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# 1.0 概览

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## 代码检查

### 上机前

- 写代码的人应当**完整阅读过题面**，清楚题目的**所有范围限制**。
- **避免出现没想清楚就上机**的情况。

### 提交前

- [Optional] 若题目的样例较弱，可以尝试构造一些 corner cases，力求测试样例**覆盖所有的分支情况**。
- **逐一检查所有变量的类型、数组大小、取模/模数、多测清空，以及空间限制、是否存在无解、是否关闭了同步流、读入是否超出 `int` 范围。**
- **确保所有函数都写了返回值。**
- 大致扫描一遍代码整体，不要出现一些**明显的符号或引用错误**。
- 一旦出现错误，对代码修改后，应**重新过一遍上述流程**。

### Rejected 后

- 依情况顺序执行以下步骤：
  - **重新认真地读一遍题目。**
  - 肉眼差错/小黄鸭调试法。
  - 构造小样例测试，极限数据测试，卡常。

- （基本不要使用）对拍。

## 缺省源

```
1  #include <bits/stdc++.h>
2
3  template <class T>
4  inline void read(T &res)
5  {
6      char ch; bool flag = false; res = 0;
7      while (ch = getchar(), !isdigit(ch) && ch != '-');
8      ch == '-' ? flag = true : res = ch ^ 48;
9      while (ch = getchar(), isdigit(ch))
10         res = res * 10 + ch - 48;
11     flag ? res = -res : 0;
12 }
13
14 template <class T>
15 inline void nonnegative_put(T x)
16 {
17     if (x > 9)
18         nonnegative_put(x / 10);
19     putchar(x % 10 + 48);
20 }
21
22 template <class T>
23 inline void put(T x)
24 {
25     if (x < 0)
26         x = -x, putchar('-');
27     nonnegative_put(x);
28 }
29
30 template <class T>
31 inline void CkMin(T &x, T y) {x > y ? x = y : 0;}
32 template <class T>
33 inline void CkMax(T &x, T y) {x < y ? x = y : 0;}
34 template <class T>
35 inline T Min(T x, T y) {return x < y ? x : y;}
36 template <class T>
37 inline T Max(T x, T y) {return x > y ? x : y;}
38 template <class T>
39 inline T Abs(T x) {return x < 0 ? -x : x;}
40 template <class T>
41 inline T Sqr(T x) {return x * x;}
42 //call Sqr((ll)x) when the type of returned value is "long long".
43
44 using std::map;
45 using std::set;
46 using std::pair;
47 using std::bitset;
48 using std::string;
49 using std::vector;
50 using std::complex;
51 using std::multiset;
52 using std::priority_queue;
53
```

```

54 typedef long long ll;
55 typedef long double ld;
56 typedef complex<ld> com;
57 typedef pair<int, int> pir;
58 const ld pi = acos(-1.0);
59 const ld eps = 1e-8;
60 const int Maxn = 1e9;
61 const int Minn = -1e9;
62 const int mod = 998244353;
63 const int N = 1e5 + 5;
64 int T_data, n;
65
66 inline void solve()
67 {
68
69 }
70
71 int main()
72 {
73     read(T_data);
74     while (T_data--)
75         solve();
76 }

```

## 关闭同步流

```

1  using std::ios;
2  using std::cin;
3  using std::cout;
4
5  int main()
6  {
7      ios::sync_with_stdio(false);
8      cin.tie(nullptr);
9      cout.tie(nullptr);
10 }

```

## 随机打乱

```

1      std::mt19937 rng(time(0));
2      std::shuffle(a + 1, a + n + 1, rng);

```

## linux 下对拍

- 以 A + B problem 对拍为例，编译器环境为 codeblocks。
- test/main.cpp

```

1  #include <bits/stdc++.h>
2
3  using std::vector;
4
5  int main()
6  {
7      int a, b;
8      freopen("../test_gen/test.in", "r", stdin);

```

```

9     freopen("../test_check/test.out", "w", stdout);
10
11     scanf("%d%d", &a, &b);
12     printf("%d\n", a + b);
13
14     fclose(stdin); fclose(stdout);
15     return 0;
16 }

