

ASSIGNMENT 4

Tutorial session August 22nd — not for assessment

1. (This question is aimed at obtaining results numerically; it should also be used to develop good habits in writing up assignments and projects. All data should be recorded in an organised, presentable manner.)

Consider the “Cubic #1” map

$$f(x) = 27rx^2(1-x)/16, \quad 0 \leq r \leq 4.$$

I showed in lectures that it has one fixed point for $0 \leq r < 64/27 \approx 2.37$, and that it has three fixed points for $64/27 < r \leq 4$. I also investigated the stability of these fixed points.

Use “Graphical analysis” in *Chaos for Java* to locate the value of r at which x_+^* becomes unstable, to eight decimal places. You should use a “divide and conquer”: start with a pair of r values at which $f'(x_+^*) > -1$ and $f'(x_+^*) < -1$ (respectively), then examine an intermediate r value. If $f'(x_+^*) > -1$ at this intermediate value, this eliminates smaller values of r from the search, similarly if $f'(x_+^*) < -1$ at this intermediate value, larger values of r are eliminated. Continue until you have determined an interval whose end points only differ in the fourth decimal place, and in which you know that $f'(x_+^*) = -1$ by continuity. Compare your result with the value given in lectures.
