

Mastermind.

- ❑ Mastermind is a game between a *code-maker*, and a *code-breaker*. The code-maker chooses a pattern of four colours. Duplicates are allowed, so the player could even choose four code pegs of the same colour. The chosen pattern is visible to the code-maker but not to the code-breaker.
- ❑ The code-breaker tries to guess the pattern, in both order and colour.
- ❑ Each guess is made by placing a row of code pegs on the decoding board. Once placed, the code-maker provides feedback by placing from zero to four key pegs in a separate space alongside the guess. A black key peg is placed for each colour guessed correctly and in the right position. A white peg indicates the existence of a correct colour placed in the wrong position.
- ❑ Play it [here](#)

In each of the following examples, you made your first guess as a code-breaker and received feedback from the code-maker.

If your next guess takes thoroughly into account the information received so far, what are your chances that this second trial will be successful?

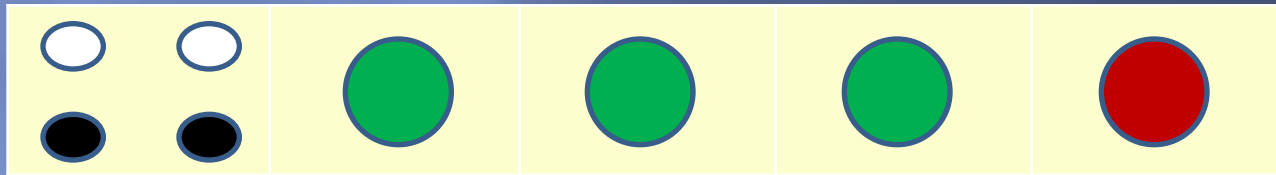


Trice, the code-maker has cheated by giving hints which are impossible. Can you spot when this happens?

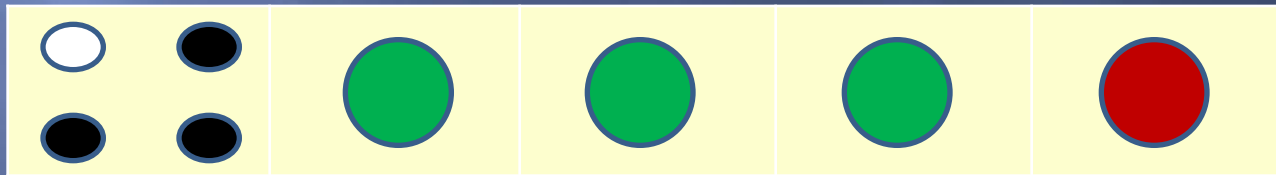
Warm up

Two colours are in the right place, while two are not.