```

- test\_bf/main.cpp

```

1  #include <iostream>
2
3  using namespace std;
4
5  int main()
6  {
7      freopen("../test_gen/test.in", "r", stdin);
8      freopen("../test_check/test_bf.out", "w", stdout);
9
10     int a, b;
11     std::cin >> a >> b;
12     std::cout << a + b << std::endl;
13
14     fclose(stdin); fclose(stdout);
15     return 0;
16 }

```

- test\_gen/main.cpp

```

1  #include <iostream>
2
3  using namespace std;
4  const int mod = 1e9;
5  int main()
6  {
7      freopen("test.in", "w", stdout);
8
9      srand(time(0));
10     printf("%d %d\n", rand() % mod + 1, rand() % mod + 1); // 64bit 的
ubunutu rand 的最大值一般是  $2^{31} - 1$ 
11     return 0;
12 }

```

- test\_check/main.cpp

```

1  #include <iostream>
2
3  using namespace std;
4
5  int main()
6  {
7      while (1)
8      {
9          system("g++ ../test_gen/main.cpp -o test_gen");
10         system("g++ ../test/main.cpp -o test");

```

```

11     system("g++ ../test_bf/main.cpp -o test_bf");
12
13     system("../test_gen");
14     system("../test");
15     system("../test_bf");
16
17     if (system("diff test.out test_bf.out"))
18         break ;
19     puts("checking");
20 }
21 return 0;
22 }

```

## bitset

C++中**\_\_builtin**内置函数<sup>Q</sup>是GCC、Clang等编译器<sup>Q</sup>所提供的一系列高效的内联函数，其中包括许多与**二进制**<sup>Q</sup>相关的函数。下面是所有与二进制相关的**\_\_builtin**函数：

- **\_\_builtin\_popcount(x)**: 返回x的二进制表示中1的个数。

```

unsigned int x = 65535u;
int count = __builtin_popcount(x); // count的值为16

```

- **\_\_builtin\_clz(x)**: 返回x的二进制表示中从最高位开始连续0的个数，如果x的值为0，则返回所在类型的位宽。

```

unsigned int x = 0xf0000u;
int count = __builtin_clz(x); // count的值为8

```

- **\_\_builtin\_ctz(x)**: 返回x的二进制表示中从最低位开始连续0的个数，如果x的值为0，则返回所在类型的位宽。

```

unsigned int x = 0xf0u;
int count = __builtin_ctz(x); // count的值为4

```

- **\_\_builtin\_parity(x)**: 返回x的二进制表示中1的个数是否为**奇数**<sup>Q</sup>，是则返回1，否则返回0。

```

unsigned int x = 0xfu;
int parity = __builtin_parity(x); // parity的值为0

```

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- `__builtin_bswap16(x)`: 将x的二进制表示中的16位进行字节交换。

```
unsigned short x = 0xaabb;
unsigned short y = __builtin_bswap16(x); // y的值为0xbbaa
```

- `__builtin_bswap32(x)`: 将x的二进制表示中的32位进行字节交换。

```
unsigned int x = 0xaabbccdd;
unsigned int y = __builtin_bswap32(x); // y的值为0xddccbbaa
```

- `__builtin_bswap64(x)`: 将x的二进制表示中的64位进行字节交换。

```
unsigned long long x = 0xaabbccddeeff1122ull;
unsigned long long y = __builtin_bswap64(x); // y的值为0x2211ffeeddccbbaa
```

CSDN @Log\_x

## Python

- 读入多个以空间间隔的整数:

```
1 string = input().split() #a list of strings
2 n = int(string[0])
3 k = int(string[1])
```

- 取整数长度:

```
1 Len = len(str(n))
```

- 格式化输出:

```
1 print(f'hello world {n} {k}')
```

- 数组的简单使用:

```
1 ex = [1]
2 for i in range(1, 101):
3     ex.append(ex[i - 1] * 10)
```

- `range(l,r,d)` 分别表示起点、终点和步幅:

```
1 >>> list(range(-10, -100, -30))
2 [-10, -40, -70]
```

