ASTR422 (Fall 2013) Homework 1

[Due 14\textsuperscript{th} February 2013]

1. Liddle, Q2.1

2. Liddle, Q2.2

3. Liddle, Q4.1

4. Liddle, Q4.2

5. In the Steady State model of the Universe, the Universe is homogeneous, isotropic and (as required by Hubble’s observations) expanding, but it is assumed that the creation of matter keeps the density constant in time, $\rho=\rho_0$.
   a. By making the further assumption that the Universe has a flat spatial geometry, derive an expression showing how the scale factor of the Universe changes with time.
   b. Derive an expression for Hubble’s parameter. Is it constant or variable?
   c. Starting from the Fluid Equation, derive an expression for the pressure of the "cosmological fluid". Comment on anything that appears to be strange about your answer.
   d. In such a scenario, is there a big bang? Answer this question using both physical arguments and by referring to the expression that you derived in part-(a).