,<br>982, 5689, 908,<br>8796, 2167, 325]   | 5689, 5914, 6292,<br>6301, 6328, 6403,<br>6942, 7093, 7251,<br>7299, 7452, 7771,<br>8252, 8572, 8653,<br>8796]   |    |
| [7148, 2077, 8697,<br>2040, 353, 3992,<br>4626, 1991, 555,<br>4773, 1409, 9102,<br>4885, 1275, 1402,<br>2439, 3522, 7036,<br>4115, 2684, 1461,<br>3404, 4573, 8393,<br>6375, 1128, 2871,<br>1430, 2629, 7924,<br>8095, 1428, 4072,<br>374, 6971, 8597,<br>3338, 113, 4679,<br>4560, 8565, 8212,<br>527, 8549, 5470,<br>7701, 5920, 1871,<br>1026] | [113, 353, 374, 527,<br>555, 1026, 1128,<br>1275, 1402, 1409,<br>1428, 1430, 1461,<br>1871, 1991, 2040,<br>2077, 2439, 2629,<br>2684, 2871, 3338,<br>3404, 3522, 3992,<br>4072, 4115, 4560,<br>4573, 4626, 4679,<br>4773, 4885, 5470,<br>5920, 6375, 6971,<br>7036, 7148, 7701,<br>7924, 8095, 8212,<br>8393, 8549, 8565,<br>8597, 8697, 9102] | 22 |

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| [1939, 8781, 1759,<br>8642, 6399, 7350,<br>4811, 3407, 3158,<br>3768, 2064, 1282,<br>5319, 7557, 5911,<br>3058, 9601, 9824,   | [215, 826, 905,<br>1255, 1282, 1310,<br>1424, 1546, 1699,<br>1759, 1939, 2064,<br>2329, 2701, 2716,<br>3005, 3058, 3158,   | 22 |

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| 6250, 3179, 2329,<br>3005, 6859, 9868,<br>3624, 905, 1255,<br>6497, 5225, 826,<br>6373, 2716, 3972,<br>3576, 6659, 9113,<br>9604, 2701, 1699,<br>7905, 1424, 6856,<br>5794, 9440, 6552,<br>4088, 1546, 4851,<br>1310, 215, 6024]                    | 3179, 3407, 3576,<br>3624, 3768, 3972,<br>4088, 4811, 4851,<br>5225, 5319, 5794,<br>5911, 6024, 6250,<br>6373, 6399, 6497,<br>6552, 6659, 6856,<br>6859, 7350, 7557,<br>7905, 8642, 8781,<br>9113, 9440, 9601,<br>9604, 9824, 9868]                            |    |
| [4036, 2744, 549,<br>6944, 6073, 5651,<br>6071, 4207, 8921,<br>170, 3472, 4690,<br>6608, 9399, 446,<br>5173, 8149, 2280,<br>4136, 239, 8362,<br>774, 9191, 908,<br>3941, 2978, 4242,<br>6570, 7085, 1857,<br>6830, 8296, 5590,<br>7562, 6469, 6972, | [170, 239, 446, 549,<br>757, 774, 908, 1857,<br>2019, 2147, 2280,<br>2679, 2744, 2978,<br>3472, 3823, 3941,<br>4036, 4063, 4136,<br>4207, 4242, 4690,<br>5173, 5421, 5590,<br>5651, 5935, 6052,<br>6071, 6073, 6469,<br>6570, 6608, 6695,<br>6716, 6830, 6944, | 24 |

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| 8304, 5421, 2679,<br>6052, 6716, 6695,<br>3823, 5935, 9730,<br>2019, 7880, 7262,<br>4063, 2147, 9455,<br>757] | 6972, 7085, 7262,<br>7562, 7880, 8149,<br>8296, 8304, 8362,<br>8921, 9191, 9399,<br>9455, 9730] |  |
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