- 按格式输出

```
1 print('%.2f' % a)
```

## 高精度

- 仅供参考，且仅支持非负整数，有需求优先考虑 Python。

```
1  #include<bits/stdc++.h>
2
3  using std::pair;
4  using std::make_pair;
5  const int N_bigint = 2500;
6  char s[N_bigint * 10];
7
8  template <class T>
9  inline T Max(T x, T y) {return x > y ? x : y;}
10
11 int askLenx(int x)
12 {
13     x = abs(x);
14     int cnt = 0;
15     while (x)
16     {
17         x /= 10;
18         ++cnt;
19     }
20     return cnt;
21 }
22
23 struct bigint
24 {
25     typedef long long ll;
26     const ll base = 1e8;
27     ll a[N_bigint];
28     int len;
29
30     void clear() {memset(a, 0, sizeof(a)); a[len = 1] = 0;}
31     bigint() {clear();}
32     bigint(ll x) {*this = x;}
33     bigint operator = (const bigint &b)
34     {
35         memset(a, 0, sizeof(a));
36         len = b.len;
37         for (int i = 1; i <= len; ++i)
38             a[i] = b.a[i];
39         return *this;
40     }
41
42     bigint operator + (const bigint &b) const
43     {
44         int L = Max(len, b.len);
45         bigint tmp;
46         for (int i = 1; i <= L; ++i)
47         {
48             if (i > len)
49                 tmp.a[i] += b.a[i];
50             else if (i > b.len)
51                 tmp.a[i] += a[i];
52             else
53                 {
```

```

54         tmp.a[i] += a[i] + b.a[i];
55         if (tmp.a[i] >= base)
56         {
57             tmp.a[i] -= base;
58             ++tmp.a[i + 1];
59         }
60     }
61 }
62 if (tmp.a[L + 1]) tmp.len = L + 1;
63 else tmp.len = L;
64 return tmp;
65 }
66 bigint operator - (const bigint &b) const
67 {
68     int L = Max(len, b.len);
69     bigint tmp;
70     for (int i = 1; i <= L; ++i)
71     {
72         tmp.a[i] += a[i] - b.a[i];
73         if (tmp.a[i] < 0)
74         {
75             tmp.a[i] += base;
76             --tmp.a[i + 1];
77         }
78     }
79     while (L > 1 && !tmp.a[L]) --L;
80     tmp.len = L;
81     return tmp;
82 }
83 bigint operator * (const bigint &b) const
84 {
85     int L = len + b.len;
86     bigint tmp;
87     for (int i = 1; i <= len; ++i)
88         for (int j = 1; j <= b.len; ++j)
89         {
90             tmp.a[i + j - 1] += a[i] * b.a[j];
91             if (tmp.a[i + j - 1] >= base)
92             {
93                 tmp.a[i + j] += tmp.a[i + j - 1] / base;
94                 tmp.a[i + j - 1] %= base;
95             }
96         }
97     tmp.len = len + b.len;
98     while (tmp.len > 1 && !tmp.a[tmp.len])
99         --tmp.len;
100     return tmp;
101 }
102 pair<bigint, bigint> Divide(const bigint &a, bigint b) const
103 {
104     int L = a.len; bigint c, d;
105     for (int i = L; i; --i)
106     {
107         c.a[i] = 0;
108         d = d * base;
109         d.a[1] = a.a[i];
110         ll l = 0, r = base - 1, mid;
111         while (l < r)

