Flow Charts Hw.6

Predatory-prey populations Exercise 8.2

- The Lotka-Volterra equations

Used eqn: $\frac{dx}{dt} = \alpha x - \beta x y,$

$\frac{dy}{dt} = \gamma x y - \delta y$

$\alpha, \beta, \gamma, \delta \rightarrow$ constants

Define constants

↓

Define initial values for x & y

↓

Define the differential equations aka $f(r,t)$

↓

For loop to calculate the value of x & y at the current time step using the fourth-order Runge-Kutta method

↓

Plot the tpoints, xpoints & ypoints in the graph

↓

Describe what is going on in the system in LaTEX

Pendula Exercise 8.4

- Eq.

$$\frac{d\theta}{dt} = \omega$$

$$\frac{d\omega}{dt} = -\frac{g}{l}\sin\theta$$

Define constants

↓

Define initial conditions & values

↓

Define the first-order equations

↓

Use the fourth-order Runge-Kutta in a for loop to calculate the angle at the current time step

↓

Plot the angle as a function of time

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Make animation if enough time

Exercise 8.5: The driven pendulum

Eqn: $$\frac{d^2\theta}{dt^2} = -\frac{g}{\ell}\sin\theta + C\cos\theta\sin\Omega t$$

$g = 9.81$
$\ell = 10$ cm
$C = 2s^{-2}$
$\Omega = 5s^{-1}$

$$\frac{d\theta}{dt} = \omega \qquad \frac{d\omega}{dt} = \left(-\frac{g}{\ell}\right)\sin\theta + C\cos\theta\sin\Omega t$$

Define constants — Part a

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Define the function for the differential equations

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Use a fourth-order Runge-Kutta method to numerically solve the differential equations

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Create a plot of θ as a function of time from $t=0$ to $t=100$ s.

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Part b

Create an array of values of omega, and create a list to store the amplitude of the pendulum at each time.

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Create a for loop that for each omega value, the amplitude is calculated by using the fourth-order Runge-Kutta method to integrate the differential equation

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After the integration calculate the maximum amplitude of the pendulum, then after the loop make the current value of omega the resonant frequency

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Create a plot of the resonat frequency against time