

**PHYS 503/629 – HOMEWORK No. 2 – DUE TUESDAY, 4/12/2005**

**Problem 1.** Problem 9.12 of Hartle's book.

**Problem 2.** Problem 9.18 of Hartle's book.

**Problem 3.** Problem 10.1 of Hartle's book.

**Problem 4. (Only for 629 level)** Show that  $r = 0$  is a true singularity of the Schwarzschild solution and  $r = 2M$  is a coordinate singularity by computing the curvature invariant  $R_{\mu\nu\rho\sigma}R^{\mu\nu\rho\sigma}$  (Kretschmann scalar). Together with  $R = 0$  and  $R_{\mu\nu}R^{\mu\nu} = 0$ , the regularity of the Kretschmann invariant at  $r = 2M$  shows that the curvature is finite at the black hole horizon, and therefore the spacetime is regular there.