```



```

112         {
113             mid = (l + r + 1) >> 1;
114             if (b * mid <= d) l = mid;
115             else r = mid - 1;
116         }
117         c.a[i] = l;
118         d -= b * l;
119     }
120     while (L > 1 && !c.a[L])
121         --L;
122     c.len = L;
123     return make_pair(c, d);
124 }
125 bigint operator / (ll x) const
126 {
127     ll d = 0; bigint tmp;
128     for (int i = len; i; --i)
129     {
130         d = d * base + a[i];
131         tmp.a[i] = d / x;
132         d %= x;
133     }
134     tmp.len = len;
135     while (tmp.len > 1 && !tmp.a[tmp.len])
136         --tmp.len;
137     return tmp;
138 }
139 ll operator % (ll x) const
140 {
141     ll d = 0;
142     for (int i = len; i; --i) d = (d * base + a[i]) % x;
143     return d;
144 }
145 bigint operator / (const bigint &b) const {return Divide(*this,
146 b).first;}
147 bigint operator % (const bigint &b) const {return Divide(*this,
148 b).second;}
149 bigint &operator += (const bigint &b) {*this = *this + b; return
150 *this;}
151 bigint &operator -= (const bigint &b) {*this = *this - b; return
152 *this;}
153 bigint &operator *= (const bigint &b) {*this = *this * b; return
154 *this;}
155 bigint &operator ++() {bigint T; T = 1; *this = *this + T; return
156 *this;} //前缀++
157 bigint &operator --() {bigint T; T = 1; *this = *this - T; return
158 *this;} //前缀--
159 bigint operator ++(int) {bigint T, tmp = *this; T = 1; *this = *this +
160 T; return tmp;} //后缀++
161 bigint operator --(int) {bigint T, tmp = *this; T = 1; *this = *this -
162 T; return tmp;} //后缀--
163 bigint operator + (ll x) const {bigint T; T = x; return *this + T;}
164 bigint operator - (ll x) const {bigint T; T = x; return *this - T;}
165 bigint operator * (ll x) const {bigint T; T = x; return *this * T;}
166 bigint operator *= (ll x) {*this = *this * x; return *this;}
167 bigint operator += (ll x) {*this = *this + x; return *this;}
168 bigint operator -= (ll x) {*this = *this - x; return *this;}
169 bigint operator /= (ll x) {*this = *this / x; return *this;}

```

```

161     bigint operator %= (ll x) { *this = *this % x; return *this; }
162     bool operator == (ll x) const { bigint T; T = x; return *this == T; }
163     bool operator != (ll x) const { bigint T; T = x; return *this != T; }
164     bool operator <= (ll x) const { bigint T; T = x; return *this <= T; }
165     bool operator >= (ll x) const { bigint T; T = x; return *this >= T; }
166     bool operator < (ll x) const { bigint T; T = x; return *this < T; }
167     bool operator > (ll x) const { bigint T; T = x; return *this > T; }
168     bigint operator = (ll x)
169     {
170         len = 0;
171         while (x)
172             a[++len] = x % base, x /= base;
173         if (!len) a[++len] = 0;
174         return *this;
175     }
176     bool operator < (const bigint &b) const
177     {
178         if (len < b.len) return 1;
179         if (len > b.len) return 0;
180         for (int i = len; i; --i)
181         {
182             if (a[i] < b.a[i]) return 1;
183             if (a[i] > b.a[i]) return 0;
184         }
185         return 0;
186     }
187     bool operator == (const bigint &b) const
188     {
189         if (len != b.len) return 0;
190         for (int i = len; i; --i)
191             if (a[i] != b.a[i]) return 0;
192         return 1;
193     }
194     bool operator != (const bigint &b) const { return !(*this == b); }
195     bool operator > (const bigint &b) const { return !(*this < b || *this ==
b); }
196     bool operator <= (const bigint &b) const { return (*this < b) || (*this
== b); }
197     bool operator >= (const bigint &b) const { return (*this > b) || (*this
== b); }
198
199     void str(char *s)
200     {
201         int l = strlen(s);
202         ll x = 0, y = 1; len = 0;
203         for (int i = l - 1; i >= 0; --i)
204         {
205             x = x + (s[i] - '0') * y;
206             y *= 10;
207             if (y == base)
208             {
209                 a[++len] = x;
210                 x = 0;
211                 y = 1;
212             }
213         }
214         if (!len || x)
215             a[++len] = x;

```

```

216     }
217     void read()
218     {
219         scanf("%s", s);
220         this->str(s);
221     }
222     void print() const
223     {
224         printf("%d", (int)a[len]);
225         for (int i = len - 1; i; --i)
226         {
227             for (int j = base / 10; j >= 10; j /= 10)
228             {
229                 if (a[i] < j) putchar('0');
230                 else break;
231             }
232             printf("%d", (int)a[i]);
233         }
234         putchar('\n');
235     }
236     int askLen() const
237     {
238         return (len - 1) * 8 + askLenx(a[len]);
239     }
240 }a, b;
241
242 int main()
243 {
244     a.read();
245     b.read();
246     (a + b).print();
247     if (a >= b)
248         (a - b).print();
249     else
250     {
251         putchar('-');
252         (b - a).print();
253     }
254     (a * b).print();
255     pair<bigint, bigint> t = a.Divide(a, b);
256     t.first.print(); t.second.print();
257 }

```