**Data S1** The derivation of Colley’s rating

Let *ri* be the Colley’s rating.

First, the winning percentage based on Laplacian’s rule is defined by .

Since all teams begin with *rk*=1/2, then the number of times player *i* win can be written as

where *Oi* is the set of opponents of player *i*.

After substitute Wi,

Then, multiplying by Ni+2,

Next, is subtracted from both sides of equation to obtain,

Finally, *Cr=b* is obtained.