Mastermind is a two-player game consisting of a codemaker and a codebreaker. The codemaker secretly selects a code consisting of an ordered sequence of four colors (c_1, c_2, c_3, c_4), each chosen from a set $\{A, B, C, D, E, F\}$ of six possible colors, with repetitions allowed. The codebreaker then tries to guess the code by repeatedly proposing a sequence of colors. After each guess, the codemaker tells the codebreaker two numbers: the number of correct colors in the correct positions b and the number of colors in that are part of the code but not in the correct positions m. For example, if the code is (A, B, C, C) and the codebreaker's guess is (B, C, D, C), then the codemaker's response would be $(1, 2)$, since the codebreaker has guessed the second C and correctly and in the correct position, while having guessed the B and the first C correctly, but in the wrong position.

The codebreaker continues guessing until he guesses the code correctly or until he reaches a maximum allowable number of guesses without having correctly identified the secret code. See `http://mathworld.wolfram.com/Mastermind.html`

1. Find the code for the sequence given.

Guess number	Guess	b	m
1	AABB	0	0
2	CCDE	1	3
3	DCAC	0	3

Solution: CECD.

2. Find the code for the sequence given.

Guess number	Guess	b	m
1	AABB	0	1
2	BCDD	0	2
3	CBCE	1	2
4	EFCB	1	3

Solution: EBFC.

3. Consider the sequence given.

Guess number	Guess	b	m
1	AABB	0	1
2	BCDD	0	0
3	EEAE	1	2

What are the two possible codes?

Solution: FEEA and EFEA.

The next two problems are due to Brendan Fletcher.

4. Find the code for the sequence given.

Guess number	Guess	b	m
1	$AABB$	0	1
2	$BCDD$	0	2
3	$CBCE$	1	2
4	$EFCB$	2	2

Solution: We know from guess 4 that B, C, E, and F are the correct colors. We know from guess 1 that B is not in the 3rd or 4th positions, and from guess 2 that B cannot be in the first position. Therefore, B is in the 2nd position, so $\_B\_\ \_$. Since in guess 3 ($CBCE$) $b = 1$ and $m = 2$, the '$b = 1$' corresponds to the B. Therefore, both C's are in the wrong place. In other words, C is not in the 1st or 3rd positions. But B is in the 2nd position, so $\_B\_C$, which leaves only two answers: $EBFC$ and $FBEC$. But guess 4 is $EBFC$, which is not the answer. Therefore, $FBEC$.

5. Find the code for the sequence given.

Guess number	Guess	b	m
1	$AABB$	0	2
2	$BCDD$	0	1
3	$CBCE$	1	0
4	$EFCB$	3	0

Solution: According to guess 4, three of the colors A, A, C, and F are correct. Any way you combine three of those colors, there is an A, so there is at least one A in the code. There is only one correct color in guess 3 ($EBAE$), which must be A, so there are no B's or E's in the code. There are only two correct colors in $AABB$, but there are no B's, so there must be two A's in the code. That means $\_\ \_AA$. Suppose C was in the code. There is only one correct color in $BCDD$, which would be C. Therefore, there would be no B's or D's, which would leave only F to put in the blank of C_AA, since there are no E's. But $CFAA$ is guess 4, which is not correct. So C is not in the code, and $\_FAA$. There are no B's or C's, so according to guess 2, D is in the code. Therefore, $DFAA$.

6. Find the code for the sequence given.

Guess number	Guess	b	m
1	$BBCC$	1	0
2	$ADDB$	0	1
3	$CEFE$	0	2
4	$FBEC$	3	0

Solution: Which three colors are right in guess 4? It can't be B, C, E because of guess 1. It can't be B, C, F because of guess 1. It can't be C, E, F because of guess 2. So it must be B, E, F. What can be the fourth color? We'll try each combination B, E, F, x where x is one of the six colors. What about A, B, E, F? No, because of guess 2; what about B, B, E, F? No, because of guess 1; what about C, B, E, F? No, because of guess 3; what about D, B, E, F? No, because of guess 2; what about E, B, E, F? No, because of guess 3. So the set must be F, B, E, F. And the order must be $FBEF$.