ロジスティック写像 カオス2　　Revised jan 8, 2017

離散型ロジスティック方程式

$$f(x)=3.839x(1-x)$$

漸化式　X n= 4 * Xn * (1-Xn)、　　0.01 < x < 4　Xn としてコンピュータで計算する。
パラメーターである4を、3.839に変えた漸化式にすると、Xの挙動はカオス的になる

```
#include <stdio.h>

//FILE *w_file1;
//const char FILENAME1[]="xfile.txt";

float recursion(float Xn);

//int main(int argc, const char * argv[])
int main ()
{
   //w_file1=fopen(FILENAME1,"a");

   float Xn=0.01;

   for(int n=0;n<1001;n++)
   {
      printf("%f, ",recursion(Xn));

      //fprintf(w_file1,"%f\t",recursion(Xn));

      Xn=recursion(Xn);
   }
   // fclose(w_file1);
   return 0;
}


float recursion(float Xn)
{
   return(4*Xn*(1-Xn));  /* 4を3.839nに変えた漸化式にすると、カオスが現れる*/
}
```

計算結果1;

0.039600, 0.152127, 0.515939, 0.998984, 0.004060, 0.016176, 0.063656, 0.238417, 0.726298,
0.795157, 0.651529, 0.908155, 0.333637, 0.889293, 0.393804, 0.954889, 0.172303, 0.570458,
0.980142, 0.077853, 0.287168, 0.818810, 0.593441, 0.965075, 0.134821, 0.466578, 0.995532,

0.017793, 0.069905, 0.260075, 0.769743, 0.708954, 0.825353, 0.576582, 0.976541, 0.091635,
0.332951, 0.888379, 0.396647, 0.957273, 0.163607, 0.547358, 0.991029, 0.035563, 0.137192,
0.473481, 0.997187, 0.011220, 0.044378, 0.169633, 0.563430, 0.983907, 0.063337, 0.237302,
0.723959, 0.799370, 0.641511, 0.919899, 0.294739, 0.831472, 0.560504, 0.985357, 0.057715,
0.217536, 0.680857, 0.869163, 0.454874, 0.991854, 0.032317, 0.125089, 0.437767, 0.984508,
0.061006, 0.229139, 0.706537, 0.829371, 0.566060, 0.982544, 0.068604, 0.255591, 0.761056,
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0.972227, 0.108005, 0.385359, 0.947430, 0.199225, 0.638137, 0.923672, 0.282007, 0.809916,
0.615808, 0.946354, 0.203071, 0.647332, 0.913173, 0.317153, 0.866268, 0.463392, 0.994639,
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0.122894, 0.431164, 0.981046, 0.074377, 0.275381, 0.798186, 0.644341, 0.916663, 0.305569,
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0.591954, 0.966178, 0.130713, 0.454507, 0.991722, 0.032840, 0.127045, 0.443617, 0.987284,
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0.911298, 0.323336,
```

次に 、漸化式の係数を4から3.839に変えて実行した結果

0.149888...., 0.489171...., 0.959299.... という数字を繰り返し、循環しているのが分かる。

計算結果2;

```
0.038006, 0.140360, 0.463211, 0.954554, 0.166538, 0.532866, 0.955603, 0.162872, 0.523428,
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$f(x) = x$ であれば、点x はf の不動点という

$f^n(x) = x$ であれば、点x の周期点という

我々が出会うたいていの力学系は、孤立した周期点を持つ