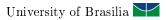
# Competitive programming Notebook •



## Meia noite eu te conto

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#### 1 General

#### 1.1 Random

```
1 random_device dev;
2 mt19937 rng(dev());
4 uniform_int_distribution < mt19937::result_type > dist
      (1, 6); // distribution in range [1, 6]
6 int val = dist(rng);
  1.2 Split
vector<string> split(string s, char key=' ') {
      vector < string > ans;
      string aux = "";
      for (int i = 0; i < (int)s.size(); i++) {</pre>
          if (s[i] == key) {
               if (aux.size() > 0) {
                  ans.push_back(aux);
                   aux = "";
              }
1.0
          } else {
              aux += s[i];
12
```

#### 1.3 Base Converter

return ans;

if ((int)aux.size() > 0) {

ans.push\_back(aux);

}

15

16

1.7

18

19

20 21 }

```
1 const string digits = "0123456789
       ABCDEFGHIJKLMNOPQRSTUVWXYZ";
3 11 tobase10(string number, int base) {
      map < char, int > val;
for (int i = 0; i < digits.size(); i++) {</pre>
           val[digits[i]] = i;
       }
      ll ans = 0, pot = 1;
g
10
       for (int i = number.size() - 1; i >= 0; i--) {
           ans += val[number[i]] * pot;
12
           pot *= base;
13
1.4
15
       return ans;
16
17 }
19 string frombase10(ll number, int base) {
      if (number == 0) return "0";
20
21
       string ans = "";
       while (number > 0) {
24
           ans += digits[number % base];
           number /= base;
26
27
       reverse(ans.begin(), ans.end());
29
30
3.1
       return ans;
32 }
```

```
3.3
34 // verifica se um nÞmero estÃą na base especificada
35 bool verify_base(string num, int base) {
36
       map < char , int > val;
37
       for (int i = 0; i < digits.size(); i++) {</pre>
           val[digits[i]] = i;
38
39
       for (auto digit : num) {
41
           if (val[digit] >= base) {
               return false;
43
44
45
46
47
       return true;
```

### 1.4 Template

#### $2 ext{DS}$

#### 2.1 Dsu

```
_{2} DSU - Disjoint Set Union (or Union Find)
4 find(x) -> find component that x is on
5 join(a, b) -> union of a set containing 'a' and set
      containing b
7 find / join with path compreension -> O(inv_Ackermann
      (n)) [0(1)]
8 find / join without path compreension -> O(logN)
10 https://judge.yosupo.jp/submission/126864
11 */
12
13 struct DSU {
14
      int n = 0, components = 0;
15
      vector < int > parent;
16
17
      vector < int > size;
18
      DSU(int nn){
19
          n = nn;
20
21
           components = n;
           size.assign(n + 5, 1);
22
           parent.assign(n + 5, 0);
23
24
           iota(parent.begin(), parent.end(), 0);
25
26
      int find(int x){
27
           if(x == parent[x]) {
28
29
               return x;
30
```

```
//path compression
3.1
32
           return parent[x] = find(parent[x]);
3.3
34
       void join(int a, int b){
           a = find(a);
36
           b = find(b);
           if(a == b) {
3.8
                return;
39
40
           if(size[a] < size[b]) {</pre>
41
                swap(a, b);
43
           parent[b] = a;
44
           size[a] += size[b];
45
           components -= 1;
46
47
48
      int sameSet(int a, int b) {
           a = find(a);
5.0
           b = find(b);
51
           return a == b;
52
5.3
54
55 };
```

#### 2.2 Ordered Set

```
1 // Ordered Set
2 //
3 // set roubado com mais operacoes
4 //
5 // para alterar para multiset
6 // trocar less para less_equal
7 //
8 // ordered_set < int > s
9 //
10 // order_of_key(k) // number of items strictly
      smaller than k \rightarrow int
11 // find_by_order(k) // k-th element in a set (
      counting from zero) -> iterator
13 // https://cses.fi/problemset/task/2169
14 //
_{15} // O(log N) para insert, erase (com iterator),
      order_of_key, find_by_order
17 using namespace __gnu_pbds;
18 template <typename T>
19 using ordered_set = tree<T,null_type,less<T>,
      rb_tree_tag,tree_order_statistics_node_update>;
```

#### 3 DP

#### 3.1 Knapsack

#### 3.2 Edit Distance

```
1 // Edit Distance / Levenshtein Distance
2 //
3 // numero minimo de operacoes
_4 // para transformar
5 // uma string em outra
6 //
7 // tamanho da matriz da dp eh |a| x |b|
8 // edit_distance(a.size(), b.size(), a, b)
9 //
10 // https://cses.fi/problemset/task/1639
11 //
12 // O(n^2)
13
14 int tb[MAX][MAX];
15
int edit_distance(int i, int j, string &a, string &b)
      if (i == 0) return j;
      if (j == 0) return i;
19
      int &ans = tb[i][j];
20
21
22
      if (ans != -1) return ans;
23
      ans = min({
24
          25
26
          edit_distance(i-1, j-1, a, b) + (a[i-1] != b[
27
      j-1])
      });
28
29
30
      return ans;
31 }
```

## 4 Graph

#### 4.1 Dfs

```
1 // DFS
2 //
3 // Percorre todos os vertices
4 // priorizando profundidade
5 //
6 // 0(n+m)
8 vector<vector<int>> g;
9 vector < bool > vis;
10
void dfs(int s){
      if(vis[s]) return;
      vis[s] = true;
13
      for(auto v : g[s]){
14
15
           dfs(v);
16
17 }
```