(See https://cs.stanford.edu/~knuth/programs.html for date.)

1.   Intro.   Creating a graph for the distinct positions in all games of tic-tac-toe.

#**define** *rank z.I*   /∗ number of moves made ∗/
#**define** *link y.V*   /∗ next vertex of same rank ∗/
#**define** *head x.V*   /∗ first vertex of given rank ∗/
#**define** *winner w.I*   /∗ is this a winning position? ∗/
#**define** *bitcode v.I*   /∗ binary representation of this position ∗/

#**include** `"gb_graph.h"`
#**include** `"gb_save.h"`
  Vertex ∗ pos[1 ≪ 18];

  int *move*[9];
  int *win*[16] = {   /∗ the board is now numbered 263/917/584 ∗/
  #05040, #10011, #00504, #04101, #10044, #01410, #14400, #11100};
  int *place*[18] = {4, 4, 9, 9, 6, 6, 1, 1, 8, 8, 10, 10, 2, 2, 0, 0, 5, 5};

  main ( )
  {
    register *k*, *l*, *board*;

    Vertex ∗ u, ∗*v*;
    Graph ∗ g = *gb_new_graph*(5478);
    strcpy(*g→util_types*, `"ZIIVVIZZZZZZZZ"`);
    strcpy(*g→id*, `"tictactoe"`);
    for (*k* = 0; *k* < 8; *k*++) *win*[*k* + 8] = *win*[*k*] ≪ 1;
    l = *board* = 0;
    pos[0] = *u* = *v* = *g→vertices*;
    v→rank = *v→winner* = *v→bitcode* = 0;
    v→link = Λ, (*g→vertices* + 0)→*head* = *v*;
    v→name = *gb_save_string*(`"␣␣␣/␣␣␣/␣␣␣"`);
  newlev: *move*[*l*] = 3;
  tryit:
    if (¬(*board* & *move*[*l*])) {
      board += *move*[*l*] & (*l* & 1 ? #55555 : #aaaaa);
      if (*pos*[*board*]) {
        gb_new_arc(*v*, *pos*[*board*], 1);
        goto *unmove*;
      }
      pos[*board*] = ++*u*;
      u→rank = *l* + 1, *u→winner* = 0, *u→bitcode* = *board*;
      u→name = *gb_save_string*(`"␣␣␣/␣␣␣/␣␣␣"`);
      for (*k* = 0; *k* < 18; *k*++)
        if (*board* & (1 ≪ *k*)) *u→name*[*place*[*k*]] = ((*l* ⊕ *k*) & 1 ? 'O' : 'X');
      u→link = (*g→vertices* + *l* + 1)→*head*, (*g→vertices* + *l* + 1)→*head* = *u*;
      gb_new_arc(*v*, *u*, 1);
      for (*k* = 0; *k* < 16; *k*++)
        if ((*board* & *win*[*k*]) ≡ *win*[*k*]) {
          u→winner = 1;
          goto *unmove*;
        }
      if (*l* ≡ 8) **goto** *unmove*;
      l++, *v* = *u*;
      goto *newlev*;

```
  }
tryagain: move[l] ≪= 2;
  if (move[l] < (1 ≪ 18)) goto tryit;
  if (l > 0) {
    l−−, v = pos[board & ∼move[l]];
  unmove: board &= ∼move[l];
    goto tryagain;
  }
  save_graph(g, "/tmp/tictactoe.gb");
}
```

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bitcode: 1.
board: 1.
gb_new_arc: 1.
gb_new_graph: 1.
gb_save_string: 1.
Graph: 1.
head: 1.
id: 1.
k: 1.
l: 1.
link: 1.
main: 1.
move: 1.
name: 1.
newlev: 1.
place: 1.
pos: 1.
rank: 1.
save_graph: 1.
strcpy: 1.
tryagain: 1.
tryit: 1.
unmove: 1.
util_types: 1.
Vertex: 1.
vertices: 1.
win: 1.
winner: 1.

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