Problem: 7

A linear congruential pseudorandom number generator has four parameters:
modulus: m
multiplier a
increment c
and seed x[0]

The recursion for n random numbers varying from 0 to n is given by a loop of n steps:
x[i+1]=(a*x[i]+c) mod m
(x[i] is i'th number in the sequence)

The method will or will not properly according to the choice of the seed, modulus and increment.
Example:
For a = 2; c = 1 ; m = 2 ; x[0] = 1 if we run the loop then the numbers are:
random=[1,1,1,1,1,1,1,1,1,...........................1,1,1]

which is not even a little bit of random. The seed comes in only 2nd step.

Or

For m= 10,a= 7,c= 7, then with x[0]= 7,
the random sequence is: [7,6,9,0,7,6,9,0,7,6,9,0,......]

which is an alternating sequence and not random. The seed comes back after every 4 steps.

But,
By proper choice of those quantities, we get good random numbers when the seed never comes back.
Example:
For
a = 21356981
c = 1234567890
m = 9753113579
x[0] = 1.325*pi

If I run the Linear Congruential random number Generator (100 loops) in python with these values then we get:

```
[1323468678.3615053, 3004514931.0, 6523942507.0, 4716830518.0, 3677116536.0,
9431256975.0, 3024445216.0, 2106083794.0, 8047757178.0, 3586740959.0,
1127688035.0, 6105869310.0, 3811195182.0, 626476708.0, 9323846131.0,
2996178348.0, 5367591232.0, 3500350178.0, 120603200.0, 2214201822.0,
3818341663.0, 1411012809.0, 9466128479.0, 5319922184.0, 5555756418.0,
142863227.0, 3419605533.0, 5789616596.0, 7316600672.0, 8500639157.0,
3411851330.0, 7292046880.0, 9289219298.0, 8218834855.0, 4628102710.0,
7264093535.0, 8066452011.0, 5569336604.0, 3578742968.0, 4217085473.0,
5004205822.0, 4012179895.0, 4012281632.0, 1863129515.0, 1835562851.0,
7817477802.0, 7122822922.0, 448189175.0, 9682064912.0, 5613994381.0,
1896743790.0, 3836857174.0, 6590698121.0, 2706807221.0, 1384977727.0,
3719659829.0, 5670515767.0, 4702193782.0, 4227783049.0, 6245995811.0,
8200727573.0, 8456987991.0, 7403523768.0, 6018631902.0, 3679932725.0,
7274780690.0, 1315641746.0, 1972412452.0, 6105900606.0, 8987549186.0,
5902166698.0, 4840109554.0, 8942902227.0, 4549260428.0, 439269350.0,
6963441614.0, 1792344060.0, 82137236.0, 9614893466.0, 2041251400.0,
4116384559.0, 6325644067.0, 4198375740.0, 6655341388.0, 5245455962.0,
3826893119.0, 7642560370.0, 4685853755.0, 6738574752.0, 6384947923.0,
6441711957.0, 2819463617.0, 6305074697.0, 4295929090.0, 1328145339.0,
720752168.0, 6011470052.0, 6265817334.0, 2195933142.0, 3522300899.0]
```

Here the seed has never come again.