

- 1.
- 2.
- 3.

n

- 4.
- 5.
- 6.
- 7.

k -

1.

.

n -

$$A = \{a_1, a_2, \dots, a_n\}.$$

,

:

•

,

•

,

.

,

n -

A

2^n

.

.

$$B \subset A$$

$$b_1 b_2 \dots b_j \dots b_n,$$

:

$$b_j = \begin{cases} 0, & a_j \notin B, \\ 1, & a_j \in B. \end{cases}$$

n

B .

2.

n -

A ,

,

n .

2.

$$i = 1, 2, \dots, 2^{|M|}$$

$$M = \{a_0, a_1, a_2\}$$

$$B_i$$

$$b_0 b_1 b_2$$

$$b_j = \begin{cases} 0, & a_j \notin B, \\ 1, & a_j \in B. \end{cases}$$

$$:$$

i	$b_0 b_1 b_2$	B_i
0	000	\emptyset
1	001	a_2
2	010	a_1
3	011	a_1, a_2
4	100	a_0
5	101	a_0, a_2
6	110	a_0, a_1
7	111	a_0, a_1, a_2

$$2^M = \{\emptyset, a_0, a_1, a_2, \{a_0, a_1\}, \{a_0, a_2\}, \{a_1, a_2\}, \{a_0, a_1, a_2\}\}$$

3. n

$$b = (b_{n-1}, b_{n-1}, \dots, b_1, b_0)$$

$$n$$

1. $b[n], b[n-1], \dots, b[1], b[0],$

$$b[n] := 0.$$

2. $b[i] = 0.$

3. $b[i] := 1, \quad b[j], j < i,$

$$b[i], \quad 0.$$

4. $b[n]$

$$(1, 1, \dots, 1), \quad i = n. \quad b[n] = 1$$

```

For i:=0 to n do b[i]:=0; [
While b[n] ≠ 1 do [
begin
  Write(b[n-1], b[n-2],..., b[0]);
  i:=0;
  While b[i]=1 do
  begin
    b[i]:=0;
    i:=i+1;
  end;
  b[i]:=1;
end;

```

$$A = \{a_0, a_1, \dots, a_{n-1}\}.$$

$$a_n \notin A.$$

b

 $n = 3$ B

$$A = \{a_0, a_1, a_2\}.$$

```

  B := ∅ ;
while  $a_n \notin B$  do
begin
  write ( B ) ;
  i := 0 ;
  while  $a_i \in B$  do
  begin
     $B := B \setminus \{a_i\}$  ;
    i := i + 1 ;
  end;
   $B := B \cup \{a_i\}$  ;
end;

```

$$b^1 = (0, 0, 0), B^1 = \emptyset, i = 1;$$

$$b^2 = (0, 0, 1), B^2 = \{a_2\}, i = 2;$$

$$b^3 = (0, 1, 0), B^3 = \{a_1\}, i = 0;$$

$$b^4 = (0, 1, 1), B^4 = \{a_1, a_2\}, i = 2;$$

$$b^5 = (1, 0, 0), B^5 = \{a_0\}, i = 0;$$

$$b^6 = (1, 0, 1), B^6 = \{a_0, a_2\}, i = 1;$$

$$b^7 = (1, 1, 0), B^7 = \{a_0, a_1\}, i = 0;$$

$$b^8 = (1, 1, 1), B^8 = \{a_0, a_1, a_2\}, i = 3.$$

4.

$$b_1 b_2 \dots b_n -$$

$$\begin{aligned}
 & \vdots \\
 & b_1 b_2 b_3 \dots b_{n-1} b_n \\
 & \oplus b_1 b_2 b_3 \dots b_{n-1} \cancel{b_n} \\
 \hline
 & c_1 c_2 c_3 \dots c_{n-1} c_n
 \end{aligned}
 \quad , \quad
 \begin{aligned}
 & c_i = b_i \oplus b_{i-1}, \quad b_0 = 0.
 \end{aligned}$$

i	.		
0	000	$000 \oplus 00 = 000$	000
1	001	$001 \oplus 00 = 001$	001
2	010	$010 \oplus 01 = 011$	011
3	011	$011 \oplus 01 = 010$	010
4	100	$100 \oplus 10 = 110$	110
5	101	$101 \oplus 10 = 111$	111
6	110	$110 \oplus 11 = 101$	101
7	111	$111 \oplus 11 = 100$	100

1. : 00,01,11,10.
2. :
2 . 00,01,11,10 0:
000,010,110,100.
2 . 00,01,11,10 :
10,11,01,00.
2 . 10,11,01,00 1:
101,111,011,001.
2 . .2 .2 :
000, 010,110,100,101,111,011,001.

3. .1 , .2 .

