First Homework: Geology – Physics 30

Pixel and Chaos Games

You will see reproduced below figure 1.13 from the text *Chaos Under Control*. This is a simple model for the behavior of the video feedback that you saw in the tape. Using these figures and the following "dynamics":

1) Begin in a "pixel box" of the specified number.
2) Draw a vertical line from the diagonal line to the curve.
3) From the point where the vertical line intersects the curve, draw a horizontal line back to the diagonal line.
4) Repeat #2 and #3 until you see what the basic pattern is.

You will use a pencil and ruler for this exercise (pretend you're back in second grade…but believe it or not, serious scientists do this routinely in chaotic dynamics – it helps in the development of intuition)

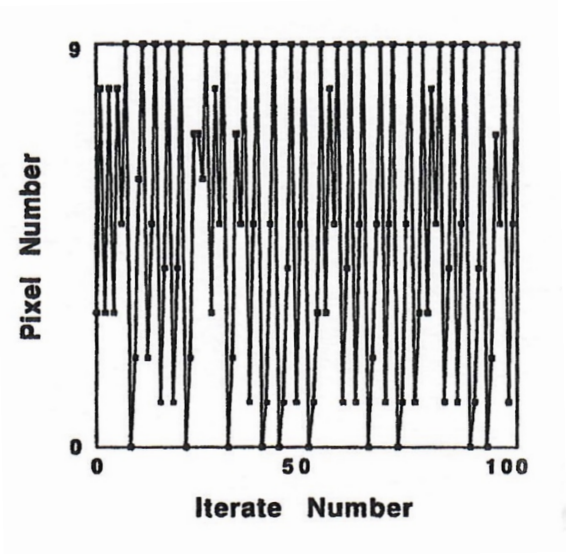
I. Using the top left panel of the figure below, begin at box #8 and carry out 10 iterations ("repititions") and state the box where you end up. An iteration consists of both steps 2) and 3) above.

II. Now use the top right panel. Begin at box #2, carry out 10 iterations and state the box where you end up.

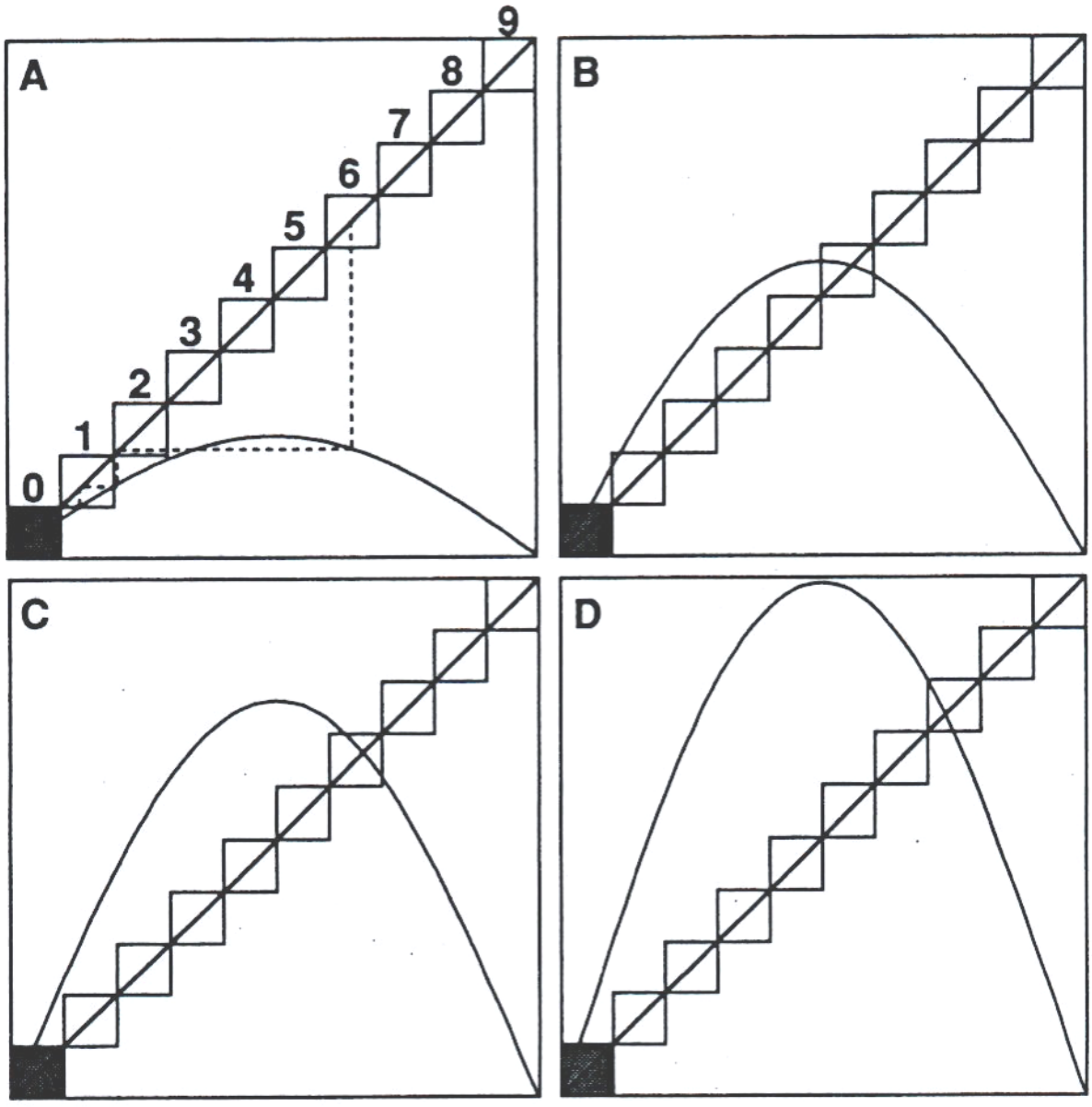
III. Try to explain the behavior you found in I and II in terms of the shape and height of the bump curve.

IV. Now use the bottom left panel. Start in box 2 and do 15 iterations. Repeat, beginning with box 6. Describe what happens now.

V. Finally, use the bottom right panel. Begin with box #5, and do 15 iterations. Plot the results on a plot of pixel box vs. iteration number. Referring to the figure at right, which is 1.14D in *Chaos Under Control*, determine whether your plot is the same for 15 iterations, or is it different? Repeat this beginning with box #3, do 15 iterations, and describe the difference. (The figure at right records the "orbits" of the iteration).



VI Download and run the Excel program "Chaos Game" from the web site. For values of the scale factor = 0.5, 0.4, 0.3, 0.2, print a copy of the figure, and describe the types of transformations that take the figure from one scale (generation) to the next.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