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Spooky ^[8]

CookieCat,

an educational [open source chess program](#) by [Steven Edwards](#) designed for pedagogical purposes, written in [Free Pascal](#) ^[1].

CookieCat evolved from the earlier **Bozochess** project ^[2] announced in October 2011 ^[3], renamed in December 2011 ^[4], and first released in January 2012 ^[5] under the [permissive BSD License](#).

However, Steven's wish that his CookieCat should be easily searchable on the net without too many false positives didn't fulfill when [Steven Universe](#) came up with a fictional character ^[6] and ice cream ^[7] in 2013.

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Description

CookieCat utilizes [bitboards](#) as basic data structure [to represent](#) the board. Inside CookieCat's source code [\[9\]](#), there are three groups of routines named after some of Steven's [feline](#) companions. There are the **Lucky** [positional evaluator](#) routines, the **Smokey** [mate finder](#) routines, and the **Spooky** general [search](#) routines. The names were chosen not so much to be cute, but rather to make it easier for others to identify the program's functional organization [\[10\]](#). CookieCat features five [hash-tables](#), beside the [main transposition table](#), an [endgame tablebase](#) cache, a [pawn hash table](#), [evaluation hash table](#), and a dedicated [perf hash table](#), and can further probe an [opening book](#) [\[11\]](#) and [Edwards' tablebases](#).

Bitboard Infrastructure

[Bitboards](#) are defined as union ([variable structure](#)) of four 16-bit [words](#) and one 64 bit value:

```
bbtype =
  record
    case Boolean of
      False: (wvec: array [bbwtype] of bbwspantype);
{ Array of bitboard words }
      True:  (bv64: ui64type)
              { Unsigned 64 bit value }
    end;
```

[Population count](#) and [BitScan](#) rely on [16-bit lookups](#):

```
function BbCount(var bb: bbtype): cctype; inline;
var
  myresult: cctype;
  bbw: bbwtype;
begin
  with bb do
    begin
      myresult := 0;
      for bbw := bbwmin to bbwmax do
        myresult := myresult + bitcountvec[wvec[bbw]]
      end;
```

```
BbCount := myresult
end; { BbCount }

function BbFirstSq(var bb: bbtype): sqxtype; inline;
var
  myresult: sqxtype;
  bbwindex: Integer;
  wordfirstbit: Integer;
begin
  with bb do
    begin
      myresult := sqnil;
      bbwindex := 0;
      while (myresult = sqnil) and (bbwindex < bbwlen) do
        begin
          wordfirstbit := bitfirstvec[wvec[bbwindex]];
          if wordfirstbit >= 0 then
            myresult := sqxtype(wordfirstbit + (bbwindex *
bbwbitlen))
          else
            Inc(bbwindex)
          end
        end;
      BbFirstSq := myresult
    end; { BbFirstSq }
```

Spooky

CookieCat's [search](#) dubbed **Spooky** is implemented as [iterative search](#) using a [finite-state machine](#) as nested procedure inside SpookyFindMove, which structure is outlined in following snippet:

```
{ ***** Spooky search routines ***** }
procedure SpookyFindMove(var ssc: ssctype);
  procedure SpookyPrepareRoot;
  procedure SpookyIterationSequence;
  procedure SpookyIterate;
  procedure SpookySearch;
    procedure SpookyLimitTestNode;
    procedure SpookyMovePick;
    procedure SpookyOrderMoves;
    procedure SpookyPickThis(index: Integer);
    procedure SpookyMinimax;
  begin { SpookySearch }
```

```
        with ssc do
            while pirvec[ply].nss <> nssexit do
                case pirvec[ply].nss of
                    nssplystart:
{ Search state: Initialize processing at this node }
                    nssfirdrawtest:
{ Search state: Draw tests for fiftymoves/insufficient/repetition }
                    nsstbprobe:      { Search state: Probe the tablebases }
                    nssstandtest:
{ Search state: Gainer (QSearch ed.) search stand-
pat evaluation and test }
                    nssgenerate:      { Search state: Move generation }
                    nssmovepick:      { Search state: Move pick }
                    nssexecute:
{ Search state: Execute the move and advance one ply }
                    nssretract:
{ Search state: Retreat one ply and retract the move }
                    nsspostscan:
{ Search state: Post move scan operations }
                    nssplyfinish:
{ Search state: Final processing for this node }
                    end; { SpookySearch }
                    end; { SpookyIterate }
                    end; { SpookyIterationSequence }
                end; { SpookyFindMove }
            end;
        end;
```

