

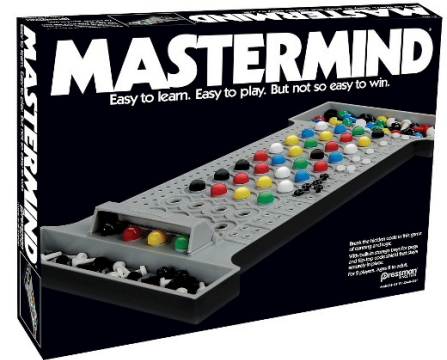
# MasterMind

**Objective:** To use iteration and conditional statements to create a game.

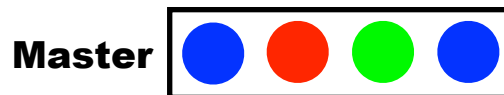
## Background:

MasterMind is a popular logic game that claims it is “easy to learn, easy to play, but not so easy to win.” It requires a bit of puzzle solving, deductive reasoning, and some luck.

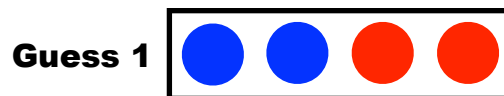
The game involves two players, a board, and pegs of six different colors. One person is designated the “code-maker” and the other the “code-breaker”. The code-maker *secretly* chooses a pattern of four pegs in which some or all can be duplicate colors, then places the pegs into an ordered row that is hidden from view. The code-breaker has up to ten guesses to determine the code and win; otherwise, the code-maker wins.



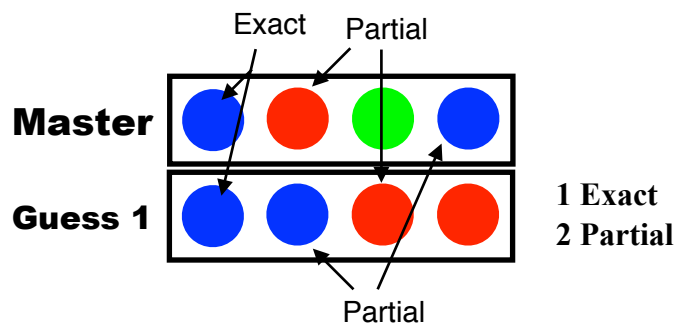
Suppose the code-maker creates a secret code of *blue-red-green-blue* in that order. This is called the “Master” code:



The code-breaker has no clues at this point, so must make a guess. Suppose she guesses *blue-blue-red-red* in that order:



By comparing the two codes, we can see that two blue pegs and one red peg from the “Guess 1” code match two blue pegs and one red peg in the “Master” code. One blue peg from Guess 1 matches the position of a blue peg in the Master so this is called an “exact” match (see below). The other blue peg and red peg in Guess 1 are in the wrong positions so they are called “partial” matches. The final red in Guess 1 does not match the green in the Master.



The code-master reports “1 Exact, 2 Partial” and places it next to “Guess 1”. This is helpful to the code-breaker because it means three of the four Guess 1 pegs are the right color and one of them is in the correct position. The code-breaker uses this information to make the next guess.

In our game, the computer will be the code-maker and the user will be the code-breaker. We will use pegs labeled **A** through **F** instead of colors.

**Discussion:**

This assignment uses four different classes: **MasterMind**, **PegArray**, **Peg**, and **Prompt**. You will be given the first three classes and you must supply the **Prompt** class. It is best to become familiar with each class before starting the assignment.

**MasterMind:** The main method that will contain the rules about playing the game and plays the game. The initial file comes with methods to print out the introduction and the peg board. **You will create the other methods.**

**PegArray:** A class definition of an array of pegs. It is used to represent the master code or a guess code. The initial file comes with the **Peg** array, the **getPeg()** accessor method, and fields for the number of partial and exact matches compared to the Master. It also contains signatures for **getExactMatches()** and **getPartialMatches()** that **you will implement.**

**Peg:** This class contains a field for the peg's letter and all the methods needed for the game. Use methods from this class but **do not change the class definition.**

The initial peg board looks like this:

MASTER	***	***	***	***	Exact	Partial
GUESS						
1					0	0
2					0	0
3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Notice the Master code is hidden and the 10 guesses are empty. When the game concludes, either through breaking the code or losing, the Master code is revealed like below:

MASTER	C	D	A	A	Exact	Partial
GUESS						
1	A	A	A	A	2	0
2	A	A	B	B	0	2
3	C	C	A	A	3	0
4	C	D	A	A	4	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Mr Greenstein will also supply a fully functioning game in a **MasterMind.jar** file so you can play the game and get a sense of what your game should look and act like. You should run his program and your program in side-by-side terminal windows to see how they compare. The command is:

```
java -cp MasterMind.jar MasterMind
```

### Assignment:

Download the **MasterMind.zip** file from Mr Greenstein's web site and unzip. It will create the directory "**MasterMind**" and all the classes mentioned above. You are to do all of your work in the **MasterMind** directory.

1) Edit **MasterMind.java** and write the following.

1a) Create a constructor and main method.

1b) Create a method to generate a Master code **PegArray**. You can use your **Dice** class to generate random numbers 1 through 6 to represent the letters A through F for the Master code.

