

Solution to the 12 balls Problem

Key:

$A1\ A2 \vee B1\ B2$ means weigh A1 and A2 against B1 and B2.

$A1 > B1$ means A1 is heavier than B1, ie the scales go down on the side of A1.

$A1 = B1$ means A1 and B1 weigh the same, ie the scales stay level.

H1
H means H1 is the odd ball and is heavier than the others.

C1
L means C1 is the odd ball and is lighter than the others.

Divide the 12 balls into 3 groups of 4. Call them A1, A2, A3, A4; B1, B2, B3, B4; and C1, C2, C3, C4.

Weighing One:

$A1\ A2\ A3\ A4 \vee B1\ B2\ B3\ B4$

One side is heavier than the other.

Both sides are equal.

Rename the balls on the heavier side H1 H2 H3 H4.
Rename the balls on the lighter side L1 L2 L3 L4.

Weighing Two:

$H1\ H2\ L1 \vee H3\ H4\ L2$

$C1\ C2\ C3 \vee A1\ A2\ A3$

$H1\ H2\ L1 > H3\ H4\ L2$

$H1\ H2\ L1 = H3\ H4\ L2$

$H1\ H2\ L1 < H3\ H4\ L2$

$C1\ C2\ C3 > A1\ A2\ A3$

$C1\ C2\ C3 = A1\ A2\ A3$

$C1\ C2\ C3 < A1\ A2\ A3$

$H1 \vee H2$

$L3 \vee L4$

$H3 \vee H4$

$C1 \vee C2$

$C4 \vee A4$

$C1 \vee C2$

$H1 > H2$

$H1 = H2$

$H1 < H2$

$L3 > L4$

$L3 < L4$

$H3 > H4$

$H3 = H4$

$H3 < H4$

$C1 > C2$

$C1 = C2$

$C1 < C2$

$C4 > A4$

$C4 < A4$

$C1 > C2$

$C1 = C2$

$C1 < C2$

H1
H

L2
L

H2
H

L4
L

L3
L

H3
H

L1
L

H4
H

C1
H

C3
H

C2
H

C4
H

C4
L

C2
L

C3
L

C1
L

Weighing Three:

Conclusion: