1. Classify, with proof, the points of the affine plane \( \mathbb{A}^2 \mathbb{C} = \text{Spec } \mathbb{C}[x, y] \), and describe the closure of each point in the Zariski topology.

2. Do the same for \( \text{Spec } \mathbb{Z}[x] \) (see Eisenbud-Harris II-37).

3. Do the same for \( \text{Spec } \mathbb{C}[\![x, y]\!]/(xy) \). Here \( \mathbb{C}[\![x, y]\!] \) denotes the power series ring.

4. Let \( \mathcal{F} \) be the presheaf of bounded holomorphic functions on \( \mathbb{C} \), with its usual topology. That is, for \( U \subseteq \mathbb{C} \) open,

\[
\mathcal{F}(U) = \{ f : U \to \mathbb{C} \mid \text{for some } M, |f(z)| \leq M \forall z \in U \}.
\]

Describe, with proof, the sheafification of \( \mathcal{F} \).


6. Vakil exercise 3.3C (equivalently, Hartshorne exercise II.1.15) on sheaf hom.

7. How many hours did you spend on this problem set?