

1.

HW 16

1.
a. $x(n) = x(n-1) \left(\frac{5}{3} - x(n-2) \right)$
 $x_1(n) = x_1(n-1) \left(\frac{5}{3} - x_2(n-2) \right), x_2(n) = x_1(n-1)$

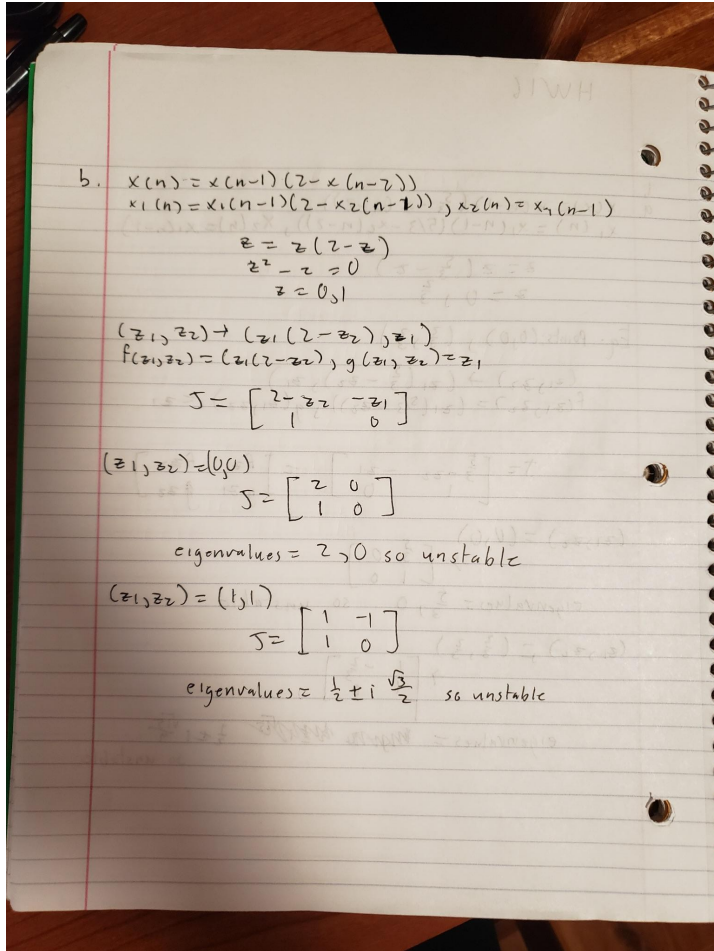
$$z = z \left(\frac{5}{3} - z \right)$$
$$z = 0, \frac{5}{3}$$

Eq. points: $(0,0), \left(\frac{5}{3}, \frac{5}{3}\right)$

$$(z_1, z_2) \rightarrow (z_1 \left(\frac{5}{3} - z_2 \right), z_1)$$
$$f(z_1, z_2) = (z_1 \left(\frac{5}{3} - z_2 \right), z_1), g(z_1, z_2) = z_1$$
$$J = \begin{bmatrix} \frac{5}{3} - z_2 & -z_1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} f_{z_1} & f_{z_2} \\ g_{z_1} & g_{z_2} \end{bmatrix}$$

$(z_1, z_2) = (0,0)$
 $\rightarrow \begin{bmatrix} \frac{5}{3} & 0 \\ 1 & 0 \end{bmatrix}$
eigenvalues = $\frac{5}{3}, 0$ so unstable

$(z_1, z_2) = \left(\frac{5}{3}, \frac{5}{3}\right)$
 $\rightarrow \begin{bmatrix} 1 & -\frac{2}{3} \\ 1 & 0 \end{bmatrix}$
eigenvalues = ~~negative~~ $\frac{1}{2} \pm i \frac{\sqrt{3}}{2}$ so unstable



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> read "/Users/jjj104/Documents/M15.txt";
> Help15();
    HW3(u,v,w), HW2(u,v) , Dis1(F,y,y0,h,A), ToSys(k,z,f,INI)

;
> NULL;
> Orbk(2, z, z[1]*(5/3 - z[2]), [0, 0], 1000, 1020);
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]

;
> NULL;
> Orbk(2, z, z[1]*(5/3 - z[2]), [2/3, 2/3], 1000, 1020);
[2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2]

[-, -, -, -, -, -, -, -, -, -, -, -, -, -, -, -, -, -, -]

[3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3]
  
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;
> NULL;
> Orbk(2, z, z[1]*(2 - z[2]), [1, 1], 1000, 1020);
[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]

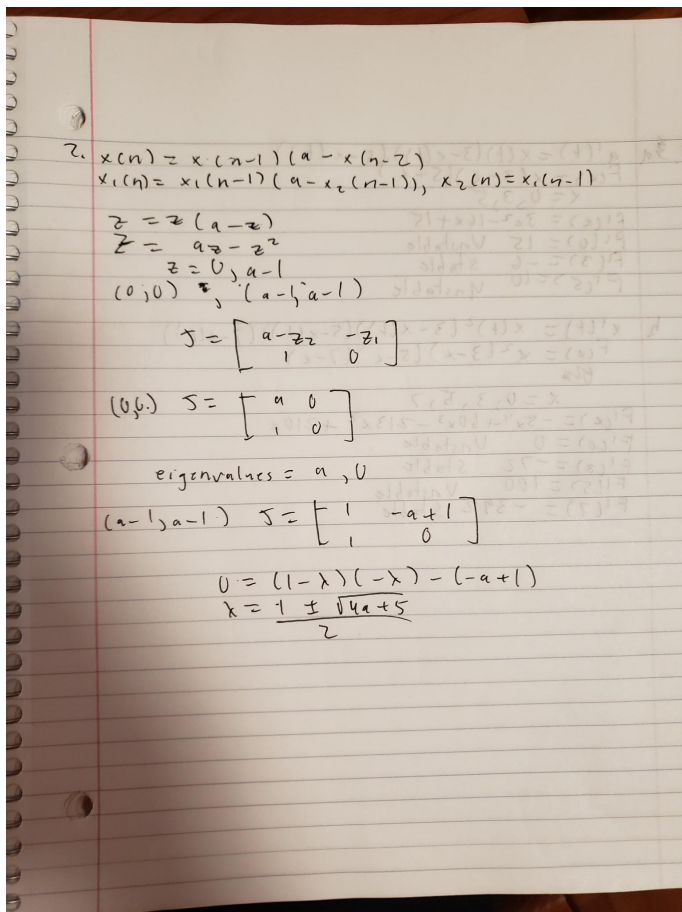
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;
> NULL;
> Orbk(2, z, z[1]*(2 - z[2]), [0, 0], 1000, 1020);
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]

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2.



4.

4.3a $x'(t) = x(t)(3-x(t))(5-x(t))$
 $F(x) = x(3-x)(5-x)$
 $x = 0, 3, 5$

$F'(x) = 3x^2 - 16x + 15$

$F'(0) = 15$ Unstable

$F'(3) = -6$ stable

$F'(5) = 10$ Unstable

b $x'(t) = x(t)^2(3-x(t))(5-x(t))(7-x(t))$

$F(x) = x^2(3-x)(5-x)(7-x)$

or

$x = 0, 3, 5, 7$

$F'(x) = -5x^4 + 60x^3 - 213x^2 + 210x$

$F'(0) = 0$ Unstable

$F'(3) = -72$ stable

$F'(5) = 100$ Unstable

$F'(7) = -392$ stable