

(Downloaded from <https://cs.stanford.edu/~knuth/programs.html> and typeset on May 28, 2023)

**1. Intro.** Counting the number of distinct positions in all games of tic-tac-toe.

```
#include <stdio.h>
char pos[1 << 18];
int move[9], count[9], nonwin[9];
int win[16] = {#15000, #00540, #00015, #10410, #04104, #01041, #10101, #01110};
main()
{
    register k, l, board;
    for (k = 0; k < 8; k++) win[k + 8] = win[k] << 1;
    l = board = 0;
newlev: move[l] = 3;
tryit:
    if (¬(board & move[l])) {
        board += move[l] & (l & 1 ? #55555 : #aaaaa);
        if (pos[board]) goto unmove;
        pos[board] = 1, count[l]++;
        for (k = 0; k < 16; k++)
            if ((board & win[k]) ≡ win[k]) goto unmove;
        nonwin[l]++;
        if (l ≡ 8) goto unmove;
        l++;
        goto newlev;
    }
tryagain: move[l] <= 2;
    if (move[l] < (1 << 18)) goto tryit;
    if (l > 0) {
        l--;
    unmove: board &= ~move[l];
        goto tryagain;
    }
    for (k = 0; k ≤ 8; k++) printf("(%d,%d) at level %d\n", count[k], count[k] - nonwin[k], k);
}
```

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