

The silver coin and the silver grain, first part



How do we find the ‘grain mass’ from which silver coins, such as the rupee or dollar, are demarcated †? Picking up a handful of grains of wheat, it’s easy to observe that all the grains differ from each other, so to demarcate any mass in terms of ‘a grain’ might seem to lack accuracy. Does the procedure of ‘averaging’ solve the problem? Averaging involves ‘counting’ the ‘number’ of grains in the pile, comparing each grain’s mass to a ‘known’ grain’s mass. Calculating the ‘average’ mass of a grain from a pile involves having something *outside of the pile of grains* to compare each grain in the pile to in order to sum up the grains’ weights, dividing by the ‘number’ of them, to find the ‘average’ grain. Consequently ‘averaging’ isn’t a technically valid (scientific) process ‡.

Is there a better way to find the representative grain than by averaging? Is there a way of *not* trying to compare the grains *in* the pile to something *outside of* the pile in this manner? There is and it involves a pair of simple scales and the idea of the *median* grain with the grains placed in some kind of *order*.

Question (I)

Imagine you have grains A and B with a pair of scales. How do you place these grains in some order using the scales? How many ‘turns’ of the scale are needed?

Answer (I)

It might seem trivial but immediately we come across the problem of scale ‘calibration.’ The scale is in a certain ‘state’ before being used. It’s assumed that A and B are such that a recognisable ‘change’ in this ‘state’ can be surmised; however this may not be the case ‡. If A and B are such that a recognisable ‘change’ in this ‘state’ can be surmised, then the quantity of ‘turns’ of the scale to order the grains is ‘one turn.’

Question (II)

Imagine you have grains A, B, C, D, \dots with a pair of scales. How do you place these grains in some order using the scales? How many ‘turns’ of the scale are needed.

The answer(s) to question II will take into account the answer to question (I) and will be revealed at some stage. In the meantime, why not attempt it yourself?



† The rupee was demarcated as 178 grains and the dollar 371.25 grains of pure silver.

‡ Another way of viewing the technical invalidity of ‘averaging’ is by appreciating that ‘the average’ of a sample group may not be a member of that group: for example, ‘the average weight of an apple’ in a sample group of apples weighing 35g, 38g and 44g is 39g; however, there is no apple in the sample group that weighs 39g to supposedly represent the apples. This issue doesn’t occur with the idea of ‘median.’

‡‡ The ‘state’ of the scale *is not binary*; rather than describing a scale as being in ‘one of two states,’ a truer description would be that a scale moves from ‘one state’ to ‘another state.’ The misrepresentations of a scale being in ‘one of two states’ and ‘perfectly balanced’ has given rise to [the nonsense of] linear algebra.