```cpp
class Suffix_Array {
private:
  struct sa_t {
    int r0, r1;
    int p;
    bool operator<(const sa_t &another) const {
      return r0 != another.r0 ? r0 < another.r0 : r1 < another.r1;
    }
  };
public:
  // excluding empty substring
  static vi suffix_array(const string &s) {
    int n = s.length();
    vi ret(n);
    vector<sa_t> a(n); // fst = current rank, snd add rank
    Loop(k, ceillog2(n)) {
      if (k == 0) {
        Loop(i, n) a[i] = { s[i], 0, i };
      }
      else {
        int d = 1 << (k - 1);
        Loop(i, n) {
          if (inrange(a[i].p + d, n)) a[i].r1 = ret[a[i].p + d];
          else a[i].r1 = -1;
        }
      }
      sort(a.begin(), a.end());
      sa_t pre;
      Loop(i, n) {
        if (i > 0 && a[i].r0 == pre.r0 && a[i].r1 == pre.r1) {
          a[i] = { a[i - 1].r0, 0, a[i].p };
        }
        else {
          pre = a[i];
          a[i] = { i, 0, a[i].p };
        }
        ret[a[i].p] = a[i].r0;
      }
    }
    return ret;
  }
};
```