

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

**1. Intro.** This simple program calculates Schensted's Y function. Consider the array

```

      x
    x x      x
  x o o      x o      x
o o x x      o o x      o o      o
x o x x x      o o x x      o o x      o o      o

```

The first nine columns of these five rows were given as standard input; this array shows the standard output.

In general the standard input should consist of  $n + 1$  lines of  $2n + 1$  characters, for some  $n$ , using only spaces and x's and o's. (Otherwise who knows what might occur. I wrote this in a terrific hurry.)

```

#define maxn 100
#include <stdio.h>
char a[maxn + 1][maxn + 1][maxn + maxn + 1];
main()
{
    register int i, j, k, n, s;
    < Read the input into a[0], determining n 2 >;
    for (k = 1; k ≤ n; k++) < Compute a[k] from a[k - 1] 3 >;
    < Print the results 4 >;
}

```

**2.** < Read the input into a[0], determining n 2 > ≡

```

fgets(a[0][0], maxn + 2, stdin);
for (n = 0; a[0][0][n] ≡ '␣'; n++) ;
a[0][0][n + n + 1] = '\\0';
for (k = 1; k ≤ n; k++) {
    fgets(a[0][k], maxn + 2, stdin);
    a[0][k][n + n + 1] = 0;
}

```

This code is used in section 1.

**3.** < Compute a[k] from a[k - 1] 3 > ≡

```

for (j = 0; j ≤ n - k; j++) {
    for (i = 0; i ≤ n + n - k - k; i++) a[k][j][i] = '␣';
    for (i = n - k - j; i ≤ n - k + j; i += 2) {
        s = 0;
        if (a[k - 1][j][i + 1] ≡ 'o') s++;
        if (a[k - 1][j + 1][i] ≡ 'o') s++;
        if (a[k - 1][j + 1][i + 2] ≡ 'o') s++;
        a[k][j][i] = (s > 1 ? 'o' : 'x');
    }
}

```

This code is used in section 1.

**4.** < Print the results 4 > ≡

```

for (k = 0; k ≤ n; k++) {
    printf(a[0][k]);
    for (j = 1; j ≤ k; j++) printf("␣%s", a[j][k - j]);
    printf("\\n");
}

```

This code is used in section 1.

**5. Index.**

*a*: [1](#).

*fgets*: [2](#).

*i*: [1](#).

*j*: [1](#).

*k*: [1](#).

*main*: [1](#).

*maxn*: [1](#), [2](#).

*n*: [1](#).

*printf*: [4](#).

*s*: [1](#).

*stdin*: [2](#).

- ⟨ Compute  $a[k]$  from  $a[k-1]$  3 ⟩ Used in section 1.
- ⟨ Print the results 4 ⟩ Used in section 1.
- ⟨ Read the input into  $a[0]$ , determining  $n$  2 ⟩ Used in section 1.

# YPLAY

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