

1* Intro. Given a graph g with m edges, make data from which DLX2 should tell us all ways to label the vertices, using distinct labels in $\{0, 1, \dots, m\}$, so that the edges have distinct difference. (Those differences will be $\{1, \dots, m\}$).

Each label could be complemented with respect to m . I avoid this by “orienting” the edge labeled m .

```
#define encode(x) ((x) < 10 ? (x) + '0' : (x) < 36 ? (x) - 10 + 'a' : (x) < 62 ? (x) - 36 + 'A' : (x) + 99)
#define maxm 156 /* based on that encoding, but I could go higher in a pinch! */
```

```
#include <stdio.h>
#include <stdlib.h>
#include "gb_graph.h"
#include "gb_save.h"
int c;
main(int argc, char *argv[])
{
    register int i, j, k, m, n;
    register Arc *a;
    register Graph *g;
    register Vertex *v;
    ⟨Process the command line 2⟩;
    ⟨Output the item-name line 3*⟩;
    for (k = 1; k ≤ m; k++) ⟨Output the options for edge k 4⟩;
    for (v = g-vertices; v < g-vertices + n; v++) ⟨Output the options for vertex v 5*⟩;
}
```

2. ⟨Process the command line 2⟩ ≡

```
if (argc ≠ 2) {
    fprintf(stderr, "Usage: %s foo.gb\n", argv[0]);
    exit(-1);
}
g = restore_graph(argv[1]);
if (!g) {
    fprintf(stderr, "I couldn't reconstruct graph %s!\n", argv[1]);
    exit(-2);
}
m = g-m/2, n = g-n;
if (m ≥ maxm) {
    fprintf(stderr, "Sorry, at present I require %d!\n", maxm);
    exit(-3);
}
printf("%s\n", argv[0], argv[1]);
```

This code is used in section 1*.

3* There's a primary item k for each edge label, and a primary item uv for each edge. This enforces a permutation between edges and labels.

This version also introduces a primary item $\#v$ for each vertex.

There's a secondary item $.v$ for each vertex; its color will be its label.

There's a secondary item $+k$ for each vertex label; its color will be the vertex so labeled.

⟨ Output the item-name line **3*** ⟩ \equiv

```

for ( $k = 1$ ;  $k \leq m$ ;  $k++$ ) printf ("%c□", encode( $k$ ));
for ( $v = g\text{-vertices}$ ;  $v < g\text{-vertices} + n$ ;  $v++$ )
  for ( $a = v\text{-arcs}$ ;  $a; a = a\text{-next}$ )
    if ( $a\text{-tip} > v$ ) printf ("%s-%s□",  $v\text{-name}$ ,  $a\text{-tip-name}$ );
for ( $v = g\text{-vertices}$ ;  $v < g\text{-vertices} + n$ ;  $v++$ ) printf ("#%s□",  $v\text{-name}$ );
printf ("|");
for ( $v = g\text{-vertices}$ ;  $v < g\text{-vertices} + n$ ;  $v++$ ) printf ("□.%s",  $v\text{-name}$ );
for ( $k = 0$ ;  $k \leq m$ ;  $k++$ ) printf ("□+%c", encode( $k$ ));
printf ("\n");

```

This code is used in section **1***.

4. **#define** *vrt*(v) ((**int**)((v) - $g\text{-vertices}$))

⟨ Output the options for edge k **4** ⟩ \equiv

```

{
  for ( $i = 0, j = k$ ;  $j \leq m$ ;  $i++, j++$ ) {
    for ( $v = g\text{-vertices}$ ;  $v < g\text{-vertices} + n$ ;  $v++$ )
      for ( $a = v\text{-arcs}$ ;  $a; a = a\text{-next}$ )
        if ( $a\text{-tip} > v$ ) {
          printf ("%c□%s-%s□.%s:%c□.%s:%c□+%c:%c□+%c:%c\n", encode( $k$ ),  $v\text{-name}$ ,  $a\text{-tip-name}$ ,
             $v\text{-name}$ , encode( $i$ ),  $a\text{-tip-name}$ , encode( $j$ ), encode( $i$ ), encode(vrt( $v$ )), encode( $j$ ),
            encode(vrt( $a\text{-tip}$ )));
          if ( $i \neq 0 \vee j \neq m$ ) /* prevent complementation symmetry */
            printf ("%c□%s-%s□.%s:%c□.%s:%c□+%c:%c□+%c:%c\n", encode( $k$ ),  $v\text{-name}$ ,  $a\text{-tip-name}$ ,
               $v\text{-name}$ , encode( $j$ ),  $a\text{-tip-name}$ , encode( $i$ ), encode( $j$ ), encode(vrt( $v$ )), encode( $i$ ),
              encode(vrt( $a\text{-tip}$ )));
        }
      }
  }
}

```

This code is used in section **1***.

5* ⟨ Output the options for vertex v **5*** ⟩ \equiv

```

{
  for ( $k = 0$ ;  $k \leq m$ ;  $k++$ ) printf ("#%s□.%s:%c□+%c:%c\n",  $v\text{-name}$ ,  $v\text{-name}$ , encode( $k$ ), encode( $k$ ),
    encode((int)( $v - g\text{-vertices}$ )));
}

```

This code is used in section **1***.

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- ⟨Output the item-name line 3*⟩ Used in section 1*.
- ⟨Output the options for edge k 4⟩ Used in section 1*.
- ⟨Output the options for vertex v 5*⟩ Used in section 1*.
- ⟨Process the command line 2⟩ Used in section 1*.

GRACEFUL-DLX-DOMAINS

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