Solve the following problems, and turn in the solutions to at least four of them.


2. Let $X$ be the scheme $\text{Spec } \mathbb{C}[x, y]$. Among the blowups of $X$ along the ideals
   
   $(x, y), (x, y^2), (x^2, y^2), (x^2, xy, y^2), (x^2, xy),$

   determine which ones are isomorphic. (Hint: see Hartshorne, exercise II.7.11.)


4. Use Hartshorne, example II.8.20.1 (which works over any base ring, not necessarily a field) and a previous assignment to compute the cohomology of the sheaf $\omega_X(d)$ where $X = \mathbb{P}_A^n$ for some ring $A$.


6. Put $X = \text{Spec } \mathbb{C}[x_1, x_2, x_3, x_4]$, let $Y_1$ be the plane $x_1 = x_2 = 0$ in $X$, and let $Y_2$ be the plane $x_3 = x_4 = 0$ in $X$. Compute Čech cohomology of $U = X \setminus (Y_1 \cup Y_2)$ with respect to the open covering

   $D(x_1x_3), D(x_1x_4), D(x_2x_3), D(x_2x_4)$

   to see that $H^2(U, \mathcal{O}_U) \neq 0$. (This is one step of Hartshorne, exercise III.4.9.)