1c) Create a method to accept user input of a code using letters A through F. The method allows lowercase, uppercase, or mixed case input. If the input is not exactly four characters long or is contains a letter not A through F, then it asks the user again for input. Example:

```
Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> a
ERROR: Bad input, try again.
Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> aaax
ERROR: Bad input, try again.
Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> aaAc
```

1d) Create a method that plays one turn or guess.

1e) Create a method that plays the game.

2) Edit **PegArray.java** and write the following.

2a) Create the constructor which declares the array of **Pegs** and initializes each one.

2b) Create the methods **getExactMatches()** and **getPartialMatches()**. Each returns the number of exact and partial matches. You may create helper methods, but they should be designated **private**.

## A sample run:

```
% java MasterMind
```

```
+-----+
|                                               |
|  _____   _____   _____   _____  |
|  . | . |   / | \ | / | \ | / | \ | / | \ | / | \ |   | | |
|  | | | |   ( | \ | / | \ | / | \ | / | \ | / | \ |   |
|  \ | / | \ | / | \ | / | \ | / | \ | / | \ | / | \ |   |
|  _____   _____   _____   _____  |
|                                               |
| WELCOME TO MONTA VISTA MASTERMIND!           |
|                                               |
| The game of MasterMind is played on a four-peg  |
| gameboard, and six peg letters can be used.    |
| First, the computer will choose a random      |
| combination of four pegs, using some of the   |
| six letters (A, B, C, D, E, and F). Repeats  |
| are allowed, so there are  $6 * 6 * 6 * 6 = 1296$  |
| possible combinations. This "master code" is |
| then hidden from the player, and the player   |
| starts making guesses at the master code. The |
| player has 10 turns to guess the code. Each  |
| time the player makes a guess for the 4-peg  |
| code, the number of exact matches and        |
| partial matches are then reported back to    |
| the user. If the player finds the exact code,|
| the game ends with a win. If the player does |
| not find the master code after 10 guesses,   |
| the game ends with a loss.                  |
|                                               |
| LET'S PLAY SOME MASTERMIND!                 |
+-----+
```

Hit the Enter key to start the game ->

MASTER	***	***	***	***	Exact	Partial
GUESS						
1					0	0
2					0	0
3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 1

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> ab  
ERROR: Bad input, try again.

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> abxd  
ERROR: Bad input, try again.

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> abcd

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2					0	0

3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 2

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> EAbd

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 3

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> cABd

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3	C	A	B	D	2	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 4

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> ceed

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3	C	A	B	D	2	0
4	C	E	E	D	1	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 5

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> cfad

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3	C	A	B	D	2	0
4	C	E	E	D	1	0
5	C	F	A	D	1	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 6

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> cdbd

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3	C	A	B	D	2	0
4	C	E	E	D	1	0

5	C	F	A	D	1	0
6	C	D	B	D	2	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 7

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> bdad

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3	C	A	B	D	2	0
4	C	E	E	D	1	0
5	C	F	A	D	1	0
6	C	D	B	D	2	0
7	B	D	A	D	0	1
8					0	0
9					0	0
10					0	0

Guess 8

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> cabe

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	B	C	D	1	1
2	E	A	B	D	1	0
3	C	A	B	D	2	0
4	C	E	E	D	1	0
5	C	F	A	D	1	0
6	C	D	B	D	2	0
7	B	D	A	D	0	1
8	C	A	B	E	2	0
9					0	0
10					0	0

Guess 9

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> cfbe





```

| WELCOME TO MONTA VISTA MASTERMIND!
|
| The game of MasterMind is played on a four-peg gameboard, and six peg letters can
| be used. First, the computer will choose a random combination of four pegs, using
| some of the six letters (A, B, C, D, E, and F). Repeats are allowed, so there are
| 6 * 6 * 6 * 6 = 1296 possible combinations. This "master code" is then hidden
| from the player, and the player starts making guesses at the master code. The
| player has 10 turns to guess the code. Each time the player makes a guess for
| the 4-peg code, the number of exact matches and partial matches are then reported
| back to the user. If the player finds the exact code, the game ends with a win.
| If the player does not find the master code after 10 guesses, the game ends with
| a loss.
|
| LET'S PLAY SOME MASTERMIND!
+-----+

```

Hit the Enter key to start the game ->

MASTER	***	***	***	***	Exact	Partial
GUESS						
1					0	0
2					0	0
3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 1

```

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> a
ERROR: Bad input, try again.
Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> aaax
ERROR: Bad input, try again.
Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> aaaa

```

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	A	A	A	1	0
2					0	0
3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0

10					0	0
----	--	--	--	--	---	---

Guess 2

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> aabb

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	A	A	A	1	0
2	A	A	B	B	2	0
3					0	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 3

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> acbc

MASTER	***	***	***	***	Exact	Partial
GUESS						
1	A	A	A	A	1	0
2	A	A	B	B	2	0
3	A	C	B	C	3	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Guess 4

Enter the code using (A,B,C,D,E,F). For example, ABCD or abcd from left-to-right -> acbd

MASTER	A	C	B	D	Exact	Partial
GUESS						
1	A	A	A	A	1	0
2	A	A	B	B	2	0
3	A	C	B	C	3	0

	A	C	B	D	4	0
4					0	0
5					0	0
6					0	0
7					0	0
8					0	0
9					0	0
10					0	0

Nice work! You found the master code in 4 guesses.