```cpp
1   #include <iostream>
2   #include <vector>
3   #include <cmath>
4   #include <gmp.h>
5   #include <stdlib.h>
6   #include <errno.h>
7   #include <limits.h>
8   typedef unsigned int uint;
9   using std::cout;
10  using std::cerr;
11  using std::endl;
12  using std::cin;
13  using std::vector;
14
15  void usage (const char *program_name) {
16          cerr << "Usage : " << program_name << " integer" << endl;
17  }
18
19  vector<uint> *primes_list (uint n)
20  {
21          vector<uint> *list = new vector<uint> ();
22          if (n < 2) { return list; }
23
24          list->push_back (2);
25
26          for (uint k = 3; k <= n; k += 2) {
27                  double sqrt_k = sqrt(k);
28                  bool is_prime = true;
29                  vector<uint>::iterator iter;
30                  for (iter = list->begin(); *iter <= sqrt_k; iter++) {
31                          if (k % *iter == 0) {
32                                  is_prime = false;
33                                  break;
34                          }
35                  }
36
37                  if (is_prime) {
38                          list->push_back (k);
39                  }
40          }
41
42          return list;
43  }
44
45  int main (int argc, char **argv)
46  {
47          if (argc < 2) {
48                  usage (argv[0]);
49                  exit(EXIT_FAILURE);
50          }
51
52          char *str = argv[1];
53          char *endptr;
54          errno = 0;
55          long n = strtol (str, &endptr, 10);
56
57          if ((errno == ERANGE && (n == LONG_MAX || n == LONG_MIN))
58                          || (errno != 0 && n == 0)) {
59                  perror("strtol");
60                  exit(EXIT_FAILURE);
61          }
62
63          if (endptr == str) {
64                  usage (argv[0]);
65                  exit(EXIT_FAILURE);
66          }
67
68          vector<uint> *list = primes_list (n);
69          mpz_t primorielle;
70          mpz_init (primorielle);
71          mpz_set_si (primorielle, 1);
72          vector<uint>::iterator iter;
73
74          for (iter = list->begin(); iter != list->end(); iter++) {
75                  mpz_mul_si (primorielle, primorielle, *iter);
76          }
77
78          gmp_printf ("%Zd\n", primorielle);
79          delete list;
80          mpz_clear (primorielle);
81
82          return EXIT_SUCCESS;
83  }
```