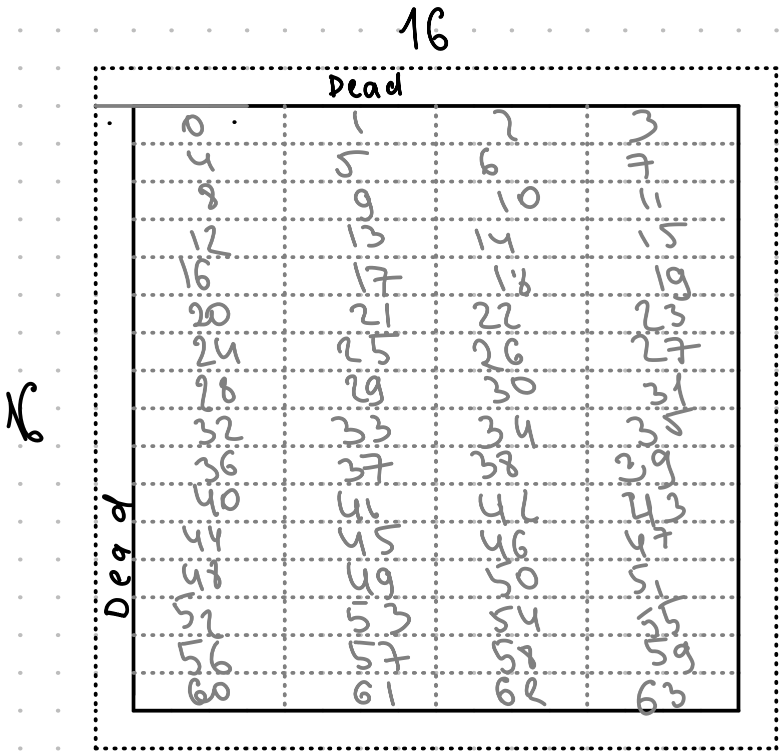
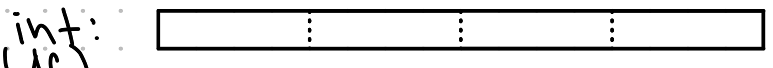
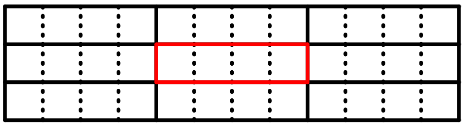


0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31
32	33	34	35
36	37	38	39
40	41	42	43
44	45	46	47
48	49	50	51
52	53	54	55
56	57	58	59
60	61	62	63

поле -
64xint16 +
4+4 (верх, низ)



4 клетки в 16 бит



N = M[(j-1)%4]

S = M[(i+1)%4]

W = M[i]>>4 | (0b1111 0000 0000 0000 & M[i-1

E = M[i]<<4 | (0b0000 0000 0000 1111 & M[i+1] f(ceil:1 , count:3)

count

dead

0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	1
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	1
1	0	1	1	1
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	
a	b	c	d	

Dead and $011_2 = 3_{10}$ neighbours

Alive and $010_2 = 2_{10}$ neighbours
$011_2 = 3_{10}$ neighbours

$$f(a,b,c,d) = (\bar{a} \,\&\, \bar{b} \overset{\textcircled{1}}{\&} c \,\&\, d) \vee (a \,\&\, \bar{b} \overset{\textcircled{2}}{\&} c \,\&\, \bar{d}) \vee (a \,\&\, \bar{b} \overset{\textcircled{3}}{\&} c \,\&\, d)$$

минимизация

$\textcircled{1}$ и $\textcircled{3}$ $\quad \bar{b}cd(\bar{a} \vee a) = \bar{b}cd \; \textcircled{4}$

$\textcircled{2}$ и $\textcircled{4}$ $\quad \bar{b}cd \vee a\bar{b}c\bar{d} = \bar{b}c(d \vee a\bar{d}) \overset{(*)}{=} \underset{\sim\sim\sim}{\bar{b}c(d \vee a)}$