4. $n - 2$, $n -$.

$$c_1, c_2, c_3, \dots, c_k$$

k

, ,

,

,

,

$k + 1,$

.

$$A = \{a_1, a_2, a_3\}$$

.

.

.

:

i	$b_1b_2b_3$	B_i
0	000	\emptyset
1	001	a_3
2	011	a_2, a_3
3	010	a_2
4	110	a_1, a_2
5	111	a_1, a_2, a_3
6	101	a_1, a_3
7	100	a_1

,

Program Gray;

Var

i,M,N:byte;

{N- , $=2^N$ - }

G:array[1..M] of byte;

function BinToGray(b:byte):byte;

begin

BinToGray:=b xor (b shr 1)

end;

begin (* *)

For i:=1 **to** M **do** G[i]:=BinToGray(i);

end; (* *)

5. $k -$

$X .$ $X = \{1, 2, \dots, n\} .$ $k -$ $n -$
 $k ,$
 $X .$

1. $(a_1, a_2, \dots, a_k) .$

2. $:$
 $(b_1, b_2, \dots, b_k) = (a_1, \dots, a_{p-1}, a_p + 1, a_p + 2, \dots, a_p + k - p + 1) ,$
 $p = \max \{i \mid a_i < n - k + 1\}$

3. $(b_1, b_2, \dots, b_k) :$
 $(c_1, \dots, c_k) = (b_1, \dots, b_{p'-1}, b_{p'} + 1, b_{p'} + 2, \dots, b_{p'} + k - p' + 1) ,$
 $p' = \begin{cases} p - 1, & b_k = n, \\ k, & b_k < n \end{cases}$

$n -$, $k -$

begin

For i:=0 **to** k **do** A[i]:=i;

p:=k;

while p≥1 **do**

begin

write (A[1],...,A[k]);

if A[k]=n **then** p:=p-1

else p:=k;

If p≥1 **then**

For i:=k **downto** p **do**

A[i]:=A[p]+i-p+1;

end;

end;

4-
 $\{1, \dots, 6\} ,$

1234
1235
1236
1245
1246
1256
1345
1346
1356
1456
2345
2546
2356
2456
3456

6.

$$\begin{array}{c}
n! \\
, \qquad \qquad \qquad n \\
P[1], P[2], \dots, P[n]. \\
, \qquad \qquad \qquad , \\
P[i], \quad i=1, 2, \dots, n, \qquad \qquad \qquad ,
\end{array}$$

$$\begin{array}{c}
P[i] \quad P[j], \, 1 \leq i, j \leq n \qquad \qquad \qquad : \\
vrem := P[i], \, P[i] := P[j], \, P[j] := vrem, \\
vrem - \qquad \qquad \qquad , \\
P[i].
\end{array}$$

$$\begin{array}{c}
\{x_1, x_2, x_3, \dots, x_n\}, \{y_1, y_2, y_3, \dots, y_n\}, \dots \\
X. \qquad \qquad \qquad X \\
, \\
\{x_1, x_2, x_3, \dots, x_n\} < \{y_1, y_2, y_3, \dots, y_n\} \qquad \qquad \qquad , \qquad \qquad \qquad k: \\
x_k \leq y_k \quad x_i = y_i \qquad \qquad \qquad i < k.
\end{array}$$

$$\begin{array}{c}
\{x_1, x_2, x_3, \dots, x_n\}, \{y_1, y_2, y_3, \dots, y_n\}, \dots \\
X. \qquad \qquad \qquad X \\
, \\
\{x_1, x_2, x_3, \dots, x_n\} < \{y_1, y_2, y_3, \dots, y_n\} \qquad \qquad \qquad , \qquad \qquad \qquad k: \\
x_k > y_k \quad x_i = y_i \qquad \qquad \qquad i < k.
\end{array}$$

$$\begin{array}{c}
(1, 2, \dots, n). \\
(n, n-1, \dots, 1). \\
(x_1, x_2, \dots, x_n) \quad (y_1, y_2, \dots, y_n) \\
(y_1, y_2, \dots, y_n)?
\end{array}$$

1.

$$\begin{array}{c}
\leftarrow \\
x = (x_1, x_2, \dots, x_i, x_{i+1}, \dots, x_n) \\
i, \qquad \qquad x_i < x_{i+1}.
\end{array}$$

2. , $x_1 > x_2 > \dots > x_n$, $x = (n, n-1, \dots, 1)$.
 .

3. i , $x_i < x_{i+1} > x_{i+2} > \dots > x_n$.