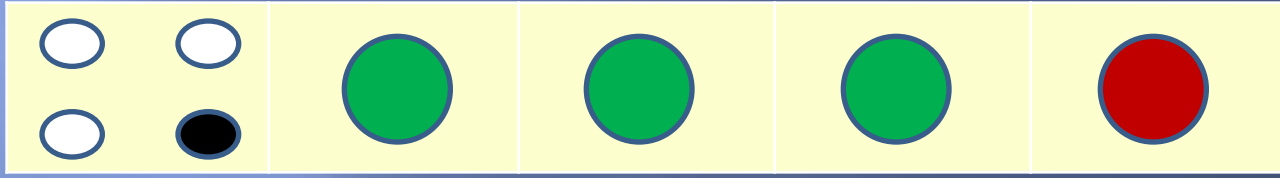
1



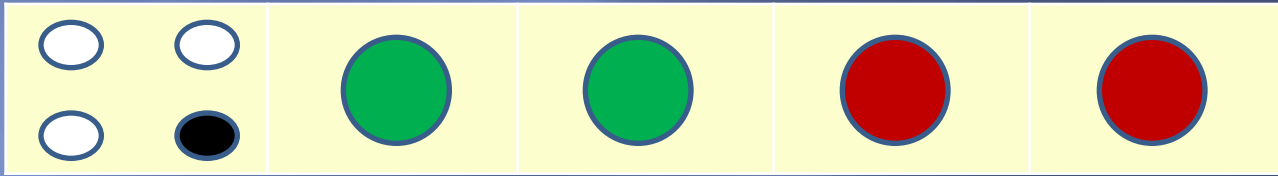
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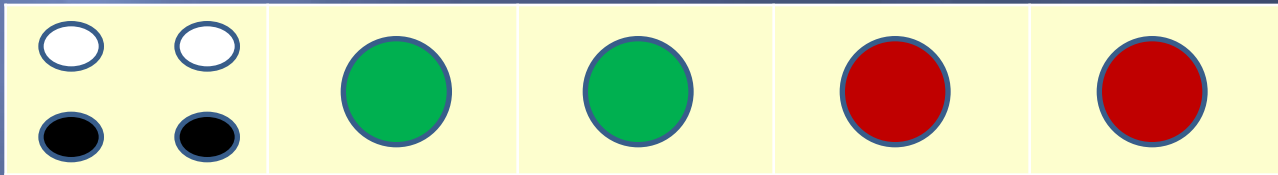
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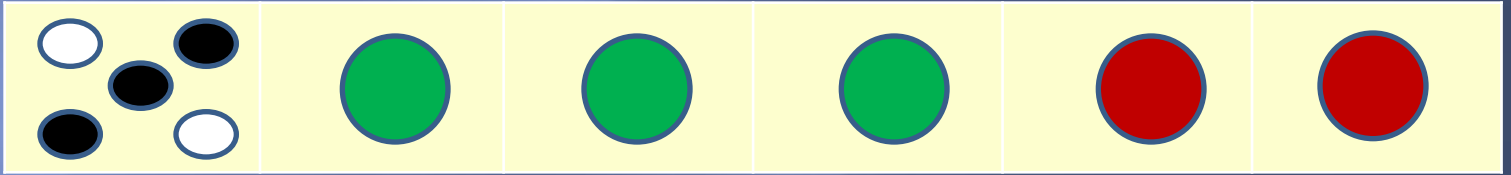
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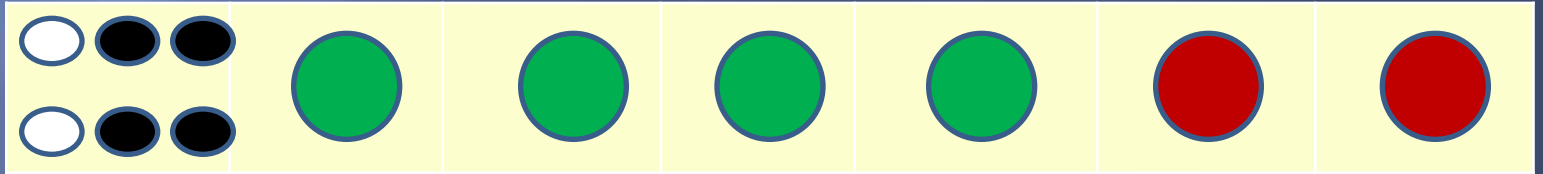
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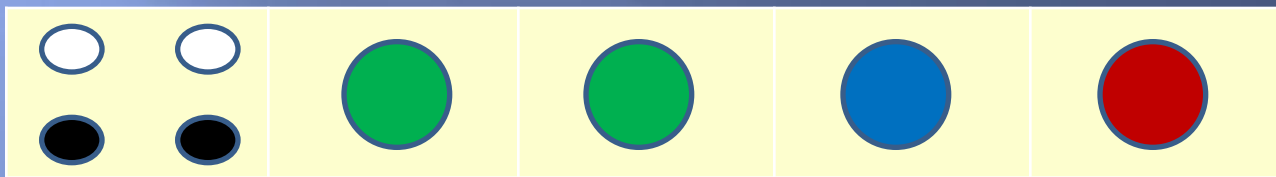
Arrangements

You are now the code-maker. There are 6 colours available. How many codes can you make:

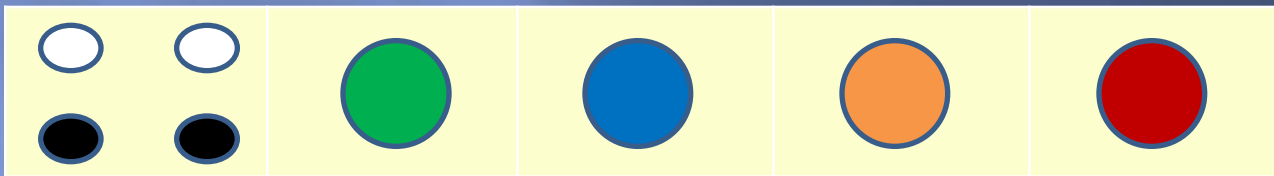
- 9) In a game with 3 slots, if you don't repeat any colour.
- 10) In a game with 4 slots, if you don't repeat any colour.
- 11) In a game with 5 slots, if you don't repeat any colour.

