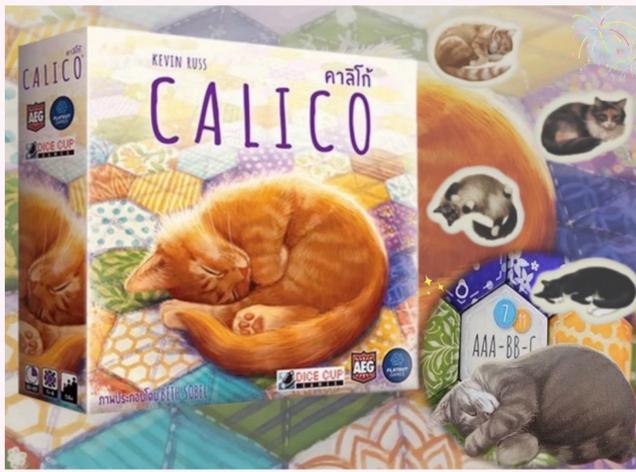




Score in Calico Game

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Abstract

This independent study is a study of the Calico game, which is a board game that imitates sewing patchwork quilt with different colors and patterns to attract cats to sleep on the quilt. The rule is that players must place patch tiles in empty positions, one piece at a time until all 22 slots are filled. At the end of the game, the player's score depends on the color and pattern of patch tiles that correspond to the conditions in that game. We consider the number of patch tiles placement satisfying the design goal tiles. We also consider the highest possible score of the player using the blue board under the following constraints: the placement of patch tiles must complete all design goal tiles requirement with both colors and patterns; the design goal tiles that are used from top to bottom are \neq , AAAA-BB and AAA-BBB; and the active cats are Millie, Coconut and Gwenivere. From the experiment, it is found that the maximum score obtained from button tokens is 27, the maximum score obtained from cat tokens is 31 points. Therefore, the maximum score under these constraints is 100 points.

Game Components

- 4 Dual-layer Quilt Boards
- 108 Patch Tiles
- 24 Design Goal Tiles
- 6 Black&White Patch Tiles
- 5 Double-sided Cat Scoring Tiles
- 80 Cat Tokens
- 52 Button Tokens

Game Setup

- Pick 3 **Cat Scoring Tiles**, one from each group separated by the number of dots at the lower right corner (., ..., ..).
- Assign 2 of the **Black + White Patch Tiles** to each **Cat Scoring Tile**.
- Each player chooses 3 **Design Goal Tiles** and places them on their **Quilt Board**.

Game End + Final Scoring

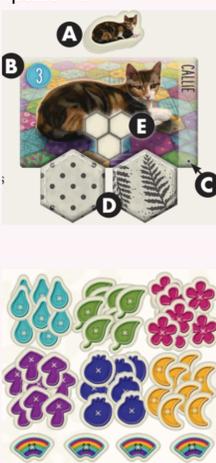
The game ends after each player has completely filled their **Quilt board** with **Patch Tiles**. Points are from **Design Goal Tiles**, **Cat Tokens** and **Button Tokens**. Player with the most points is the winner.

Design Goal Tile : Each **Design Goal Tile** scores points based on the six **Patch Tiles** that surround it. If the color or pattern requirement is completed, player gains the point in the blue circle. If the color and pattern requirements are completed, player gains only the point in the yellow circle.

- | | | | |
|--|---|--|---|
| | All different colors
OR
All different patterns | | A 4-of-a-color and a pair of colors
OR
A 4-of-a-pattern and a pair of patterns |
| | Two different 3-of-a-color
OR
Two different 3-of-a-pattern | | A 3-of-a-color, a pair of colors, and a single color
OR
A 3-of-a-pattern, a pair of patterns, and a single pattern |
| | Three different pairs of colors
OR
Three different pairs of patterns | | Two different pairs of colors and two different single colors
OR
Two different pairs of patterns and two different single patterns |

Cat Scoring Tiles : Player earns a **Cat Token** if their preferred tile group size or shape using one of their two preferred patterns are formed. The partial and whole edge tiles printed on player board can be used as part of the tile group. Each **Cat Token** give points in the blue circle on the **Cat Scoring Tiles** (B).

Button Tokens : To earn a button to place on the quilt board player must make a group of three **Patch Tiles** or more, of the same color. The partial and whole edge tiles printed on player board can be used as part of each group. To gain a second button of the same color, another group needs to be formed separately. Once the player earns buttons of all color, he/she earns a rainbow button. Each button, including the rainbow button, is worth 3 points.



Counting

In this section we show the number of ways to place 6 **Patch Tiles** corresponding to the **Design Goal Tile**.

Design Goal	Completed with	
	Colors + Patterns (♥)	Only Colors or Only Patterns
\neq	$(6!)^2$	$6!6^6 - \heartsuit$
AA-BB-CC	$\binom{6}{3}^2 \binom{6}{2,2,2}^2$	$\binom{6}{3} \binom{6}{2,2,2} 6^6 - \heartsuit$
AAA-BBB	$\binom{6}{2}^2 \binom{6}{3,3}^2$	$\binom{6}{2} \binom{6}{3,3} 6^6 - \heartsuit$
AAAA-BB	$30^2 \binom{6}{4,2}^2 - 15 \cdot 30^2$	$30 \binom{6}{4,2} - 30^2 6^6 - \heartsuit$
AAA-BB-C	$120^2 \binom{6}{3,2,1}^2$	$120 \binom{6}{3,2,1} 6^6 - \heartsuit$
AA-BB-C-D	$\binom{6}{2,2,2}^2 \binom{6}{2,2,1,1}^2$	$\binom{6}{2,2,2} \binom{6}{2,2,1,1} 6^6 - \heartsuit$

Highest Score

In this section we find the highest score for "Calico" under these constraints.

- Use the blue **Quilt Board**.
- Design Goal Tile** used from top to bottom are \neq , AAAA-BB and AAA-BBB.
- Design Goal Tiles** must be completed with both colors and patterns.
- The **Patch Tiles** surrounding **Design Goal Tile** \neq are as follows.
- The **Cat Scoring Tiles** used are Millie, Coconut and Gwenivere with preferred patterns as follows.



Scoring Example

The following **Quilt Board** earn 113 points, which are 38 points from **Design Goal Tiles**, 45 points from **Cat Tokens** and 30 points from **Button Tokens**.



Person icon	Nungning
Design Goal Tile icon	11+14+13 = 38
Cat Scoring Tile icon	11+11+9+9+5 = 45
Button Token icon	10 x 3 = 30
Σ icon	113

- When consider only the colors, the highest score form Button Tokens is 27 points.
- When consider only the patterns, the highest score form Cat Tokens is 31 points.
- The highest possible score under these constraints is 100 points. There are 28,673 different quilts with score 100.

