Consider the differential equation
\[ u_t + Au_x = F , \quad 0 \leq x < \infty , \quad 0 \leq t , \]
where \( u \) and \( F \) are vector functions with two components, and \( A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \).

The initial and boundary conditions are
\[
\begin{align*}
  u(x,0) &= f(x) , \\
  u^{(1)}(0,t) + \alpha u^{(2)}(0,t) &= g(t) , \\
  ||u||_h &< \infty .
\end{align*}
\]

Approximate the problem by
\[
\begin{align*}
  \frac{du_j}{dt} + AD_0 u_j &= F_j , \quad j = 1, 2, \ldots , \\
  u_j(0) &= f_j , \\
  u_0^{(1)}(t) + \alpha u_0^{(2)}(t) &= g(t) , \\
  \frac{du_0}{dt} + D_+ u_0^{(1)} &= F_0^{(1)} , \\
  ||u||_h &< \infty .
\end{align*}
\]

Derive the Godunov-Ryabenkii and the Kreiss condition for this approximation and investigate whether or not they are both satisfied for all \( \alpha \) in the interval \( 0 \leq \alpha \leq 1 \). For which \( \alpha \)-values can we conclude strong stability?