Combinations

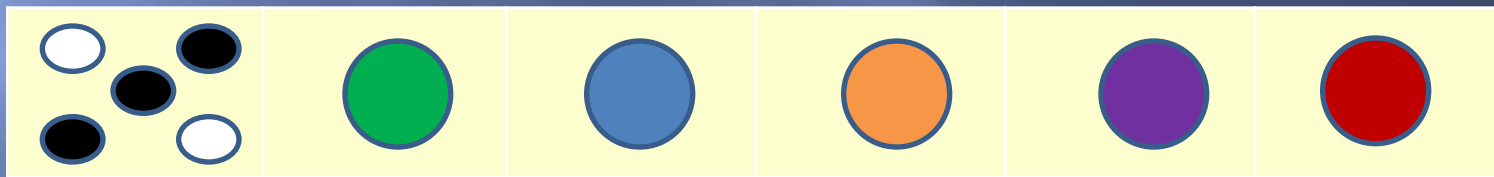
12



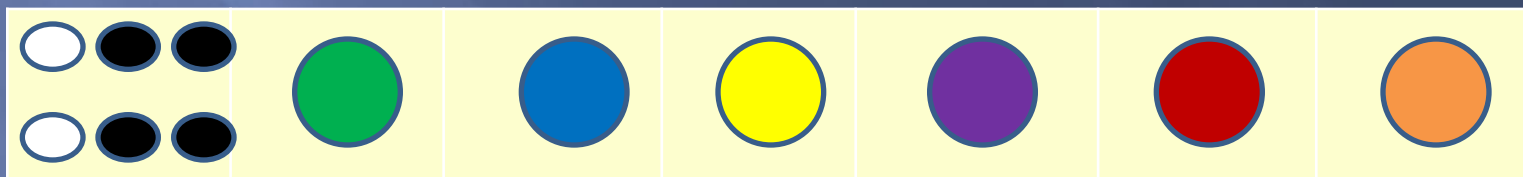
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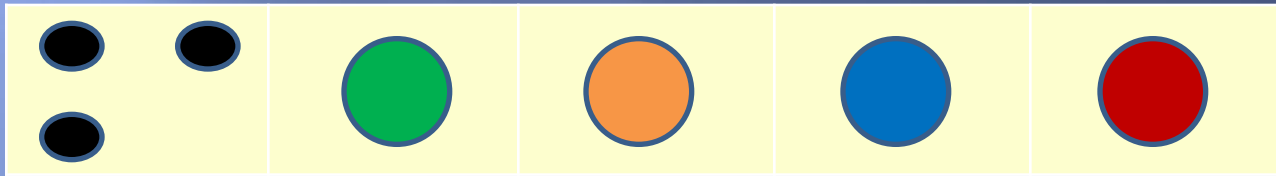


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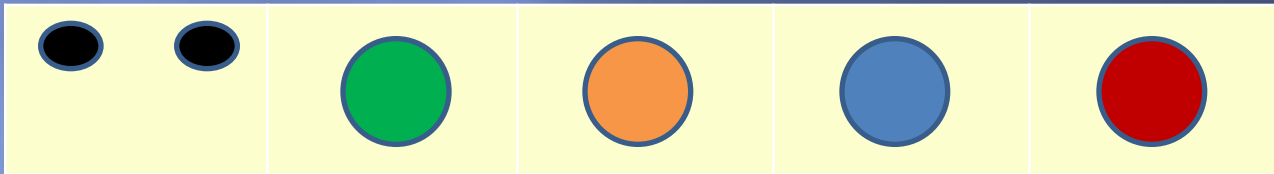


All games have 6 colour choices.

