1. **Binary Addition with RNN**

   Idea is to have h_1, h_2, h_3 activate when sum of inputs to hidden layer is at least 1, 2, or 3, respecrively. $h_3^{(t-1)}$ represent the carry over to the sum at step t, $h_1^{(t-1)}$ and $h_2^{(t-1)}$ are irrelevant to computation of sum at step t.

$$\mathbf{U} = \begin{pmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{pmatrix} \qquad \mathbf{W} = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix} \qquad \mathbf{b}_h = \begin{pmatrix} -0.5 \\ -1.5 \\ -2.5 \end{pmatrix} \qquad \mathbf{v} = \begin{pmatrix} 1 \\ -1 \\ 5 \end{pmatrix} \qquad b_y = -0.5$$