(See https://cs.stanford.edu/~knuth/programs.html for date.)

1. Intro. An experimental forward method for topswops, using genlex permutation generation.

```
#define n 16   /* degree of perms; should be at most 16 */
#include <stdio.h>
  unsigned char score[ ] = {0, 0, 1, 2, 4, 7, 10, 16, 22, 30, 38, 51, 65, 80, 101, 113, 114};
    /* should have n + 1 entries */
  typedef char perm[16];
  perm p;   /* current permutation for card choices */
  perm v;   /* inversion control for perm generation */
  perm h;   /* index of largest element not yet in final position */
  perm b, bb;   /* buffers used to print solutions */
  struct {
    perm q;
  } s[16], a;
  int d[16];   /* distances so far */
  int profile[16];

  main( )
  {
    register int j, k, l, t, c;
    for (k = 1; k < n; k++) p[k − 1] = k + 1, a.q[k − 1] = −k;
    p[n − 1] = 1;
    v[0] = 1;
    h[1] = n;
    profile[0] = 1;
    l = 1;
    s[l] = a;
    j = n − 1;
  advance: j−−;
  tryit: ⟨Go up a level, except goto infeas if j is infeasible 2⟩;
  infeas:
    if (j) goto advance;
  backup: l−−;
  nextv:
    if (v[l] ≡ 0) {
      t = p[l − 1], p[l − 1] = p[n − 2], p[n − 2] = t;
      goto backup;
    }
    if (l) {
      j = v[l] − 1;
      t = p[l − 1], p[l − 1] = p[n − 3 − j], p[n − 3 − j] = t;
      a = s[l];
      goto tryit;
    }
    ⟨Print the stats 4⟩;
  }
```

2. ⟨ Go up a level, except **goto** *infeas* if *j* is infeasible 2 ⟩ ≡

```
k = p[n − 2 − j];
if (k ≡ −a.q[0]) goto infeas;
t = h[l];
c = d[l] + 1;
if (k ≡ t) {
  for (t = 1; a.q[t] ≡ k − t; t++) ;
  if (c + score[k − t] < score[n]) goto infeas;
} else if (c + score[t] < score[n]) goto infeas;
v[l] = j, p[n − 2 − j] = p[l − 1], p[l − 1] = k;
while (1) {
  a.q[0] = a.q[k − 1], a.q[k − 1] = k;
  for (j = 1, k −= 2; j < k; j++, k−−) t = a.q[j], a.q[j] = a.q[k], a.q[k] = t;
  k = a.q[0];
  if (k ≤ 0) break;
  c++;
}
profile[l]++;
if (l ≡ n − 1) {
  if (c ≥ score[n]) ⟨ Record and print the solution 3 ⟩;
  goto nextv;
}
for (t = h[l]; a.q[t − 1] ≡ t; t−−) ;
l++;
s[l] = a, d[l] = c, h[l] = t;
j = n − l;
goto advance;
```

This code is used in section 1.

3. ⟨ Record and print the solution 3 ⟩ ≡

```
{
  score[n] = c;
  printf("%d:", c);
  for (k = 1; k ≤ n; k++) b[k − 1] = −k;
  for (k = 1; k ≤ n; k++) {
    while (b[0] > 0)
      for (j = b[0], b[0] = b[j − 1], b[j − 1] = j, c = 1, j −= 2; c < j; c++, j−−)
        t = b[c], b[c] = b[j], b[j] = t;
    bb[−b[0] − 1] = p[k − 1];
    b[0] = p[k − 1];
  }
  for (k = 0; k < n; k++) printf("␣%d", bb[k]);
  printf("␣->␣1");
  for (k = 1; k < n; k++) printf("␣%d", a.q[k]);
  printf("\n"); fflush(stdout);
}
```

This code is used in section 2.

4. ⟨ Print the stats 4 ⟩ ≡

```
for (k = 0; k < n; k++) printf("%9d␣nodes␣at␣level␣%d.\n", profile[k], k);
```

This code is used in section 1.

5. Index.

⟨ Go up a level, except **goto** *infeas* if j is infeasible 2 ⟩ Used in section 1.
⟨ Print the stats 4 ⟩ Used in section 1.
⟨ Record and print the solution 3 ⟩ Used in section 2.

TOPSWOPS-FWD