MCMS Problem Set

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Question 2 Continued

•) For non zero equilibrium

$B^* = N - \frac{N}{R_0}$, Also $A^* + B^* = N$, so

$\rightarrow A^* = N - \left(N - \frac{N}{R_0}\right) \rightarrow \boxed{A^* = \frac{N}{R_0}}$

→ So the equilibrium points are $(N, 0)$ & $\left(\frac{N}{R_0}, N - \frac{N}{R_0}\right)$ also $(0,0)$ is an equilibrium point.

•) Now to check the stability by finding the Jacobian which is going to be a 2x2 matrix.

→ $[\dot{B}] = f(A, B)$

→ $[\dot{A}] = g(A, B)$

So now differentiate

$\rightarrow f_A = \frac{\beta[B]}{N}$, $f_B = \frac{\beta[A]}{N} - \gamma$

$\rightarrow g_A = -\frac{\beta[B]}{N}$, $g_B = -\frac{\beta[A]}{N} + \gamma$

So the Jacobian matrix will be

$$\begin{bmatrix} f_A & f_B \\ g_A & g_B \end{bmatrix}$$