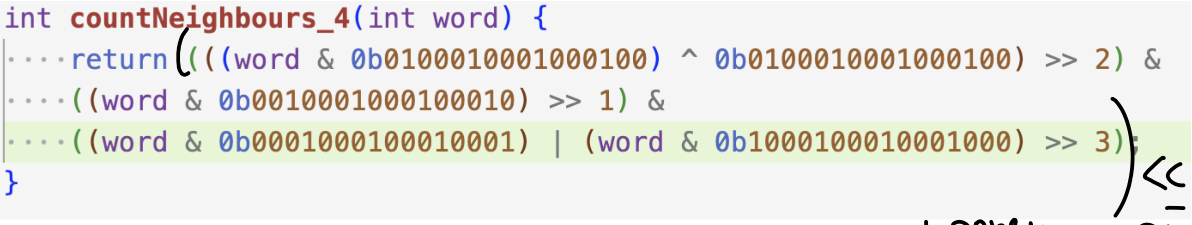
$$f(a,b,c,d) = \bar{b}c(d \vee a)$$

$A+\bar{A}B = A+B$ (*)

A	B	$A+\bar{A}B$	$A+B$
0	0	0	0
0	1	1	1
1	0	1	1
1	1	1	1

$N = \overline{abcd}_2 = !(N \& 0b0100) \& N \& 0b0010 \&$

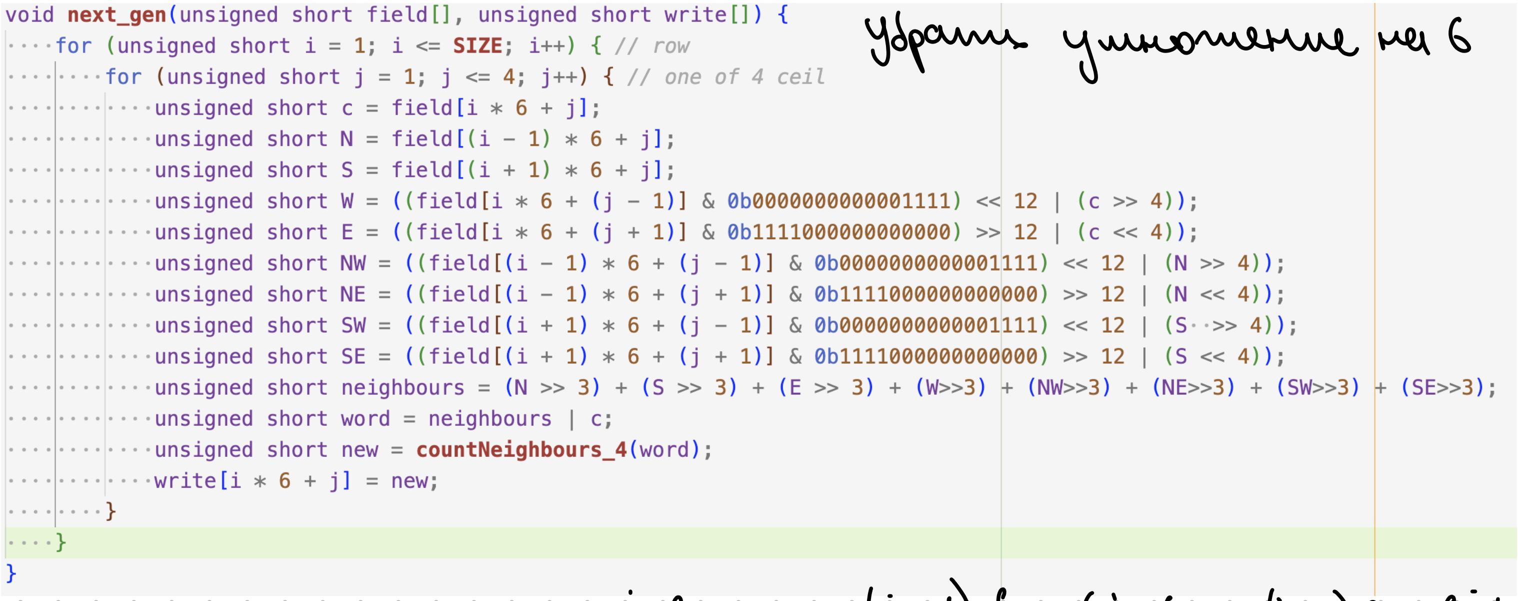
$(N \& 0b0001 \mid N \& 0b1000)$



```
int countNeighbours_4(int word) {
    return (((word & 0b0100010001000100) ^ 0b0100010001000100) >> 2) &
    ((word & 0b0010001000100010) >> 1) &
    ((word & 0b0001000100010001) | (word & 0b1000100010001000) >> 3);
}
```

