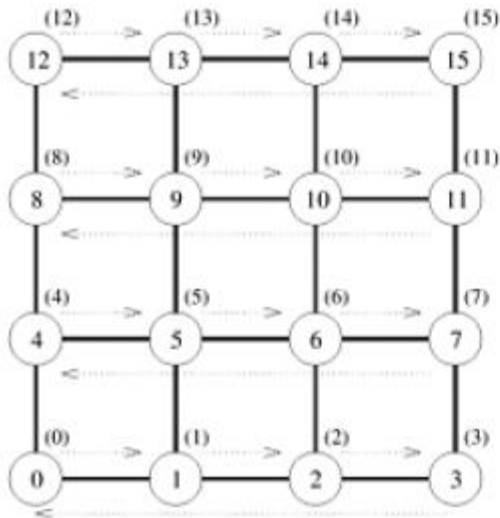


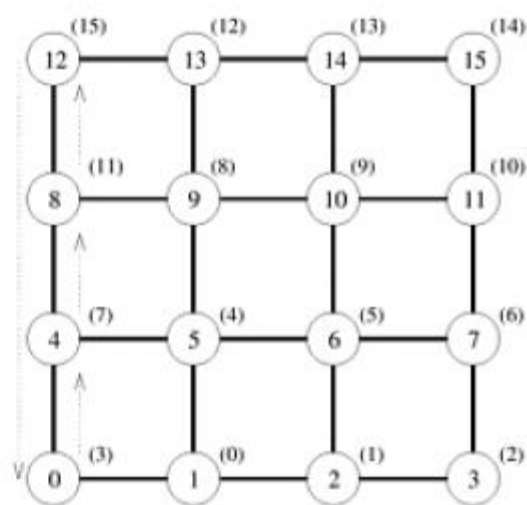
## Circular Shift



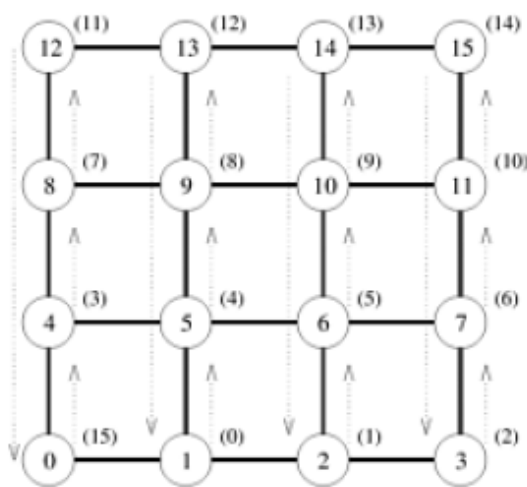
## The communication steps in a circular 5-shift on a 4 x 4 Mesh



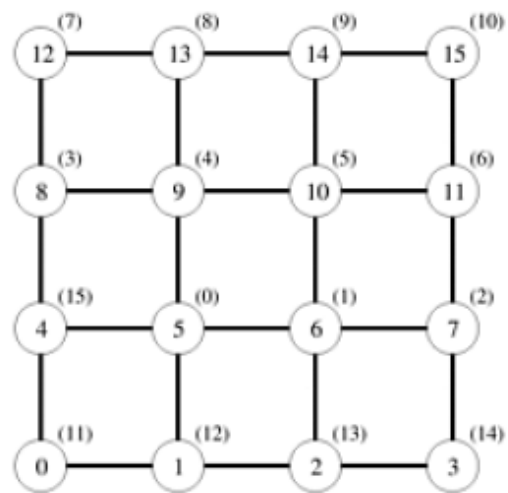
(a) Initial data distribution and the first communication step



(b) Step to compensate for backward row shifts

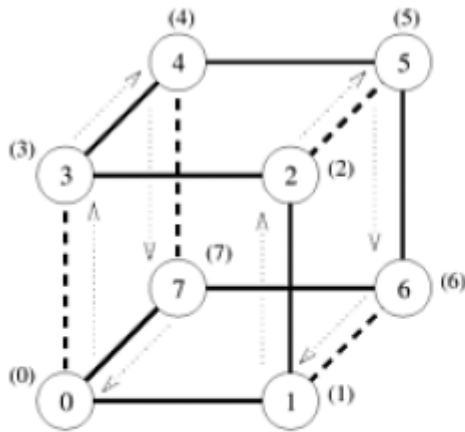


(c) Column shifts in the third communication step

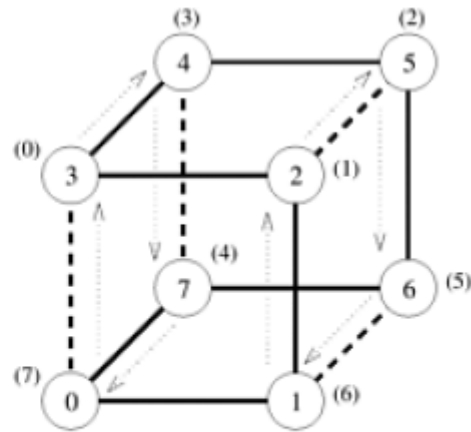


(d) Final distribution of the data

**The mapping of an eight-node linear array onto a three dimensional hypercube to perform a circular 5-shift as a combination of a 4-shift and a 1-shift**

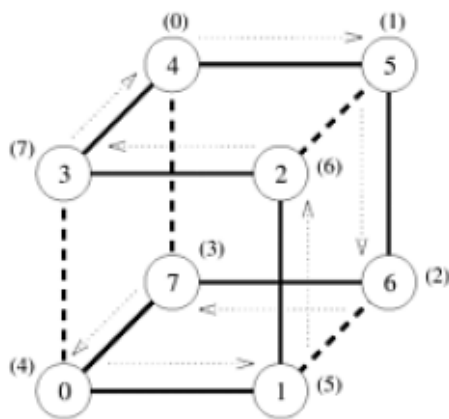


First communication step of the 4-shift

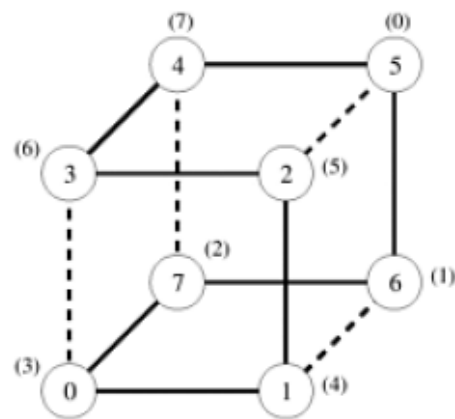


Second communication step of the 4-shift

(a) The first phase (a 4-shift)



(b) The second phase (a 1-shift)



(c) Final data distribution after the 5-shift

# Circular $q$ -shifts on an 8-node hypercube for $1 \leq q < 8$

