Digraph construction technique using adjacency matrix

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In communication network design, there are several factors which should be considered. Two of the factors seem to appear most frequently, namely, (a) the number of connections which can be attached to a processing element is limited, and (b) a short communication route between any two processing elements is required. We would like to end up with a large network subject to these constraints.

A communication network can be modelled as a *graph* or a *directed graph* (*digraph*), where each processing element is represented by a vertex and the connection between two processing elements is represented by an *edge* (or, in case of directed connections, by an *arc*).

In graph-theoretic terms, the problem of constructing large network, subject to the constraints that the number of connections which can be attached to a processing element is limited and that a short communication route between any two processing elements is required, corresponds to the well-known fundamental problem called the degree/ diameter problem: construct graphs with the largest possible number of vertices (order) for given degree and diameter. The directed version of the problems differs only in that 'degree' is replaced by 'out-degree' in the statement of the problems.

There are two mainstreams of research activities related to the *degree/diameter problem*, namely, (a) proving the non-existence of graphs or digraphs of order 'close' to the Moore bound and so lowering the upper bound on the order; and (b) constructing large graphs or digraphs and so incidentally obtaining better lower bounds on the order.

There are many ways to construct a graph or a digraph, for example, drawing by hand, using computer search and using an algebraic specification. It is also possible to make use of existing graphs or digraphs to obtain new graphs using some particular construction technique. In this presentation, we give a new construction technique of digraph utilizing adjacency matrix with some particular operations.