Homework and Pop Quiz #7 of the course: Theory of Computer Games.

1. Let a 32-bit word with 32 bits represent **the black rooks** in a bitboard of dark chess. Assume that your machine does not support bit counting. Write a faster parallel bit counting code than the one taught in the class. Hints: the original code is as follows.

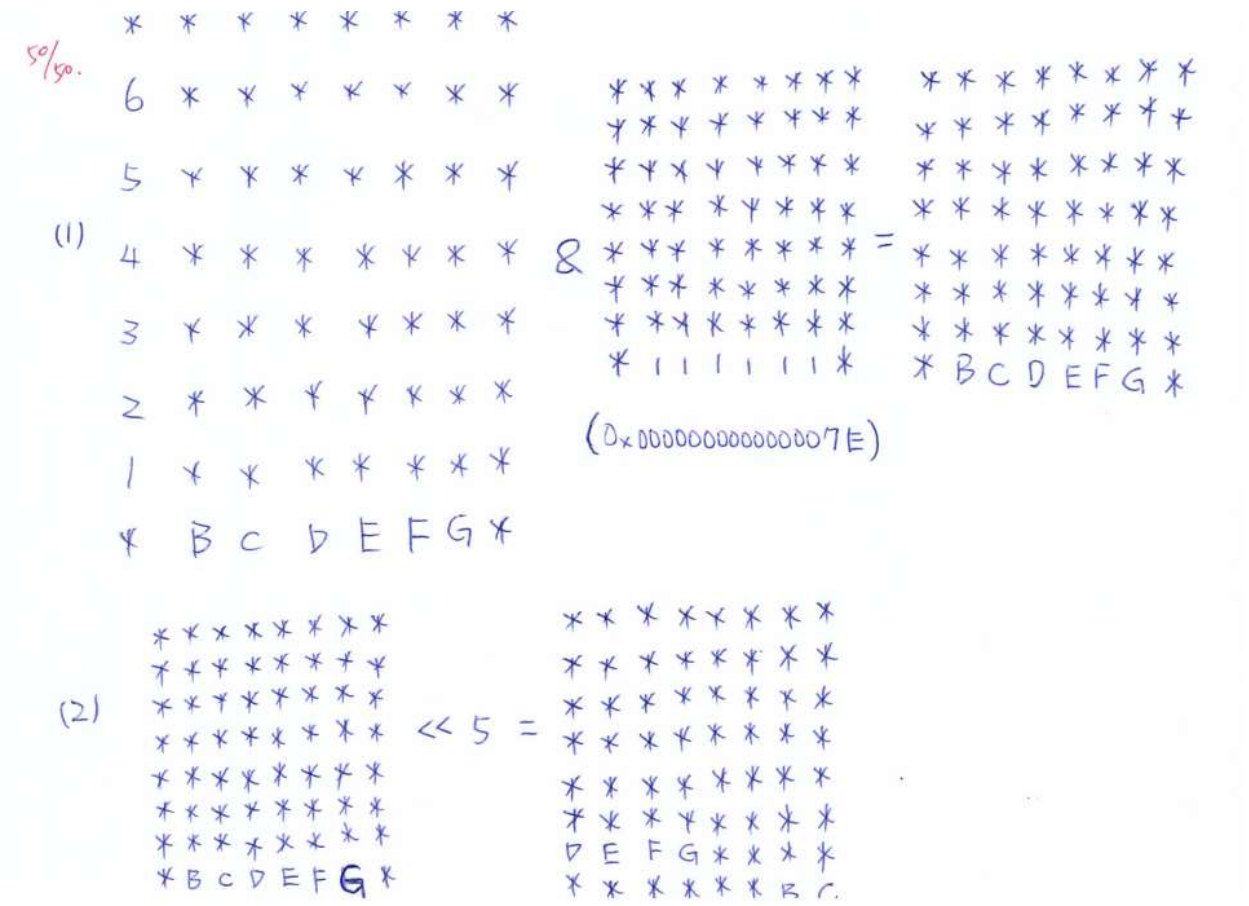
```
int Bitcount(unsigned long long b) {
  b = ( b & 0x5555555555555555 ) + ( ( b >> 1 ) & 0x5555555555555555 );
  b = ( b & 0x3333333333333333 ) + ( ( b >> 2 ) & 0x3333333333333333 );
  return ((( b + (b >> 4) ) & 0x0f0f0f0f0f0f0f0f ) * 0x0101010101010101 ) >> 56;
}
```

```
int Bitcount(unsigned int b){
    b = b - ((b >> 1) & 0x55555555);
    b = (b & 0x33333333) + ((b>>2) & 0x33333333
    return (((b + (b>>4)) & 0x0F0F0F0F) * 0x01010101) >>2
}
```

