

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

**1. Data for dancing.** This program creates data suitable for the DANCE routine, solving the famous “ $n$  queens problem.” The value of  $n$  is a command-line parameter.

```
#include <stdio.h>
#include <stdlib.h>
  <Global variables 3>
  <Subroutines 5>;
main(argc, argv)
  int argc;
  char *argv[];
{
  register int j, k, n, nn, t;
  <Read the command line 2>;
  <Output the column names 4>;
  <Output the possible queen moves 6>;
}
```

**2.** <Read the command line 2>  $\equiv$

```
if (argc  $\neq$  2  $\vee$  sscanf(argv[1], "%d", &param)  $\neq$  1) {
  fprintf(stderr, "Usage: %s\n", argv[0]);
  exit(-1);
}
n = param;
nn = n + n - 2;
```

This code is used in section 1.

**3.** <Global variables 3>  $\equiv$

```
int param;
```

This code is used in section 1.

**4.** We process the cells of the board in “organ pipe order,” on the assumption that—all other things being equal—a move near the center yields more constraints on the subsequent search.

```
<Output the column names 4>  $\equiv$ 
for (j = 0; j < n; j++) {
  t = (j & 1 ? n - 1 - j : n + j)  $\gg$  1;
  printf("r%c%c", encode(t), encode(t));
}
printf("|");
for (j = 1; j < nn; j++) printf("_a%c_c_b%c", encode(j), encode(j));
printf("\n");
```

This code is used in section 1.

**5.** <Subroutines 5>  $\equiv$

```
char encode(x)
  int x;
{
  if (x < 10) return '0' + x;
  return 'a' - 10 + x;
}
```

This code is used in section 1.

6.  $\langle$  Output the possible queen moves 6  $\rangle \equiv$   
**for** ( $j = 0$ ;  $j < n$ ;  $j++$ )  
  **for** ( $k = 0$ ;  $k < n$ ;  $k++$ ) {  
    *printf*("r%c%c", *encode*( $j$ ), *encode*( $k$ ));  
     $t = j + k$ ;  
    **if** ( $t \wedge (t < nn)$ ) *printf*("a%c", *encode*( $t$ ));  
     $t = n - 1 - j + k$ ;  
    **if** ( $t \wedge (t < nn)$ ) *printf*("b%c", *encode*( $t$ ));  
    *printf*("\\n");  
  }

This code is used in section 1.

**7. Index.**

*argc*: [1](#), [2](#).  
*argv*: [1](#), [2](#).  
*encode*: [4](#), [5](#), [6](#).  
*exit*: [2](#).  
*fprintf*: [2](#).  
*j*: [1](#).  
*k*: [1](#).  
*main*: [1](#).  
*n*: [1](#).  
*nn*: [1](#), [2](#), [4](#), [6](#).  
*param*: [2](#), [3](#).  
*printf*: [4](#), [6](#).  
*sscanf*: [2](#).  
*stderr*: [2](#).  
*t*: [1](#).  
*x*: [5](#).

⟨ Global variables [3](#) ⟩ Used in section [1](#).  
⟨ Output the column names [4](#) ⟩ Used in section [1](#).  
⟨ Output the possible queen moves [6](#) ⟩ Used in section [1](#).  
⟨ Read the command line [2](#) ⟩ Used in section [1](#).  
⟨ Subroutines [5](#) ⟩ Used in section [1](#).

QUEENS

	Section	Page
Data for dancing .....	<a href="#">1</a>	1
Index .....	<a href="#">7</a>	3