Bits

Bitwise operators

- NOT   ~
- OR |
- AND   &
- XOR   ^
- SHR   >>
- SHL   <<

NOT ~

A	~A
0	1
1	0

NOT ~

A = 0000 0000 0000 1010

~A = 1111 1111 1111 0101

OR |

A	B	A|B
0	0	0
0	1	1
1	0	1
1	1	1

OR |

A =   01001000

B =   10111000

A | B = 11111000

AND &

A	B	A&B
0	0	0
0	1	0
1	0	0
1	1	1

AND &

A =   01001000

B =   10111000

A & B = 00001000

XOR ^

A	B	A^B
0	0	0
0	1	1
1	0	1
1	1	0

XOR ^

A =   01001000

B =   10111000

A ^ B = 11110000

SHR >> (div / 2)

A = 00101

A = A >> 1

A = 00010

A = 00101

A = A >> 2

A = 00001

SHL << (mul * 2)

A = 00101

A = A << 1

A = 01010

A = 00101

A = A << 2

A = 10100

Set bit

$$A = (A \mid (1 << idx))$$

test bit

```
bool flag = ((A >> idx) & 1)
```

Counting ones in binary representation

```
int cnt = __builtin_popcount(num);
```
● will not work with Visual studio.

Complete Search

- Power Set.

Power Set

Given a set of items, find all possible subsets including the empty subset.

S = {1, 2, 3}

P(S) = {}, {1}, {2}, {3}, {1, 2}, {1, 3}, {2, 3}, {1, 2, 3}

Example I

Given a set of items, each with a mass and a value, determine the number of each item to include in a collection so that the total weight is less than or equal to a given limit and the total value is as large as possible.

Input:

15 5

(4$, 12 kg), (2$, 1 kg), (2$, 2 kg), (1$, 1 kg), (10$, 4 kg)

Output: ??

Example II

Bahosain has a lot of coins in his pocket. These coins are really heavy, so he always tries to get rid of some of the coins by using them when paying for the taxi. Whenever Bahosain has to pay Spennies for the taxi driver, he tries to choose the maximum number of coin pieces to pay. The driver will accept receiving more than Spennies only if he can't remove one or more of the given coins and still has Sor more pennies. For example, if Bahosain uses the coins of the following values: 2, 7and 5to pay 11pennies, the taxi driver will not accept this because the coin of value 2 can be removed. On the other hand, when Bahosain uses coins of 7and 5to pay 11 pennies, the driver will accept it. Note that the driver won't give Bahosain any change back if he receives more than Spennies, and Bahosain doesn't care!

Example II - cont.

Input:

The first line of input contains T (1 ≤ T ≤ 1001), the number of test cases. The first line of each test case contains two integers: N (1 ≤ N ≤ 10)and S (1 ≤ S ≤ 1000), where Nis the number of coins in Bahosain's pocket and Sis the amount (in pennies) Bahosain has to pay for the taxi driver. The next line contains Nspace-separated integers between 1and 100 that represent the values (in pennies) of the coins in Bahosain's pocket.

Output:

For each test case, print a single line with the maximum number of coins Bahosain can use to pay for the driver.

Example II – cont.

Input: 3

2   6

5 9

4   1   3   5   4

7 37

7   5   8   8   5   10   4