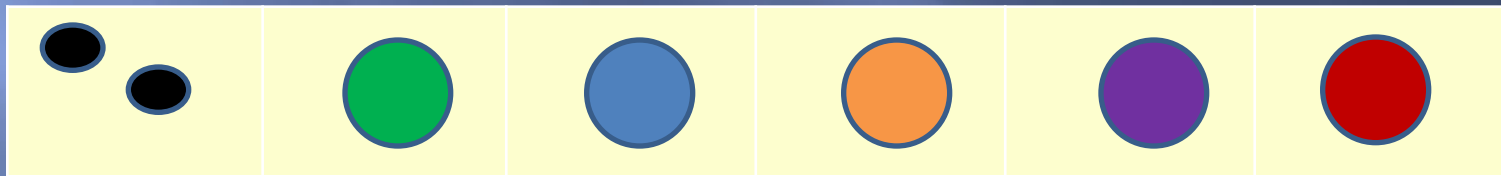
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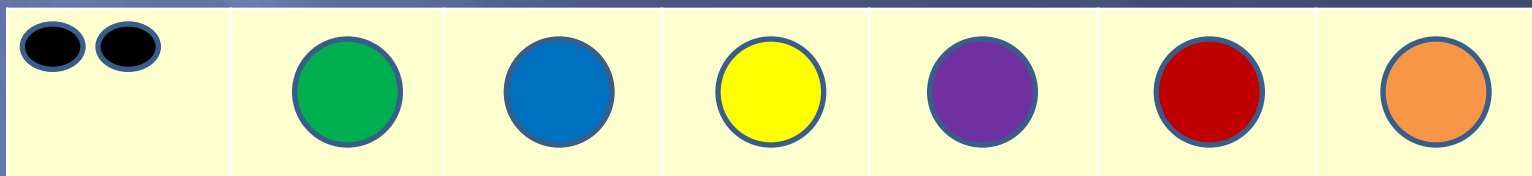
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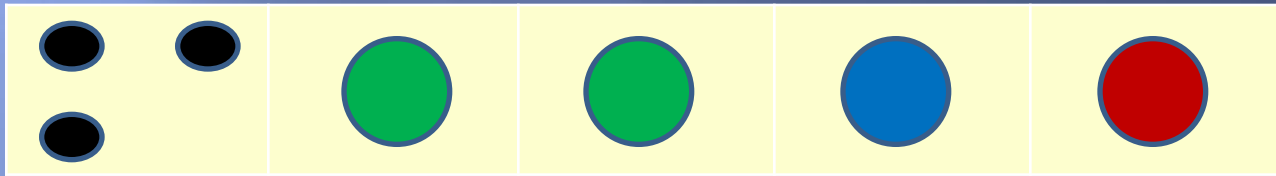


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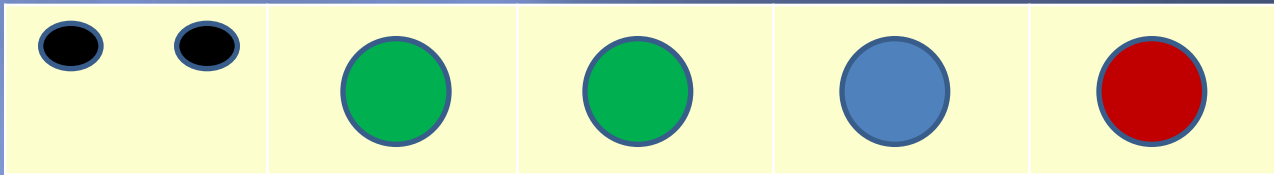


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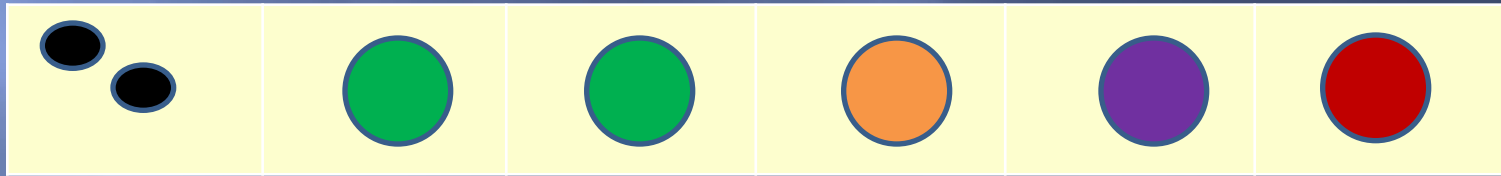
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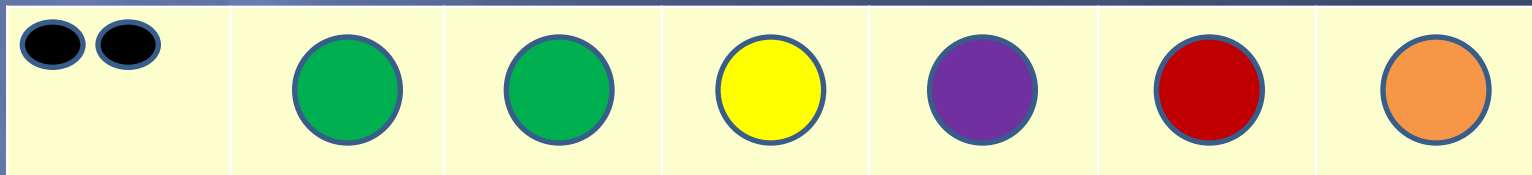
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Products, Combinations

