

**1\*** **Intro.** This program generates clauses that enforce the constraint  $x_1 + \dots + x_n \leq r$ , using a method due to Carsten Sinz [*Lecture Notes in Computer Science* **3709** (2005), 827–831]. It introduces  $r(n-r)$  new variables  $S_{i,j}$  for  $1 \leq i \leq n-r$  and  $1 \leq j \leq r$ , and generates a total of  $(r+1)(n-r) + r(n-r-1)$  clauses involving these variables and  $x_1$  through  $x_n$ . All clauses have length 3 or less.

This version inputs a graph (specified as a third parameter) and and color number (specified fourth). The output clauses will limit the number of vertices of that color.

```
#include <stdio.h>
#include <stdlib.h>
#include "gb_graph.h"
#include "gb_save.h"
int n, r, kk; /* the given parameters */
main(int argc, char *argv[])
{
    register int i, j, k;
    Graph *g;
    <Process the command line 2*>;
    for (j = 1; j ≤ r; j++) <Generate the horizontal clauses for row j 3>;
    for (j = 0; j ≤ r; j++) <Generate the vertical clauses for row j 4*>;
}

2* <Process the command line 2*> ≡
if (argc ≠ 5 ∨ sscanf(argv[1], "%d", &n) ≠ 1 ∨ sscanf(argv[2], "%d", &r) ≠ 1 ∨ sscanf(argv[4], "%d", &kk) ≠ 1)
{
    fprintf(stderr, "Usage: %s\n", argv[0]);
    exit(-1);
}
g = restore_graph(argv[3]);
if (-g) {
    fprintf(stderr, "I can't input the graph '%s'!\n", argv[3]);
    exit(-2);
}
if (g-n ≠ n) fprintf(stderr, "Warning: The graph has %ld vertices, not %d!\n", g-n, n);
if (r < 0 ∨ r ≥ n) {
    fprintf(stderr, "Eh? r should be between 0 and n-1!\n");
    exit(-2);
}
printf("~sat-threshold-sinz %d %d\n", n, r);
```

This code is used in section 1\*.

```
3. <Generate the horizontal clauses for row j 3> ≡
for (i = 1; i < n - r; i++) printf("~S%d.%dS%d.%d\n", i, j, i + 1, j);
```

This code is used in section 1\*.

```
4* #define xbar(k) printf("~%s.%d", (g-vertices + k - 1)-name, kk)
<Generate the vertical clauses for row j 4*> ≡
for (i = 1; i ≤ n - r; i++) {
    xbar(i + j);
    if (j) printf("~S%d.%d", i, j);
    if (j < r) printf("S%d.%d", i, j + 1);
    printf("\n");
}
```

This code is used in section 1\*.

**5\* Index.**

The following sections were changed by the change file: 1, 2, 4, 5.

*argc*: 1\*, 2\*

*argv*: 1\*, 2\*

*exit*: 2\*

*fprintf*: 2\*

*Graph*: 1\*

*i*: 1\*

*j*: 1\*

*k*: 1\*

*kk*: 1\*, 2\*, 4\*

*main*: 1\*

*n*: 1\*

*name*: 4\*

*printf*: 2\*, 3, 4\*

*r*: 1\*

*restore\_graph*: 2\*

*sscanf*: 2\*

*stderr*: 2\*

*vertices*: 4\*

*xbar*: 4\*

- ⟨ Generate the horizontal clauses for row  $j$  3 ⟩ Used in section 1\*.
- ⟨ Generate the vertical clauses for row  $j$  4\* ⟩ Used in section 1\*.
- ⟨ Process the command line 2\* ⟩ Used in section 1\*.

# SAT-THRESHOLD-SINZ-GRAPHS

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