

Deven Singh

HN 26

Q14:

(i) $x'(t) = 2x(t)(1-x(t))(2-x(t))(3-x(t))$

$$f(x) = 2x(1-x)(2-x)(3-x)$$

$$x(t) = 0, 1, 2, 3$$

(ii)

Time series $([2 \cdot x \cdot (1-x) \cdot (2-x) \cdot (3-x)] [x], [-.1], .01, 10, 1)$:

[.1]

[.9]

[1.1]

[1.9]

[2.1]

[2.9]

[3.1]

$x(t) = 0$ is not stable

$x(t) = 1$ is stable

$x(t) = 2$ is not stable

$x(t) = 3$ is stable

(iii)

$$f(x) = (2x - x^2)(2-x)(3-x)$$

$$f'(x) = -4x^3 + 26x^2 - 32x + 12$$

$$f(x) = (4x - 2x^2 - 2x^2 + x^3)(3-x)$$

$$f'(0) = 12 > 0 \rightarrow \text{not stable}$$

$$f(x) = (x^3 - 4x^2 + 4x)(3-x)$$

$$f'(1) = -3 < 0 \rightarrow \text{stable}$$

$$f(x) = 3x^3 - x^4 - 12x^2 + 4x^3 + 12x - 4x^2$$

$$f'(2) = 0 = 0 \rightarrow \text{not stable}$$

$$f(x) = -x^4 + 7x^3 - 16x^2 + 12x$$

$$f'(3) = -3 < 0 \rightarrow \text{stable}$$

P15:

$$z(0) = 1$$

$$y(0) = 3$$

$$z(1) = 1^3 + 2 \cdot 3 = 7$$

$$y(1) = 1^2 + 5 \cdot 3^2 = 46$$

$$z(2) = 7^3 + 2 \cdot 46 = 405$$

$$y(2) = 7^2 + 5 \cdot 46^2 = 10629$$

$$z(3) = 405^3 + 2 \cdot 10629 = 6733483$$

$$y(3) = 405^2 + 5 \cdot 10629^2 = 565067430$$

$$\text{Orb}([z^3 + 2y, z^2 + 5y^2], [x, y], [1, 3], [0, 3]);$$

P16:

$$\text{SFP} \left(\left[\frac{2+x+y}{2+2x+2y}, \frac{2+x+y}{1+2x+2y} \right], [x, y] \right);$$

F ↙

$$\text{Orb} (F, [x, y], [0.5, 4], [1000, 1010]);$$

P17:

$$\textcircled{1} \text{ Time Series } ([(1-2 \cdot x-3 \cdot y) \cdot (2-2 \cdot x-3 \cdot y) \cdot (3-x-2 \cdot y) \cdot (1-x-2 \cdot y)], [x, y],$$

$$[-5, -4], [1, 0] \text{ are not stable}$$

$$[-5, 1, 4, 1],$$

$$[0, 20, 1],$$

$$\textcircled{2} [2],$$

$$\textcircled{3} [-9, -1], [0, 20, 1],$$

$$\textcircled{4} [2],$$