

### Q1. Fake coin

For simplicity 1 refers to the first coin. 2 refers to the second coin...

#### 1. Compare (1, 2, 3, 4) with (5, 6, 7, 8)

This step splits the configuration space into 2 spaces with 8 and 4 coins.

If A is lighter than B or B is lighter than A then the fake coin is in 1-8.

If A is equal to B then the fake coin is potentially in 9-12.

#### 2. If (1, 2, 3, 4) and (5, 6, 7, 8) are equal, Compare (1, 2, 3) with (9, 10, 11).

This step splits the configuration space into the suspect coin being in 9-11 or 12.

If A and B are unequal then the fake coin is in 9-11.

If A and B are equal then the fake coin is potentially 12.

#### 3. If (1, 2, 3) and (9, 10, 11) are equal, Compare (1) with (12).

This step splits the configuration space into 3 sections, 12 being the fake coin and being heavier. 12 being the fake coin and being lighter, or no fake coin.

If A is lighter than B then 12 is the fake coin and it is heavier. DONE.

If B is lighter than A then 12 is the fake coin and it is lighter. DONE.

If A and B are equal, there are no fake coins. DONE.

#### 4. If (1, 2, 3) was lighter than (9, 10, 11), Compare (9) with (10).

This step splits the configuration space into 3 sections with 9, 10, or 11 being the fake coin and being heavier.

If A is lighter than B then 10 is the fake coin and it is heavier. DONE.

If B is lighter than A then 9 is the fake coin and it is heavier. DONE.

If A and B are equal, then 11 is the fake coin and it is heavier. DONE.

#### 5. If (9, 10, 11) was lighter than (1, 2, 3), Compare (9) with (10).

This step splits the configuration space into 3 sections with 9, 10, or 11 being the fake coin and being lighter.

If A is lighter than B then 9 is the fake coin and it is lighter. DONE.

If B is lighter than A then 10 is the fake coin and it is lighter. DONE.

If A and B are equal, then 11 is the fake coin and it is lighter. DONE.

#### 6. If (1, 2, 3, 4) was lighter than (5, 6, 7, 8), Compare (5, 6, 1) with (7, 8, 2).

This step splits the configuration space into 3 spaces.

If A is lighter than B then the fake coin is 1 and it is lighter or 7 and it is heavier or 8 and it is heavier.

If B is lighter than A then the fake coin is 2 and it is lighter or 5 and it is heavier or 6 and it is heavier.

If A and B are equal, the fake coin is 3 or 4 and it is lighter.

#### 7. If (5, 6, 1) and (7, 8, 2) are equal, Compare (3) with (4).

This step splits the configuration space into two sections with 3 being the fake coin and being lighter or 4 being the fake coin and being lighter.

If A is lighter than B then 3 is the fake coin and it is lighter. DONE.

If B is lighter than A then 4 is the fake coin and it is lighter. DONE.

8. If (5, 6, 1) was lighter than (7, 8, 2), Compare (7) with (8).  
This step splits the configuration space into three sections.  
If A is lighter than B then 8 is the fake coin and it is heavier. DONE.  
If B is lighter than A then 7 is the fake coin and it is heavier. DONE.  
If A and B are equal, the fake coin is 1 and it is lighter. DONE.
9. If (7, 8, 2) was lighter than (5, 6, 1), Compare (5) with (6).  
This step splits the configuration space into three sections.  
If A is lighter than B then 6 is the fake coin and it is heavier. DONE.  
If B is lighter than A then 5 is the fake coin and it is heavier. DONE.  
If A and B are equal, the fake coin is 2 and it is lighter. DONE.
10. If (5, 6, 7, 8) was lighter than (1, 2, 3, 4), Compare (1, 2, 5) with (3, 4, 6).  
This step splits the configuration space into 3 spaces.  
If A is lighter than B then the fake coin is 5 and it is lighter or 3 and it is heavier or 4 and it is heavier.  
If B is lighter than A then the fake coin is 6 and it is lighter or 1 and it is heavier or 2 and it is heavier.  
If A and B are equal, the fake coin is 7 or 8 and it is lighter.
11. If (1, 2, 5) and (3, 4, 6) are equal, Compare (7) with (8).  
This step splits the configuration space into two sections with 7 being the fake coin and being lighter or 8 being the fake coin and being lighter.  
If A is lighter than B then 7 is the fake coin and it is lighter. DONE.  
If B is lighter than A then 8 is the fake coin and it is lighter. DONE.
12. If (1, 2, 5) was lighter than (3, 4, 6), Compare (3) with (4).  
This step splits the configuration space into three sections.  
If A is lighter than B then 4 is the fake coin and it is heavier. DONE.  
If B is lighter than A then 3 is the fake coin and it is heavier. DONE.  
If A and B are equal, the fake coin is 5 and it is lighter. DONE.
13. If (3, 4, 6) was lighter than (1, 2, 5), Compare (1) with (2).  
This step splits the configuration space into three sections.  
If A is lighter than B then 2 is the fake coin and it is heavier. DONE.  
If B is lighter than A then 1 is the fake coin and it is heavier. DONE.  
If A and B are equal, the fake coin is 6 and it is lighter. DONE.