

1. Intro. Given the specification of a sudoku puzzle in *stdin*, this program outputs DLX data for the problem of finding all solutions. (I hacked it from my old program SUDOKU-PREP, written in 2005.)

The specification consists of nine lines of ASCII characters. If the j th character of the i th line is between 1 and 9, it defines the value that appears in cell (i, j) of the puzzle.

The puzzle is repeated in a comment line at the beginning of the output.

```
#define bufsize 16    /* beware strange behavior if you feed long lines to me! */
#include <stdio.h>
#include <stdlib.h>
char buf[bufsize];
int pos[9][9], row[9][9], col[9][9], box[9][9];    /* things to cover */
main()
{
    register int c, j, k, d, x;
    ⟨Input the given problem 2⟩;
    ⟨Output the comment line 3⟩;
    ⟨Output the item-name line 4⟩;
    ⟨Output the options 5⟩;
}
```

2. #define box(j, k) (((int)((j)/3)) * 3 + (int)((k)/3))

⟨ Input the given problem 2 ⟩ ≡

```

for (c = j = 0; j < 9; j++) {
    if (!fgets(buf, bufsz, stdin)) {
        fprintf(stderr, "There are fewer than nine lines of input!\n");
        exit(-1);
    }
    for (k = 0; k < 9; k++)
        if (buf[k] ≥ '1' ∧ buf[k] ≤ '9') {
            d = buf[k] - '1', x = box(j, k);
            pos[j][k] = d + 1;
            if (row[j][d]) {
                fprintf(stderr, "digit %d appears in columns %d and %d of row %d!\n", d + 1,
                    row[j][d] - 1, k, j);
                exit(-2);
            }
            row[j][d] = k + 1;
            if (col[k][d]) {
                fprintf(stderr, "digit %d appears in rows %d and %d of column %d!\n", d + 1,
                    col[k][d] - 1, j, k);
                exit(-3);
            }
            col[k][d] = j + 1;
            if (box[x][d]) {
                fprintf(stderr, "digit %d appears in rows %d and %d of box %d!\n", d + 1, box[x][d] - 1, j, x);
                exit(-4);
            }
            box[x][d] = j + 1;
            c++;
        }
}
fprintf(stderr, "OK, I found %d clues in the input problem.\n", c);

```

This code is used in section 1.

3. ⟨ Output the comment line 3 ⟩ ≡

```

fprintf(stdout, "| sudoku");
for (j = 0; j < 9; j++) {
    fprintf(stdout, "!");
    for (k = 0; k < 9; k++) fprintf(stdout, "%c", pos[j][k] ? '0' + pos[j][k] : '.');
}
fprintf(stdout, "\n");

```

This code is used in section 1.

4. I'm going to put all **p** items first, then **r**, then **c**, then **b**, since this sort-of corresponds to the way many humans approach the subject. (And since a branch on **b** is then interesting.)

⟨ Output the item-name line 4 ⟩ \equiv

```

for ( $j = 0; j < 9; j++$ )
  for ( $k = 0; k < 9; k++$ )
    if ( $\neg pos[j][k]$ )  $fprintf(stdout, "p\%d\%d\_\_", j, k);$ 
for ( $j = 0; j < 9; j++$ )
  for ( $k = 0; k < 9; k++$ )
    if ( $\neg row[j][k]$ )  $fprintf(stdout, "r\%d\%d\_\_", j, k + 1);$ 
for ( $j = 0; j < 9; j++$ )
  for ( $k = 0; k < 9; k++$ )
    if ( $\neg col[j][k]$ )  $fprintf(stdout, "c\%d\%d\_\_", j, k + 1);$ 
for ( $j = 0; j < 9; j++$ )
  for ( $k = 0; k < 9; k++$ )
    if ( $\neg box[j][k]$ )  $fprintf(stdout, "b\%d\%d\_\_", j, k + 1);$ 
 $fprintf(stdout, "\n");$ 

```

This code is used in section 1.

5. ⟨ Output the options 5 ⟩ \equiv

```

for ( $j = 0; j < 9; j++$ )
  for ( $k = 0; k < 9; k++$ )
    for ( $d = 0; d < 9; d++$ ) {
       $x = box(j, k);$ 
      if ( $\neg pos[j][k] \wedge \neg row[j][d] \wedge \neg col[k][d] \wedge \neg box[x][d]$ )
         $fprintf(stdout, "p\%d\%d\_\_r\%d\%d\_\_c\%d\%d\_\_b\%d\%d\_\_\n", j, k, j, d + 1, k, d + 1, x, d + 1);$ 
    }

```

This code is used in section 1.

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SUDOKU-DLX

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