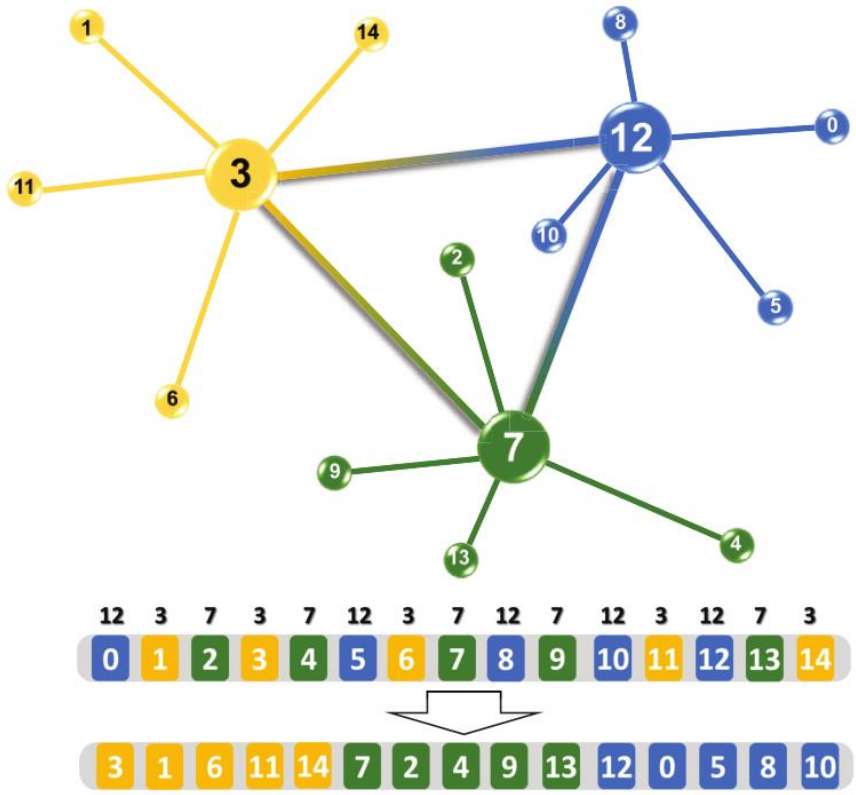
Similar to the linked-list, we **use a list of p hubs to represent chromosomes a**nd joins, as shown in Figure. A hub entry in the list is indexed by one of the spokes assigned to the hub. At the initial creation, the hubs are randomly assigned and the non-hubs also allocated randomly, as shown in Figure.



An illustration shows the chromosome encoding process. Suppose nodes 3, 7 and 12 are randomly selected as hub at initial stage, and the remaining nodes are randomly assigned to them.

Crossover: First randomly get the number of chromosome that needs to be crossed, and randomly select the chromosomes. Then, randomly get the number and the cross nodes which are hubs. Then, add them to each other. Finally, deal with the non-hubs that allocated to these cross nodes. If the non-hubs are repeated in one chromosome, then disconnect all of its original connections, and find the hub which is nearest to it ,and connect them.

Mutation: There are three ways of mutation, randomly select one way for each mutation. The specific instructions of the ways can refer to the code comments.