$) \ll 3$

корректный формат



```
void next_gen(unsigned short field[], unsigned short write[]) {
    for (unsigned short i = 1; i <= SIZE; i++) { // row
        for (unsigned short j = 1; j <= 4; j++) { // one of 4 ceil
            unsigned short c = field[i * 6 + j];
            unsigned short N = field[(i - 1) * 6 + j];
            unsigned short S = field[(i + 1) * 6 + j];
            unsigned short W = ((field[i * 6 + (j - 1)] & 0b0000000000001111) << 12 | (c >> 4));
            unsigned short E = ((field[i * 6 + (j + 1)] & 0b1111000000000000) >> 12 | (c << 4));
            unsigned short NW = ((field[(i - 1) * 6 + (j - 1)] & 0b0000000000001111) << 12 | (N >> 4));
            unsigned short NE = ((field[(i - 1) * 6 + (j + 1)] & 0b1111000000000000) >> 12 | (N << 4));
            unsigned short SW = ((field[(i + 1) * 6 + (j - 1)] & 0b0000000000001111) << 12 | (S  >> 4));
            unsigned short SE = ((field[(i + 1) * 6 + (j + 1)] & 0b1111000000000000) >> 12 | (S << 4));
            unsigned short neighbours = (N >> 3) + (S >> 3) + (E >> 3) + (W>>3) + (NW>>3) + (NE>>3) + (SW>>3) + (SE>>3);
            unsigned short word = neighbours | c;
            unsigned short new = countNeighbours_4(word);
            write[i * 6 + j] = new;
        }
    }
}
```

Убрать умножение на 6

$i = 1 \ldots 16$	$i \cdot 6$	$(i-1) \cdot 6 = 6i-6$	$(i+1)6 = 6i+6$
$k = 6, 12, \ldots, 96$	k	$k-6$	$k+6$

Memory mapped I/O

① Display: 0xffd0 - 0xffef

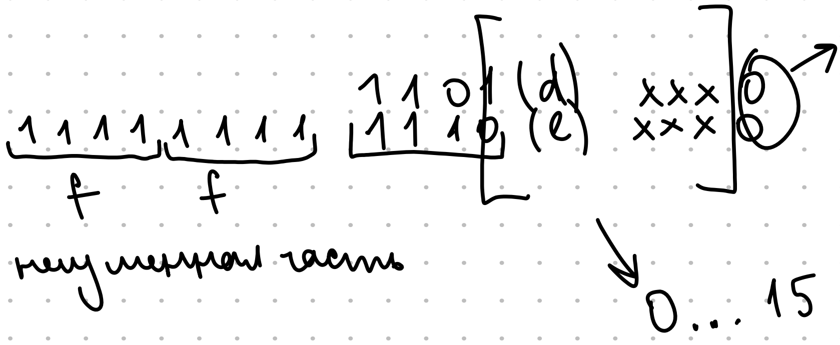
16 words x 16 bits

1 word - 1 column

0xffd0 - 0

0xffd2 - 1

0xffd4 - 2.

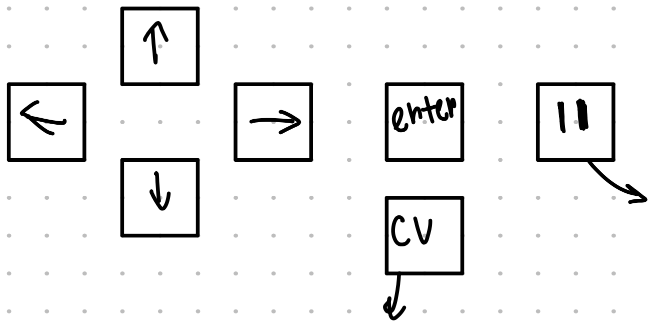


чёт/неч байт в слове

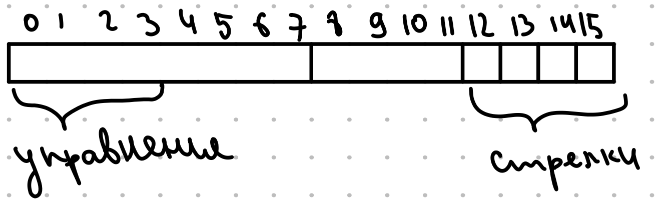
пишем всегда в чёт. по слову (не байт)

