**Comments Lab 4**

1. Note the definition used here (|**A**| usually means the determinant):

$$|\mathbf{A}| = \mathbf{S}\mathrm{diag}(|\lambda_i|)\mathbf{S}^{-1} \text{ where } \mathbf{S} \text{ is the matrix of (right) eigenvectors to } \mathbf{A}$$

2. The right-running small amplitude wave ($h,m$) must be an approximate eigenvector to the flux Jacobian at the steady solution ($h_0(x)$,$m_0(x)$=0). For the ($h,m$)-system it is $\begin{pmatrix} 1 \\ \sqrt{gh_0(x)} \end{pmatrix}$ so if the height of the wave is $dh$, i.e. the water depth $h$ is $h_0+dh$, its $m$ must be $dh \cdot \sqrt{gh_0(x)}$

3. The wall boundary conditions are implemented by $h_{\text{ghost}} = h_1$, $m_{\text{ghost}} = -m_1$
Check that your solution exactly conserves the water volume:

$$\sum_{i=1}^{n} h_i(t) = \sum_{i=1}^{n} h_i(0)$$

What about the total momentum? What happens with an attempt at a non-reflecting boundary $h_{\text{ghost}} = h_1$, $m_{\text{ghost}} = +m_1$ ?

4. When the Roe-solver works, and the wave is initiated with the correct $m$, there will be

No wiggles,
Nice translation of the pulse with only a slight change to the slope
After more steps, the pulse becomes an almost symmetric hump.
When the hump gets into shallow water it becomes triangular.

Explain !