

Decode the Dragon's Vault

Player's Guide

The classic Mastermind code-breaking game
with 3D gem pegs, AI opponents, and 2-Player pass-and-play

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Introduction

Decode the Dragon's Vault is a stylized digital version of the classic Mastermind code-breaking game. One player devises a secret sequence of colored gem pegs, and the other attempts to deduce it through logical guessing and process of elimination. The game supports three modes: a solo challenge against an AI codemaker, a solo challenge against an AI codebreaker, and a two-player pass-and-play mode.

The app runs entirely in your browser, requires no downloads (optional PWA install available), and tracks your personal statistics across sessions.

Game Setup

Before starting a game, configure the four options in the setup panel:

Option	Choices	Description
Code Size	4 / 5 / 6 holes	Sets the number of positions in the secret code. More holes = harder.
Colors	6 or 8 colors	Sets how many gem colors are available. More colors = more combinations.
AI Difficulty	Standard / Genius	Controls how the AI breaks codes. Genius mode uses Knuth's optimal algorithm.
Scoring Mode	Auto / Manual	In Auto mode the computer scores each guess. In Manual mode you provide the feedback pegs yourself.

Choosing a Role

After configuring the game, select one of three roles and press Start:

- **Codemaker:** You create the secret code. The AI tries to break it. Best for testing your code-setting creativity.
- **Codebreaker:** The AI creates the code and you try to crack it. Statistics are tracked only in this mode.
- **2-Player:** Pass-and-play head-to-head. Player 1 sets the secret code on-screen, then hands the device to Player 2 to crack it.

Playing as Codebreaker

This is the primary solo mode. The AI generates a hidden code, and you have 10 attempts to identify it.

Making a Guess

- **Select a color:** Click any gem in the color palette. It will highlight it with a blue ring.
- **Place the gem:** Click an empty peg slot in the current guess row to place your selected color. You can overwrite a slot at any time.
- **Submit your guess:** Once all slots are filled, click Submit Guess. The row locks in and feedback pegs appear.
- **Clear a row:** Click Clear to empty the current guess row and start that guess over.

Reading Feedback

After each guess a set of feedback pegs appears to the right of the row:

- ⬤ **Black peg:** Correct color in the correct position.
- ◯ **White peg:** Correct color but in the wrong position.
- **(no peg):** That color does not appear in the code at all.

Example: secret code is Red · Blue · Green · Yellow, guess is Red · Yellow · Blue · Purple:

  - **1 Black:** Red is correct and in position 1.
  - **2 White:** Blue and Yellow are in the code but in wrong positions.
  - **0 for Purple:** Purple is not in the code.

Winning and Losing

- Guess the exact code (all Black pegs) within 10 attempts to win.
- If you exhaust all 10 attempts without a perfect match, the code is revealed.
- Your result time, attempt count, and best score are saved to Statistics.

Playing as Codemaker

You design the secret code and the AI opponent tries to break it within 10 attempts.

Setting Your Code

- Select colors from the palette and click each slot in the secret-code row at the top.
- All slots must be filled. Click Confirm Code when ready.
- Your confirmed code remains visible at the top of the board for reference throughout the game.

Automatic Scoring Mode

The game scores each AI guess automatically. You simply watch the AI work through the possibilities. The AI announces its guess, the score is computed, and it continues until it cracks the code or runs out of attempts.

Manual Scoring Mode

In Manual mode you act as the referee and provide feedback for each AI guess yourself:

- **B counter:** Tap + or − to set how many Black pegs (correct color, correct position) the AI earned.
- **W counter:** Tap + or − to set how many White pegs (correct color, wrong position) the AI earned.
- ✓ **Confirm:** Press the check button to submit your feedback and let the AI continue.

⚠ The game validates your feedback against all prior responses. If your scoring is logically inconsistent, meaning no possible code could produce all the feedback you have given, the game will alert you and ask you to re-enter the score. This prevents accidental errors.

2-Player Mode

Pass-and-play Mastermind for two people sharing one device.

- **Step 1:** Player 1 selects 2-Player, configures the game, and presses Start.

- **Step 2:** Player 1 secretly builds the code on the color palette and presses Confirm Code. The board is hidden.
- **Step 3:** A "Pass to Player 2" screen appears. Player 1 hands the device to Player 2 and presses Ready.
- **Step 4:** Player 2 now sees the empty board and has 10 attempts to crack the hidden code, exactly like the solo Codebreaker mode.
- **Result:** A modal announces whether Player 2 cracked the code and in how many attempts.

Note: Statistics are not tracked in 2-Player mode.

AI Difficulty

Standard Mode

The Standard AI uses constraint-based random search. Its first guess uses a diverse spread of colors to gather maximum information. Each subsequent guess is chosen at random from the pool of codes still consistent with all previous feedback. This is an efficient, human-like approach that usually solves the code well within 10 attempts.

