Relationship between the FSR and de Bruijn graph

The FSR stores a fixed-length bit sequence, and can output the leftmost bit and update the stored sequence by a feedback function. Specifically, with stored sequence $(y_1, y_2, ..., y_k)$ ($y_i \in \{0, 1\}$, $1 \le i \le k$), the FSR can output y_1, and update the sequence to $(y_2, ..., y_k, y_{k+1})$, where $y_{k+1} = f(y_1, y_2, ..., y_k)$ and f is a feedback function. Based on these, a state transition graph of the FSR can be constructed with each node per sequence and each edge per sequence update. Such a state transition graph is actually a k-dimensional binary de Bruijn graph.

Table S1. Number of various m-sequences, gold sequences, Walsh-Hadamard sequences, and binary de Bruijn sequences with fixed sequence length requirement.

Length	M-sequences	Gold sequences	Walsh-Hadamard sequences	Binary de Bruijn sequences
31-32	6	33	32	2^{11}
63-64	6	65	64	2^{26}
127-128	18	129	128	2^{57}
255-256	16	257	256	2^{120}
511-512	48	513	512	2^{247}
1023-1024	60	1025	1024	2^{502}

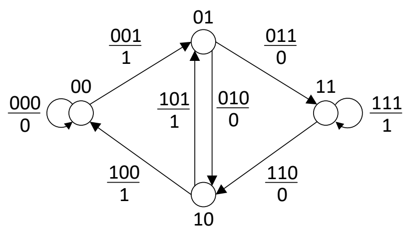

Fig. S1. An example of representing rule 150 of an one-dimensional CA with binary de Bruijn graph (1).

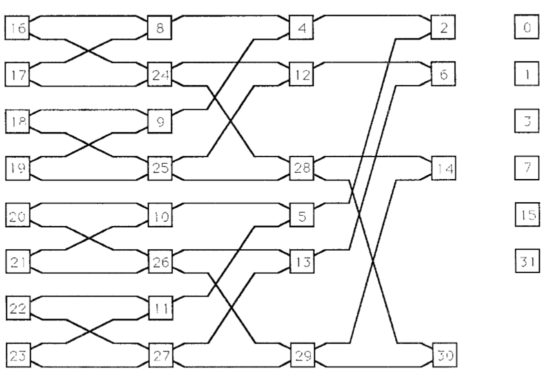

Fig. S2. An example of VLSI layout based on binary de Bruijn graph (2).

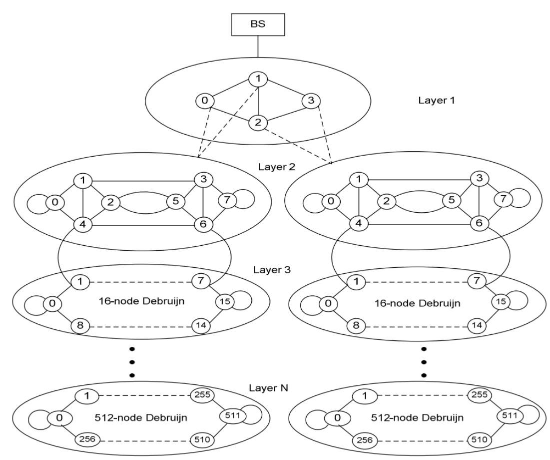

Fig. S3. An illustration of wireless sensor network with binary de Bruijn graph (3).

References

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