4. j n i ,
 $x_i < x_j$. $i < j$.

$$x = \left(\overset{\leftarrow}{x_1, x_2, \dots, x_i, x_{i+1}, \dots, x_j, \dots, x_n} \right)$$

5. x_i x_j

$$x = \left(\overset{\leftarrow}{x_1, x_2, \dots, x_i, x_{i+1}, \dots, x_j, \dots, x_n} \right)$$

6. $x_{i+1}, \dots, x_{n-1}, x_n$,

7. $y = (y_1, y_2, \dots, y_n)$.

.

. $x = (2, 6, 5, 8, 7, 4, 3, 1)$.

1. , $x_i = 5$, $x_j = 7$.

2. $i = 3$ $j = 5$:

$$\tilde{x} = (2, 6, 7, 8, 5, 4, 3, 2, 1)$$

3. $x_3, \dots, x_8 \rightarrow x_8, \dots, x_3$:
 $(8, 5, 4, 3, 1) \rightarrow (1, 3, 2, 5, 8)$.

$$y = (2, 6, 7, 1, 3, 4, 5, 8)$$

$$a[0]=0$$

.

For j:=0 **to** n **do** a[j]:=j;{ . .}
 i:=1;
while i≠0 **do**
begin


```

write(a[1],a[2],...,a[n]);
i:=n-1;           {      a[i]}
while a[i]>a[i+1] do i:=i-1;
j:=n;             {      a[j]}
while a[j]<a[i] do j:=j-1;
Swap(a[i],a[j]);

{                                     }
k:=i+1;
m:=i+trunc $\left(\frac{n-1}{2}\right)$ ;
while k≤m do
begin
  Swap(a[k],a[n-k+i+1]);
  k:=k+1;
end;
end;
.           n = 3

```

a^k.

```

a1={ 123}, a1[i]=2, a1[j]=3;
a2={ 132}, a2[i]=1, a2[j]=2;
a3={ 213}, a3[i]=1, a3[j]=3;
a4={ 231}, a4[i]=1, a4[j]=3;
a5={ 312}, a5[i]=1, a5[j]=2;
a6={ 321}, i=0;

```

$X = \{1,2,3\}$

()

()

	()	()
1	1 2 3	1 2 3
2	1 3 2	2 1 3
3	2 1 3	1 3 2
4	2 3 1	3 1 2
5	3 1 2	2 3 1
6	3 2 1	3 2 1

7.

n

k

k

n

n

$A = \{1,2,...,n\}.$

$: \{1,2,...,k\}.$

$: (n-k+1,n-k+2,...,n-1,n).$

k

:

$$a = (a_1, a_2, \dots, a_k)$$

$$b = (a_1, \dots, a_{m-1}, a_m + 1, a_m + 2, \dots, a_m + k - m + 1),$$

$$m = \max \{i | a_i < n - k + i, 1 \leq i \leq k\}.$$

$$b_i = \begin{cases} a_i, & 1 \leq i < m, \\ a_m + i - m + 1, & m \leq i \leq k, \end{cases} \quad m = \begin{cases} m-1, & b_k = n, \\ k, & b_k < n. \end{cases}$$

```

For i:=1 to k do a[i]:=i;
If k=n then m:=1
else m:=k;
while m≠0 do
begin
  write(a[1],...,a[k]);
  if a[k] then m:=m-1
  else m:=k;
  if m≠0 then
    for i=m to k do
      a[i]:=a[m]+i-m+1;
end;

```

n	k
123	
124	
125	
134	
135	
145	
234	
235	
245	
345	

$$5 \quad 3,$$

.

$$(7 \cdot 1) = (1, 1, 1, 1, 1, 1, 1),$$

$$(1 \cdot 2, 5 \cdot 1) = (2, 1, 1, 1, 1, 1),$$

$$(2 \cdot 2, 3 \cdot 1) = (2, 2, 1, 1, 1),$$

$$(3 \cdot 2, 1 \cdot 1) = (2, 2, 2, 1),$$

$$(1 \cdot 3, 4 \cdot 1) = (3, 1, 1, 1, 1),$$

$$(1 \cdot 3, 1 \cdot 2, 2 \cdot 1) = (3, 2, 1, 1),$$

$$(1 \cdot 3, 2 \cdot 2) = (3, 2, 2),$$

$$(2 \cdot 3, 1 \cdot 1) = (3, 3, 1),$$

$$(1 \cdot 4, 3 \cdot 1) = (4, 1, 1, 1),$$

$$(1 \cdot 4, 1 \cdot 2, 1 \cdot 1) = (4, 2, 1),$$

$$(1 \cdot 4, 1 \cdot 3) = (4, 3),$$

$$(1 \cdot 5, 2 \cdot 1) = (5, 1, 1),$$

$$(1 \cdot 5, 1 \cdot 2) = (5, 2),$$

$$(1 \cdot 6, 1 \cdot 1) = (6, 1),$$

$$(1 \cdot 7) = (7).$$