Genius Mode

Genius mode implements Donald Knuth's 1977 minimax algorithm, capable of solving any 4-hole, 6-color Mastermind in five moves or fewer. The algorithm:

- **Generates:** all possible codes at the start.
- **Filters:** the possibility set after each guess, eliminating codes that contradict the feedback.
- **Minimizes:** the worst-case remaining possibilities for every candidate guess (minimax selection).
- **Chooses:** the guess that produces the smallest maximum bucket of survivors.

Genius mode is significantly harder to outlast as a Codemaker. For larger code sizes (5 or 6 holes), the AI uses an optimized subset evaluation for performance while maintaining near-optimal play.

Statistics

Statistics are recorded only when playing as Codebreaker (solo). They are stored in your browser's local storage and persist between visits. Stats are tracked separately by configuration (e.g., 4 holes / 6 colors vs. 5 holes / 8 colors).

Statistic	Meaning
Games Played	Total number of Codebreaker games started for the current configuration.
Games Won	Number of games where you successfully cracked the code within 10 attempts.
Avg Attempts	Average number of guesses needed across all won games.
Best Score	Fewest attempts in a single win, with the elapsed time as a tiebreaker (shown as attempts / m:ss).

To clear all statistics, press the Reset Stats button at the bottom of the screen and confirm the prompt.

Game Timer

A live timer appears centered above the board as soon as a game begins. The elapsed time is displayed in mm:ss format and is used as a tiebreaker when comparing best scores. The timer stops automatically when the game ends.

Installing the App (PWA)

Decode the Dragon's Vault is a Progressive Web App. On supported browsers you will see an Install App button beneath the role selection buttons. Tapping it installs the game to your home screen or desktop, giving you:

- **Offline play:** The game works without an internet connection once installed.
- **App-like experience:** Launches in its own window, full-screen, with no browser chrome.
- **Home screen icon:** The Dragon's Vault icon appears alongside your other apps.

The Install button is hidden once the app is installed or if your browser does not support PWA installation.

Quick Reference

Button / Control	Available When	Action
Color Palette	Setting code / guessing	Click a gem to select that color; the active color gets a blue ring.
Peg Slot	Setting code / guessing	Click to place the currently selected color into that position.
Confirm Code	Codemaker role	Locks in your secret code and begins the game.
Submit Guess	Codebreaker role	Submits the current row for scoring once all slots are filled.
Clear	Codemaker / Codebreaker	Empties all slots in the current row so you can start that guess over.
B / W counters	Manual scoring mode	Use + / − to set the Black and White peg count for an AI guess.
✓ (OK)	Manual scoring mode	Submits your manual feedback and lets the AI continue.
Pass to Player 2	2-Player mode	Screen shown between Player 1's code setup and Player 2's guessing phase.
Reset Stats	Always	Permanently clears all stored statistics after a confirmation prompt.
Install App	Supported browsers	Installs the game as a PWA on your home screen or desktop.

Tips & Strategy

As Codebreaker

- **Start broad:** Your first guess should use as many different colors as possible. With 6 colors and 4 holes, a guess like Red–Blue–Green–Yellow immediately gives information about four colors.
- **Track eliminations:** After each round, mentally note which colors received no feedback pegs at all — they cannot appear in the code.
- **Respect position:** A White peg means the color is in the code but needs to move. Don't guess the same color in the same position twice.
- **Use smaller code sizes to learn:** Start with 4 holes / 6 colors. Once you are consistently solving in 5 or fewer guesses, step up to 5 or 6 holes.

As Codemaker

- **Use repeated colors:** Repeated gems create ambiguity. A code like Blue–Blue–Red–Green is harder to parse than one with all different colors, because feedback pegs are trickier to assign.
- **Avoid obvious first guesses:** If your code uses only the first four colors of the palette, the AI's opening guess often scores well. Mixing in colors 5 or 6 keeps the AI working longer.
- **Try Genius mode:** Genius mode is nearly unbeatable in standard 4/6 configuration. Try larger code sizes if you want to outlast it as Codemaker.

Troubleshooting

- **'Invalid feedback — no code matches':** You entered a B/W count in Manual mode that is logically inconsistent with prior feedback. Review your scoring and try again.
- **'Fill all positions first':** You pressed Submit Guess or Confirm Code before filling every slot. All positions must have a color.
- **Statistics not showing:** Stats only appear when the Codebreaker role is selected. They are hidden in Codemaker and 2-Player modes.
- **Install button is not visible:** Your browser may not support PWA installation, or the app is already installed on your device.
- **Game seems slow on large codes:** Genius mode on 6 holes / 8 colors generates up to 262,144 possible codes. The minimax calculation may take a moment. This is normal.

About

Decode the Dragon's Vault is an original implementation of the classic Mastermind game, built as a single-file HTML/CSS/JavaScript application requiring no external libraries or server-side components. It features a custom scoring engine, constraint-based and minimax AI, PWA support, persistent per-configuration statistics, and a full 2-player pass-and-play mode.

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