Lecture 12: Quiz

Name:

Problem 1

We have seen in lecture that if we press a specific key of a calculator repetitively that we get deterministic random numbers. Which was it?

a) sin in deg mode

b) sin in rad mode

c) tan in deg mode

d) tan in rad mode

Problem 2

The map $T(x) = x^2 - 1$ defines a dynamical system. Feed in $x = 1$ for example, we get $T(x) = 1^2 - 1 = 0$. Now feed in 2 etc. We get a sequence of numbers which are called an **orbit**. Which one is the orbit?

a) $1, 0, -1, -2, -3, ...$

b) $1, 0, -1, 0, -1, 0, , ...$

c) $1, 0, 2, 0, 3, 0, 4, 0...$

d) $1, 0, 0, 0, 0, 0, 0, 0, 0...$

Problem 3

What is the Ulam-Collatz system?

a) A differential equation showing chaotic behavior.   b) Produce the pedal triangle from a given triangle

c) Take the sum of the denominators from a number.

d) Divide by 2 if even and triple plus 1 if odd.

Problem 4

Which of the following dynamical systems is called the **Lorentz system** which produces the Lorentz attractor?

a) $\ddot{x} + x + (x^2 - 1)y = 0$.

b) $\dot{x} = 10(y - x), \dot{y} = -xz + 28x - y, \dot{z} = xy - \frac{8z}{3}$

c) $x'(t) = x(t)$.

d) $x''(t) = -x(t)$.

Problem 5

Which of the following dynamical systems have a discrete time? We replace "map" or "differential equation" with "system".

a) The game of life

b) Three body system

c) The double pendulum

d) Ulam-Collatz system.

Problem 6

What is an example of a billiard dynamical system?

a) The pedal map in triangles

b) The game of life

c) The Stadium

d) Collatz system.

Problem 7

Which dynamical system is used to find the roots of a function:

a) The Feigenbaum map

b) The Ulam map

c) The Newton method

d) The Kepler system

Problem 8

Which mathematician was the first to establish that low dimensional systems can exhibit chaotic bahavior?

a) Kepler

b) Newton

c) Poincaré

c) Mandelbrot

Problem 9

Which mathematicians pointed out the concept of a strange attractor?

a) Poincaré-Bendixon

b) Hardy-Littlewood

c) Ruelle-Takens

d) Douady-Hubbard

Problem 10

Which movie features the "butterfly effect"?

a) Jurassic park (1993)

b) Butterfly dreaming (2008)

c) Silence of the lambs (2001)

d) Amelie (2001)