p1.py

```python
 1: # return the absolute least residue congruent to x (mod m)
 2: def absres(x, m):
 3:     r = x % m
 4:     if r > m//2:
 5:         return r - m
 6:     else:
 7:         return r
 8:
 9:
10: def gcd(a, b):
11:     # edge cases
12:     assert a != 0 or b != 0
13:     if b == 0:
14:         return a
15:
16:     r = a % b
17:     while r != 0:
18:         a = b
19:         b = r
20:         q = a // b
21:         r = a - b * q
22:
23:     return b
24:
25:
26: # return a list of the invertible integers mod n.
27: def invertibles(n):
28:     c = []
29:     for i in range(1, n):
30:         if gcd(n, i) == 1:
31:             c.append(i)
32:     return c
33:
34:
35: # sum of all elements mod n
36: def s(n):
37:     if n == 0:
38:         return 0
39:     sum = 0
40:     for i in range(0, n):
41:         sum += i
42:     return absres(sum, n)
43:
44:
45: # sum of all invertible elements mod n
46: def si(n):
47:     if n == 0:
48:         return 0
49:     sum = 0
50:     for i in invertibles(n):
51:         sum += i
52:     return absres(sum, n)
53:
54:
55: # product of all elements mod n
56: def p(n):
57:     return 0
58:
59:
60: # product of all invertible elements mod n
61: def pi(n):
62:     if n == 0:
63:         return 0
64:     prod = 1
65:     for i in invertibles(n):
66:         prod *= i
67:     return absres(prod, n)
```