The 13 balls weighing problem Solution

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Divide them up into 2 groups of 4 and one group of 5 and weigh the two 4 ball groups against each other.

Case 1: The scales balance -- All balls on the scale are normal, and the group not on the scale contains the odd ball. Leave two of these balls aside and weigh the other three against three normal balls.

Case **1.1**: The scales balance. One of the 2 balls left aside is the odd ball. Take one of these and weigh it against one of the normal balls.

Case **1.1.1**: If the scales balance the one left is the odd ball, you do not know whether or not it is heavy or light.

Case **1.1.2**: If the scales don't balance you also know the odd ball, but also know if it's heave or light.

Case **1.2**: The scales don't balance. The odd ball is in the group of three being weighed against the normal balls, and its being light or heavy is indicated by whether the group is lighter or heavier than the normal group. Weigh any two of these three against each other to determine which ball it is.

Case **2**: The scales don't balance -- one of the two groups of on the scale contains the odd ball, either a havy ball on the side that is down, or a light ball on the side that is up. Remove two balls from the heavy group and one ball from the light group, replacing them with normal balls. Also switch a ball from the heavy side with a ball from the light side.

Case **2.1**: The scales balance. The group of three balls removed from the scale contain the odd ball. Weigh the two from the heavy side against each other. If the scales balance, the third ball is the odd ball and it's light. If the scales don't balance, the odd ball is the heavier ball on the balance and it's heavy.

Case **2.2**: The scales don't balance and the heavy side stays the same. Either the single ball remaining on the heavy side from the previous weighing is heavy, or the two balls remaining in the right pan from the previous weighings are light. Determine which is which by weighing the two light balls against each other.

Case **2.3**: The scales don't balance and the heavy side changes. One of the two switched balls is the odd ball. Determine which it is and whether it is heavy or light by weighing the ball from the now heavy side against a normal ball.

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