Figure 2A shows a local generalized phenotype network (LGPN), in which 1) both traits *Y*1 and *Y*2 have parent nodes and at least one of *Y*1 and *Y*2 has unique parent nodes; 2) each neighboring trait of *Y*1 is nonadjacent to at least one of the parent nodes of *Y*1, and the same is true of *Y*1.

***Theorem*** [Verma and Pearl, 1990]*: Two directed acyclic graphs (DAGs) are likelihood equivalent if and only if they have the same skeletons and the same v-structures (A v-structure in a DAG G is an ordered triple of nodes (X, Y, Z) such that G contains the directed edges X→Y and Z→Y, and X and Z are not adjacent in G).*

According to this theorem, we can deduce that given the directed edge pointing from *P*11 to *Y*1, the two candidate directions of the undirected edge between *C*11 and *Y*1 (i.e., *C*11*→Y*1 and *Y*1*→C*11) will form two nonequivalent structures: *P*11*→Y*1*←C*11 and *P*11*→Y*1*→C*11. The reason is quite straightforward: since *C*11 is nonadjacent to *P*11, *P*11*→Y*1*←C*11 is a v-structure whereas *P*11*→Y*1*→C*11 is not. The same is true if *P*11 is replaced by any other node {*P*11,…,*P*1k}{*P*1,…,*Ps*}, and, *C*11 is replaced by any other node {*C*11,…,*C*1*u*}{*C*1,…,*Ct*}.

Similarly, we can deduce that given the directed edge pointing from *P*21 to *Y*2, *P*21*→Y*2*←C*21 and *P*21*→Y*2*→C*21 are nonequivalent. And the same is true if *P*21 is replaced by any other node {*P*21,…,*P*2*l*}{*P*1,…,*Ps*}, and, *C*21 is replaced by any other node {*C*21,…,*C*2*v*}{*C*1,…,*Ct*}.

Lastly, let’s consider the orientation of the undirected edge between *Y*1 and *Y*2. We restrict ourselves to the cases where at least one of *Y*1 and *Y*2 has unique parent nodes (please note the unique parent nodes are not limited to QTLs, that is, traits that have been previously determined as parent nodes of *Y*1 and *Y*2 are also taken into account). In Figure 2A, *P*11 is a unique parent node of *Y*1, which indicates that *P*11 is nonadjacent to *Y*2. Therefore, we know that *P*11*→Y*1*←Y*2 and *P*11*→Y*1*→Y*2 are nonequivalent as the former forms a v-structure while the latter does not. The same is true if *P*11 is replaced by any other node {*P*11,…,*P*1k}.

Similarly, we have *P*21*→Y*2*←Y*1 and *P*21*→Y*2*→Y*1 are nonequivalent and the same is true if *P*21 is replaced by any other node {*P*21,…,*P*2*l*}.

In conclusion, if a LGPN satisfies the aforementioned two conditions and there are a total of *n* undirected edges involved in it, we know that each of the 2*n* candidate directed graphs possesses a distinct set of v-structures and is therefore not equivalent to the others.