

Solutions and hints

Step 4: The best way to find the lightest weight is to go through each object in turn, keeping track of the lightest one so far. That is, compare two objects, and keep the lighter one. Now compare that with another, keeping the lighter from the comparison. Repeat until all the objects have been used.

Step 5: Compare the weights on the balance scales. This can easily be done with three comparisons, and sometimes just two will suffice—if you realize that the comparison operator is transitive (that is, if A is lighter than B and B is lighter than C, then A must be lighter than C).

Experts:

Here is a short cut for adding up the number of comparisons that selection sort makes. To find the minimum of two objects you need one comparison, three needs two, four needs three, and so on. To sort eight objects using selection sort takes 7 comparisons to find the first one, six to find the next, five to find the next and so on.

That gives us:

$7 + 6 + 5 + 4 + 3 + 2 + 1 = 28$ comparisons.

n objects will take $1 + 2 + 3 + 4 + \dots + n - 1$ comparisons to sort.

Adding up these numbers is easy if we regroup them.

For example, to add up the numbers $1 + 2 + 3 + \dots + 20$, regroup them as

$(1 + 20) + (2 + 19) + (3 + 18) + (4 + 17) + (5 + 16) +$

$(6 + 15) + (7 + 14) + (8 + 13) + (9 + 12) + (10 + 11)$

$= 21 \times 10$

$= 210$

In general, the sum $1 + 2 + 3 + 4 \dots + n - 1 = n(n - 1)/2$.