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Summary: In the Dayan Zongshu method, Qin Jiushao showed us two channels of reducing wenshus to dingshus. One is to join all the wenshus by twos and then find one by one the dingshus (greatest common divisors, GCDs) of those pairs. The other way is to find the zongdeng (GCD of all the wenshus) first, select one wenshu and keep it and make other wenshus divide the zongdeng to get quotients, then set up the selected wenshu and the quotients, join them by twos and find the dingshus of the different pairs. The fundamental principle seeking after the dingshu of a pair of wenshus is “yue ji fu yue ou”, where ji-ou (odd-even) indicates the amounts of the dingshus contained in the two wenshus, i.e., the quotients of the two wenshus and the dingshu. The principle points out that if the quotient of one wenshu and the dingshu is an odd number, then just reduce the wenshu by the dingshu. The purpose of the reduction is to make the two numbers (one wenshu in the pair and the quotient of another wenshu and the dingshu) be relatively prime. If the two numbers are not prime to each other, i.e., still with common factor, named xudeng by Qin Jiushao, the operation should be both reducing one number and multiplying the other by the xudeng. The above-mentioned reduction process will not stop until the two numbers are relatively prime and become dingshus. The ultimate result is not affected either by the order of the wenshus or by the sequence of the reduction. Qin Jiushao reached the same goal by different routes and left us a general algorithm.

MSC:
01A25 History of Chinese mathematics
11-03 History of number theory
11A05 Multiplicative structure; Euclidean algorithm; greatest common divisors

Keywords:
Dayan Zongshu method; wenshus; dingshus; odd-even; reduction

Biographic references:
Qin, Jiushao