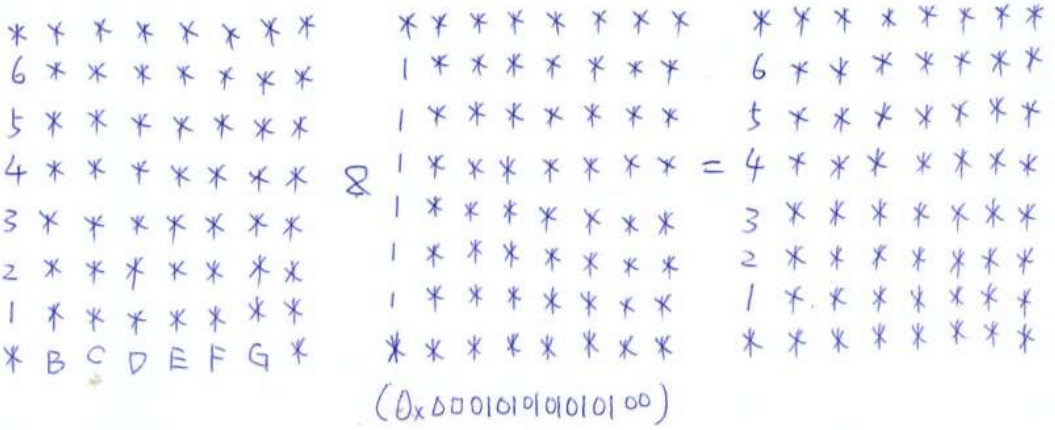
比上課教的code少了一個&

2. Consider a rook at the lower left corner of the left bitboard of the figure below (also in Page 62 of new slides). The bit representation of bitboard is based on the mapping in Page 25. We want to get information at (1 2 3 4 5 6 B C D E F G) and pack them into a segment [1 2 3 4 5 6 B C D E F G] for table lookup as shown in the right. Design the operations to perform this. Hint: the less operations, the better.

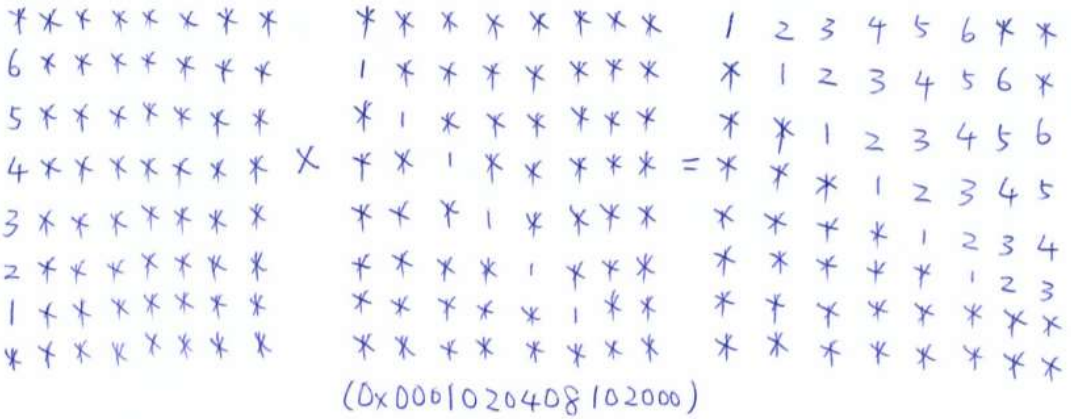
```
* * * * * * * *          * * * * * * * *
6 * * * * * * *          * * * * * * * *
5 * * * * * * *          * * * * * * * *
4 * * * * * * *          * * * * * * * *
3 * * * * * * *          * * * * * * * *
2 * * * * * * *          * * * * * * * *
1 * * * * * * *          D E F G * * * *
* B C D E F G *    ➔     1 2 3 4 5 6 B C
```



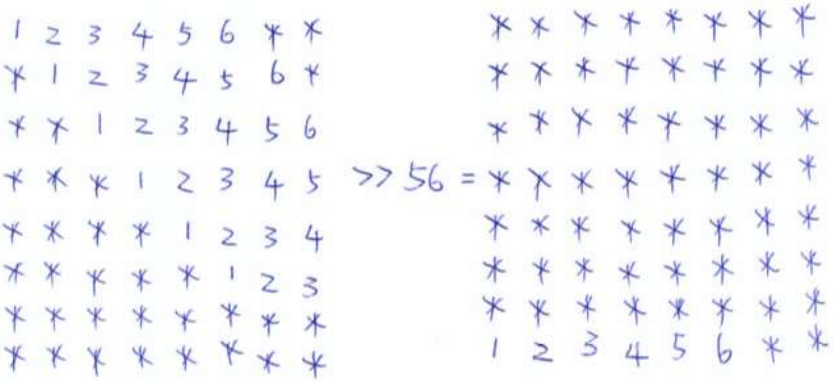
(3)



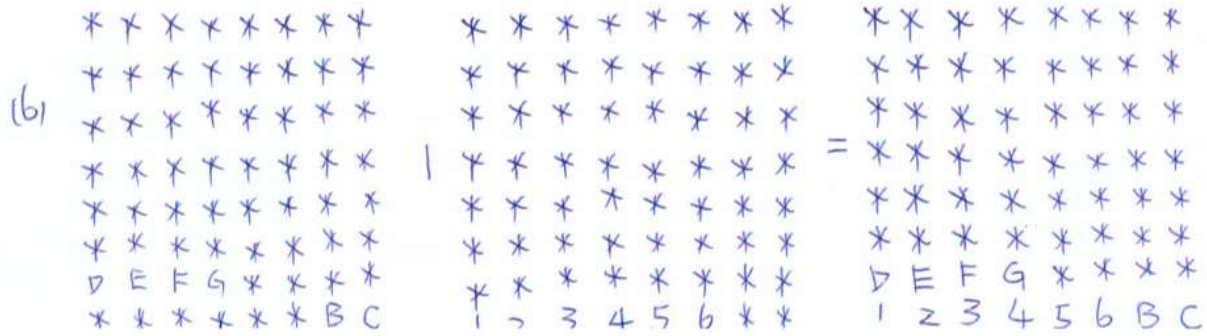
(4)



(5)



(6)



假設原盤面是 b，後來的盤面是 b'

$$b' = \left(\left(b \,\&\, 0x0000000000000\text{?E} \right) << 5 \right) \;|\; \left(\left(b \,\&\, 0x0001010101010100 \right) \times 0x0001020408102000 \right) >> 56$$