② Keyboard

game_state: {is_paused, X_cord, Y_cord, Cursor visi...} положение курсора

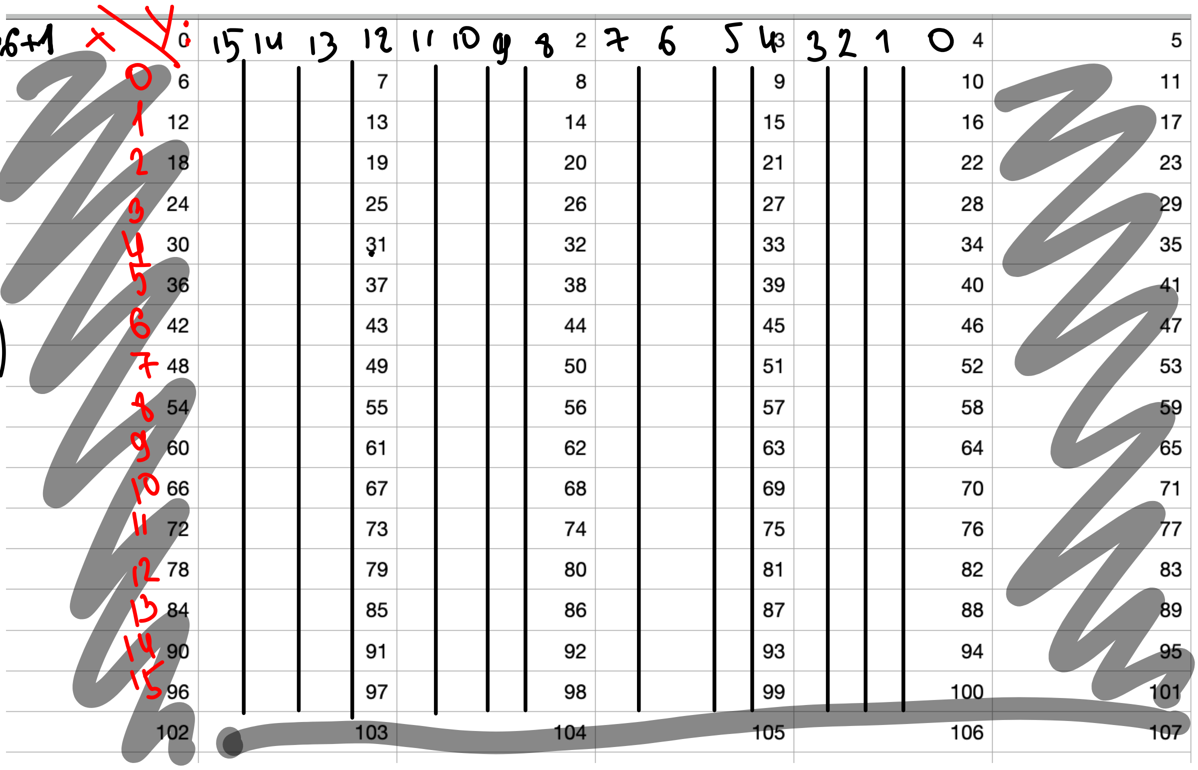


II → меняет состояние игры PLAY | PAUSE



x·6+1 x y:

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0



0	[illegible]	2	3	4	5
6	7	8	9	10	11
12	13	14	15	16	17
18	19	20	21	22	23
24	25	26	27	28	29
30	31	32	33	34	35
36	37	38	39	40	41
42	43	44	45	46	47
48	49	50	51	52	53
54	55	56	57	58	59
60	61	62	63	64	65
66	67	68	69	70	71
72	73	74	75	76	77
78	79	80	81	82	83
84	85	86	87	88	89
90	91	92	93	94	95
96	97	98	99	100	101
102	103	104	105	106	107

$(x \cdot 6+1+y/4)$

12