Nonlinear Dynamics: Mathematical and Computational Approaches

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✓ 1.6 Maps I: Unit test » Take unit 1 test Download Exam PDF

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- **Tests auto-save your answers!** Don't worry if you close the page or walk away from the computer, all of your selections will be remembered when you come back.
- When you are finished, click the "Submit" button at the bottom of the test. **Be careful: submitting tests cannot be undone.**

Instructions

You may use any course materials, websites, books, computer programs, calculators, etc. for this test. Just don't ask another person for the answers or share your answers with other people. Be aware that simply typing the question text into google is unlikely to get you directly to the right answer; you're going to have to read what you find there in order to extract that answer, and the course videos are probably a faster way to do that.

"Experts" notes clarify situations that haven't been covered in this course, but that may introduce subtleties into the exam answers. Do not worry about them unless you understand the terms and issues in those notes.

If you have questions about this test, please email us at nonlinear@complexityexplorer.org rather than posting on the forum.

Question 1

Maps describe continuous-time dynamics.

- ○ True
- ✔ ◉ False

Question 2

Difference equations are used to model discrete-time dynamics.

- ✔ ◉ True
- ○ False

Question 3

How many state variables does this map have?

$$x_{n+1} = \cos x_n$$

- ✔ ◉ 1
- ○ 2
- ○ 3
- ○ Not enough information to answer
- ○ Not defined

Question 4

How many state variables does this map have?

$$x_{n+1} = ay_n$$

$$y_{n+1} = y_n \cos x_n$$

- ○ 1
- ✔ ◉ 2
- ○ 3

Not enough information to answer

Not defined

Question 5

Dynamical systems must have lots and lots of state variables to be chaotic.

True

✔ False

Question 6

Consider the following map: $x_{n+1} = rx_n + 3$

If $r = 3$ and $x_0 = 0.2$, what is x_2?

3.6

✔ 13.8

44.4

None of the above

Question 7

A fixed point is always stable.

True

✔ False

Question 8

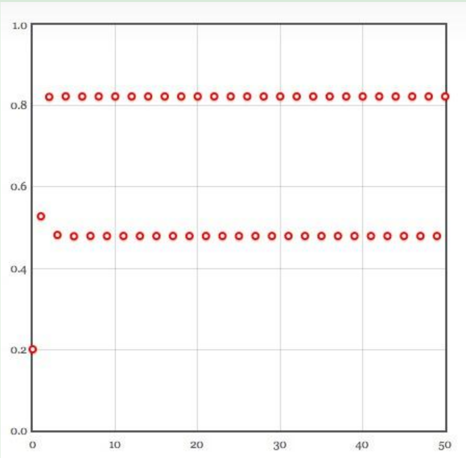
A fixed point of a map f is a state x^* such that

$x^* = f(x^*)$

✔ True

False

Question 9



Consider the above plot, which shows 50 iterates of the orbit of the logistic map from $x_0 = 0.2$.

To what kind of attractor is this orbit converging?

Fixed point

✔ Periodic orbit

Chaotic

None

Question 10

Consider the plot in the previous question. How long is the transient, roughly?

✘ One iterate.

Two or three iterates.

There is no transient.

The orbit hasn't converged, so everything that you see in the plot is technically a transient

Question 11

If two initial conditions of a given dynamical system—with the same parameter value(s)—converged to two different fixed points, both of those fixed points will always be unstable.

✖ ◉ True

○ **False**

Question 12

If two initial conditions of a given dynamical system—with the same parameter value(s)—converged to two different fixed points, the transient lengths will always be different.

○ True

✔ ◉ False

Question 13

If two initial conditions of a given dynamical system—with the same parameter value(s)—converged to two different fixed points, those initial conditions must be in different basins of attraction.

✔ ◉ True

○ False

Question 14

Use the logistic map app to generate trajectories from a variety of different initial conditions in the range 0.2<-x<-0.8 with r=3.5. What kind of attractor (if any) does the system have?

○ Fixed point

○ Two cycle

✔ ◉ Four cycle

○ Chaotic

○ No attractor

Question 15

All nonlinear systems are chaotic.

○ True

✔ ◉ False

Question 16

All chaotic systems are nonlinear.

(Note: this course is not about infininite-dimensional or function spaces.)

✔ ◉ True

○ False

Question 17

There are two variables in the logistic-map equation: x_n and r. Which of these is the *parameter*?

○ x_n

✔ ◉ r

Question 18

Can a change in the logistic map's *parameter* cause a change in the topology of the attractor, *i.e.,* a bifurcation in the dynamics?

✔ ◉ Yes

○ No

You got 16 out of 18 questions correct