

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

**1. Intro.** This little program makes empirical tests by which I can check the accuracy of the SETSET program. (See that program for explanations.)

```
#define m 12      /* size of each hand */
#define n 100000000 /* number of random trials */
#include <stdio.h>
#include "gb_flip.h" /* use the Stanford GraphBase random number routines */
char deck[81];
char occ[81];
char z[3][3] = {{0, 2, 1}, {2, 1, 0}, {1, 0, 2}}; /*  $x + y + z \equiv 0 \pmod{3}$  */
char third[81][128];

main()
{
    register int j, k, t;
    int reps, count;
    <Initialize 2>;
    while (1) {
        count = 0;
        for (reps = 0; reps < n; reps++) {
            <Shuffle the deck 4>;
            <Increase count if there are no SETs 3>;
        }
        printf("%d/%d\n", count, n);
    }
}
```

**2. #define pack( $a, b, c, d$ )**  $((a * 3 + (b)) * 3 + (c)) * 3 + (d)$

```
<Initialize 2> ≡
gb_init_rand(0);
for (k = 0; k < 81; k++) deck[k] = k;
for (k = 81 - m; k < 81; k++) occ[k] = 1;
{
    int a, b, c, d, e, f, g, h;
    for (a = 0; a < 3; a++)
        for (b = 0; b < 3; b++)
            for (c = 0; c < 3; c++)
                for (d = 0; d < 3; d++)
                    for (e = 0; e < 3; e++)
                        for (f = 0; f < 3; f++)
                            for (g = 0; g < 3; g++)
                                for (h = 0; h < 3; h++)
                                    third[pack(a, b, c, d)][pack(e, f, g, h)] = pack(z[a][e], z[b][f], z[c][g], z[d][h]);
}
```

This code is used in section 1.

3.  $\langle$  Increase *count* if there are no SETs 3  $\rangle \equiv$   
**for** ( $j = 81 - m$ ;  $j < 80$ ;  $j++$ )  
  **for** ( $k = j + 1$ ;  $k < 81$ ;  $k++$ )  
    **if** ( $occ[third[deck[j]][deck[k]]]$ ) **goto** *set\_found*;  
  *count*++;  
*set\_found*:

This code is used in section 1.

4.  $\langle$  Shuffle the deck 4  $\rangle \equiv$   
**for** ( $j = 81$ ;  $j > 81 - m$ ;  $j--$ ) {  
   $t = deck[j - 1]$ ;  
   $occ[t] = 0$ ;  
   $k = gb\_unif\_rand(j)$ ;  
   $deck[j - 1] = deck[k]$ ;  
   $occ[deck[k]] = 1$ ;  
   $deck[k] = t$ ;  
}

This code is used in section 1.

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⟨ Increase *count* if there are no SETs 3 ⟩ Used in section 1.  
⟨ Initialize 2 ⟩ Used in section 1.  
⟨ Shuffle the deck 4 ⟩ Used in section 1.

# SETSET-RANDOM

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