

**1. Intro.** Find a comma-free block code of length  $n$ , having one code in each cyclic equivalence class, if one exists.

Codewords are represented as hexadecimal numbers.

```
#define maxn 25 /* must be at most 32, to keep the variable names small */
#include <stdio.h>
#include <stdlib.h>
int n; /* command-line parameter */
char a[maxn + 1];
main(int argc, char *argv[])
{
    register int i, j, k;
    register unsigned int x, y, z;
    register unsigned long long m, acc, xy;
    < Process the command line 2 >;
    < Generate the positive clauses 3 >;
    < Generate the negative clauses 5 >;
}
```

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

```
if (argc  $\neq$  2  $\vee$  sscanf(argv[1], "%d", &n)  $\neq$  1) {
    fprintf(stderr, "Usage: %s %d\n", argv[0]);
    exit(-1);
}
if (n < 2  $\vee$  n > maxn) {
    fprintf(stderr, "n should be between 2 and %d, not %d!\n", maxn, n);
    exit(-2);
}
printf("~sat-commafree%d\n", n);
```

This code is used in section 1.

**3.** Here I use Algorithm 7.2.1.1F to find the prime binary strings.

```
< Generate the positive clauses 3 >  $\equiv$ 
f1: a[0] = -1, j = 1;
f2: if (j  $\equiv$  n) < Visit the prime string  $a_1 \dots a_n$  4 >;
f3: for (j = n; a[j]  $\equiv$  1; j--) ;
f4: if (j) {
    a[j] = 1;
    f5: for (k = j + 1; k  $\leq$  n; k++) a[k] = a[k - j];
    goto f2;
}
```

This code is used in section 1.

**4.** < Visit the prime string  $a_1 \dots a_n$  4 >  $\equiv$

```
{
    for (i = 0; i < n; i++) {
        for (x = 0, k = 0; k < n; k++) x = (x  $\ll$  1) + a[1 + ((i + k) % n)];
        printf("%x", x);
    }
    printf("\n");
}
```

This code is used in section 3.

5.  $\langle \text{Generate the negative clauses } 5 \rangle \equiv$   
 $m = (1_{LL} \ll n) - 1;$   
**for**  $(x = 0; x < (1 \ll n); x++)$  {  
 $\langle \text{If } x \text{ is cyclic, } \text{continue } 6 \rangle;$   
**for**  $(y = 0; y < (1 \ll n); y++)$  {  
 $\langle \text{If } y \text{ is cyclic, } \text{continue } 7 \rangle;$   
 $\langle \text{Generate the clauses for } x \text{ followed by } y \text{ } 9 \rangle;$   
**}**  
**}**

This code is used in section 1.

6.  $\langle \text{If } x \text{ is cyclic, } \text{continue } 6 \rangle \equiv$   
 $acc = (((\text{unsigned long long}) x) \ll n) + x;$   
**for**  $(k = 1; k < n; k++)$   
**if**  $((acc \gg k) \& m) \equiv x)$  **break**;  
**if**  $(k < n)$  **continue**;

This code is used in section 5.

7.  $\langle \text{If } y \text{ is cyclic, } \text{continue } 7 \rangle \equiv$   
 $acc = (((\text{unsigned long long}) y) \ll n) + y;$   
**for**  $(k = 1; k < n; k++)$   
**if**  $((acc \gg k) \& m) \equiv y)$  **break**;  
**if**  $(k < n)$  **continue**;

This code is used in section 5.

8.  $\langle \text{If } z \text{ is cyclic, } \text{continue } 8 \rangle \equiv$   
 $acc = (((\text{unsigned long long}) z) \ll n) + z;$   
**for**  $(k = 1; k < n; k++)$   
**if**  $((acc \gg k) \& m) \equiv z)$  **break**;  
**if**  $(k < n)$  **continue**;

This code is used in section 9.

9.  $\langle \text{Generate the clauses for } x \text{ followed by } y \text{ } 9 \rangle \equiv$   
 $xy = (((\text{unsigned long long}) x) \ll n) + y;$   
**for**  $(j = 1; j < n; j++)$  {  
 $z = (xy \gg j) \& m;$   
 $\langle \text{If } z \text{ is cyclic, } \text{continue } 8 \rangle;$   
 $\text{printf}(\text{"\%x\_%x\_%x\n"}, x, y, z);$   
**}**

This code is used in section 5.

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- ⟨ Generate the positive clauses 3 ⟩ Used in section 1.
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