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31 May 1973

Dr. N.J.A. Sloane
Bell Laboratories
600 Mountain Avenue
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Dear Dr. Sloane:

Don Knuth's third volume, "Sorting and Searching" contains a fairly complete discussion of what is known about the sorting network problem (see section 5.3.4). I really don't have anything significant in the way of additional results. The best known constructions for sorting networks that handle 2-16 items contain 1, 3, 5, 9, 12, 16, 19, 25, 29, 35, 39, 46, 51, 56, 60 cells respectively. However, proofs of minimality have not been carried out beyond S(8) = 19 so one may view some of these numbers with suspicion. In particular S(13) = 46 seems too large but I couldn't improve on it. A3075

With regard to the computation of $\psi(7)$, I was aware that conflicting results had been obtained but had not seen the references you mention. Having now read the Lunnon article, I'm tempted to write a program to check his result (it's probably right). Incidentally, I noticed that the enumeration of the monotone Boolean functions can be put into the following setting: A372

Let G_1 = {aa, ab, bb} and let G_n be the set of all strings ABCD of length 2^n where AB, CD, AC and BD are all in G_{n-1}. Then the number of strings in $G_n = \psi(n)$. For example, G_2 = {aaaa, aaab, aabb, abab, abbb, bbbb}.

As a coding theorist you may be interested in a little guessing game recently proposed by Dave Huffman. Given a concealed message consisting of a binary word of n bits, the problem is to devise a fixed schedule of q questions that uniquely determine the message. Each question must be of the type: What is the combined weight of some particular subset of the n bits in the message. To illustrate, any message of 4 bits length can be resolved in 3 questions by asking the weights of the subsets containing bits (1, 2), (1, 3), (2, 3, 4). What is the greatest message length that can be handled with q questions? All we know so far is:

q	1	2	3	4	5
n	1	2	4	5	7

Seq A360 ??

The n values should be an "interesting" sequence.

Sincerely yours,

Milton W. Green
Senior Research Engineer

MWG/mk