Smokey

Smokey is CookieCat's iterative [mate finder](#) with nested procedures outlined below:

```
{ ***** Smokey mate finder routines ***** }
procedure SmokeyFindMate(var ssc: ssctype; fmvc: Integer);
    procedure SmokeySearch;
        procedure SmokeyApplyKillerBonus;
    begin
        with ssc do
            while pirvec[ply].nss <> nssexit do
                case pirvec[ply].nss of
                    nssplystart:
                    nsstermtest:
                    nssgenerate:
                    nssmovepick:
                    nssexecute:
```

```
        nssretract:
        nsspostscan:
    end; { SmokeySearch }
end; { SmokeyFindMate }
```

Lucky

Lucky, CookieCat's [evaluation](#) function with [evaluation hash table](#) and [pawn hash table](#) considers [material](#), [pawn structure](#) with focus on [passed pawns](#) ^[12], and [piece mobility](#).

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Forum Posts

2011

- [Announcement: The Bozochess Project](#) by [Steven Edwards](#), [CCC](#), October 05, 2011
- [Release date target](#) by [Steven Edwards](#), [CCC](#), October 16, 2011
- [BozoChess Monday release schedule](#) by [Steven Edwards](#), [CCC](#), December 12, 2011
- [The name change](#) by [Steven Edwards](#), [CCC](#), December 16, 2011
- [Number sequence puzzle](#) by [Steven Edwards](#), [CCC](#), December 16, 2011 » [Endgame Tablebases](#) ^[14]
- [CookieCat Monday release schedule](#) by [Steven Edwards](#), [CCC](#), December 19, 2011
- [Tablebase class name list available](#) by [Steven Edwards](#), [CCC](#), December 19, 2011 » [Endgame Tablebases](#)
- [CookieCat sample games](#) by [Steven Edwards](#), [CCC](#), December 24, 2011
- [CookieCat goes multithreaded](#) by [Steven Edwards](#), [CCC](#), December 31, 2011 » [Perft](#)

2012 ...

- [CookieCat's opening book implementation](#) by [Steven Edwards](#), [CCC](#), January 05, 2012 » [Opening Book](#)
- [CookieCat's pawn structure code](#) by [Steven Edwards](#), [CCC](#), January 07, 2012
- [CookieCat's early search termination](#) by [Steven Edwards](#), [CCC](#), January 07, 2012
- [CookieCat and Cookie Cat](#) by [Steven Edwards](#), [CCC](#), January 08, 2012
- [CookieCat source via the net](#) by [Steven Edwards](#), [CCC](#), January 26, 2012
- [CookieCat and perft](#) by [Steven Edwards](#), [CCC](#), October 14, 2012
- [For a limited time, two sources](#) by [Steven Edwards](#), [CCC](#), January 22, 2013 » [Myopic](#)

External Links

- [Cookie from Wikipedia](#)
- [Cat from Wikipedia](#)
- [Lucky from Wikipedia](#)
- [Smokey from Wikipedia](#)
- [Smokey Stover from Wikipedia](#)
- [Spooky from Wikipedia](#)

References

1. [^] [Free Pascal wiki](#)
2. [^] [Release date target](#) by [Steven Edwards](#), [CCC](#), October 16, 2011
3. [^] [Announcement: The Bozochess Project](#) by [Steven Edwards](#), [CCC](#), October 05, 2011
4. [^] [The name change](#) by [Steven Edwards](#), [CCC](#), December 16, 2011
5. [^] [CookieCat source via the net](#) by [Steven Edwards](#), [CCC](#), January 26, 2012
6. [^] [Cookie Cat \(character\) | Steven Universe Wiki](#)
7. [^] [Cookie Cat | Steven Universe Wiki](#)
8. [^] Image from [The first Spooky and the fifth Smokey](#) (April 7, 1935) from [The Birth of Smokey Stover - First Puffs \(1935\)](#), [Bill Holman Comics](#), Copyright, 1935, by [Chicago Tribune](#), [New York News Syndicate Inc.](#), supplied by [Carl Linich](#), posted by [Paul Tumey](#), April 24, 2012
9. [^] Description is based on the source code - CookieCat.pas

10. [^ CookieCat and Cookie Cat](#) by [Steven Edwards](#), [CCC](#), January 08, 2012
11. [^ CookieCat's opening book implementation](#) by [Steven Edwards](#), [CCC](#), January 05, 2012
12. [^ CookieCat's pawn structure code](#) by [Steven Edwards](#), [CCC](#), January 07, 2012
13. [^ Source code courtesy Steven Edwards](#)
14. [^ A018214 - OEIS | Alkane \(or paraffin\) numbers](#)

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