You are now the code-maker. There are 6 colours available. How many codes can you make:

24) In a game with 4 slots.

25) In a game with 5 slots if not all colours are the same.

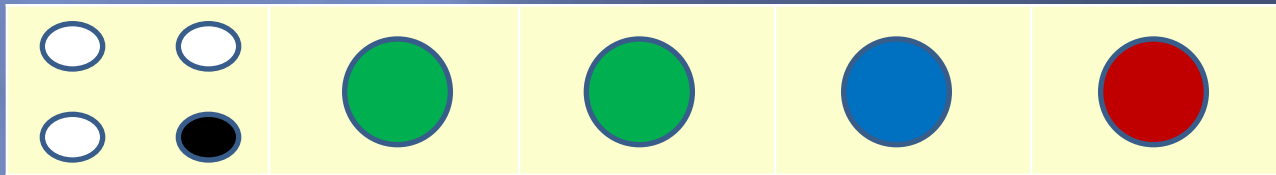
26) In a game with 4 slots, if you wish your code to be made of exactly 2 out of the 6 colours.

27) In a game with 5 slots, if you wish your code to be made of exactly 2 out of the 6 colours.

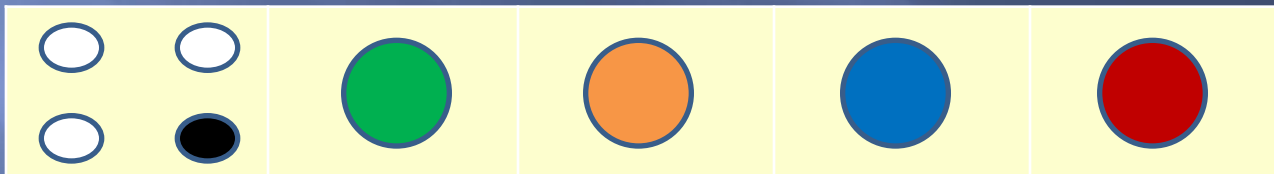
Derrangements

You are code-breaker again. Count your chances of success in 1 move.

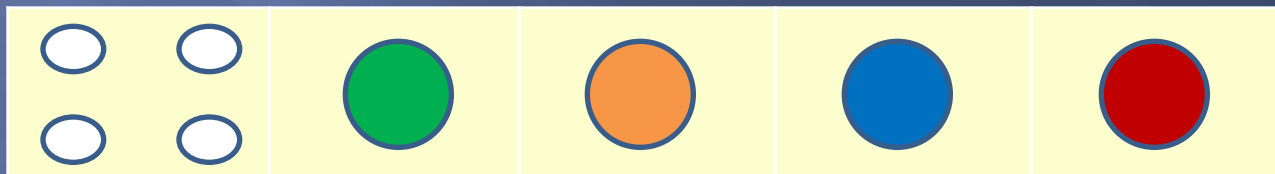
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Trivia?

- In 1977, the mathematician Donald Knuth, the father of the study of computer algorithms, demonstrated that the code-breaker can solve the pattern in five moves or less, using an algorithm that progressively reduced the number of possible patterns.



Links

- ▣ History and development of maths circles in the US:
<http://minerva.msri.org/files/circleinabox.pdf>
- ▣ Wikipedia entry on Mastermind:
[http://en.wikipedia.org/wiki/Mastermind_\(board_game\)](http://en.wikipedia.org/wiki/Mastermind_(board_game))
- ▣ Mathworld entry on Mastermind with additional links:
<http://mathworld.wolfram.com/Mastermind.html>
- ▣ UCC Enrichment information (Senior Cycle Students):
<http://euclid.ucc.ie/pages/MATHENR/index.html>