

Unit 5 - Week 3

Course outline

How to access the portal?

Assignment Zero

Week 1

Week 2

Week 3

Lyapunov Exponents; Invariant measures

Intermittency, Crises

Fractals

Chaos in Flows. The Lorenz and Rössler Systems.

Quiz : Assignment 3

Feedback

Week 4

Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-18, 23:59 IST.

In the following multiple choice questions (MCQs), choose (all) the correct answer(s).

1) If x^* is a fixed point of the function $f(x) = ax^2 + bx + c$ ($a \neq 0$), which of the following statements is true? 1 point

- If $f'(x^*) = 1$, then x^* is stable.
- If $f'(x^*) = 1$, then x^* is unstable.
- If $f'(x^*) = -1$, then x^* is asymptotically stable.
- If $f'(x^*) = 1$, then x^* is asymptotically stable.

No, the answer is incorrect.
Score: 0

Accepted Answers:

If $f'(x^*) = -1$, then x^* is asymptotically stable.

2) A system is said to be chaotic if it's Lyapunov exponents are 1 point

- negative
- lie between -1 to 1.
- such that at least one of them is positive
- All strictly positive

No, the answer is incorrect.
Score: 0

Accepted Answers:

such that at least one of them is positive

3) 1 point

Which of the following conditions apply to the largest Lyapunov exponent λ at a bifurcation?

- $\lambda = -1$
- $\lambda = 0$
- $\lambda = 1$
- $-1 \leq \lambda \leq 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\lambda = 0$

4) For a periodic orbit, the Lyapunov exponents are 1 point

- all negative
- between -1 and 1
- purely imaginary
- complex, with real part negative

No, the answer is incorrect.
Score: 0

Accepted Answers:

all negative

5) 2 points

Compute the Lyapunov exponent for the logistic map ($x \rightarrow \mu x(1-x)$) to an accuracy of 4 decimal places, for $\mu = 3.5$ and 3.8282 . Take the total number of iterations to be 50000. The values of the Lyapunov exponent are:

- 0.6932 and 0.8973
- 0.2632 and -0.8720
- 0.8720 and 0.2632
- 1 and 1

No, the answer is incorrect.
Score: 0

Accepted Answers:

-0.8720 and 0.2632

6) What is the box-counting (or capacity) dimension of the middle-thirds Cantor set? 1 point

- $\ln 3 / \ln 2$
- $\ln 2 / \ln 3$
- 0.63
- 1

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\ln 2 / \ln 3$
0.63

7) Consider the Lorenz system, 1 point

$$\begin{aligned}\dot{x} &= 10(y - x) \\ \dot{y} &= rx - y - xz \\ \dot{z} &= xy - 8z/3.\end{aligned}$$

At what value of the parameter r does the origin ($x = y = z = 0$) become unstable?

- 28
- 24.74
- 1.0
- 0

No, the answer is incorrect.
Score: 0

Accepted Answers:

24.74

8) Consider the Rössler equations, 2 points

$$\begin{aligned}\dot{x} &= -(y + z) \\ \dot{y} &= x + ay \\ \dot{z} &= b + xz - cz,\end{aligned}$$

a, b and c are constants. Set $a = b = 0.2$, and vary the parameter c . At what value of c is a "period-one" limit cycle created?

- 5.3
- 2.3
- 3.3
- 6.3

No, the answer is incorrect.
Score: 0

Accepted Answers:

2.3