This homework is assigned on Day 02 (Friday). You are expected to attempt it promptly, before Day 03 (Monday). Hand in your solutions on paper at the start of class on Day 04 (Wednesday). There are four exercises.

A. Section 13 Exercise 1. (This problem uses Section 12 material — not Section 13.)

B. Section 13 Exercise 4c. Here, "smallest" means coarsest and "largest" means finest. (This is another Section 12 problem.)

Let $x_1, \ldots, x_n$ be the usual coordinates on $\mathbb{R}^n$. For any polynomial p in $x_1, \ldots, x_n$, define the *zero set* $Z(p)$ to be the set of points in $\mathbb{R}^n$ where $p = 0$. For example, if $n = 2$, then $Z(x_1^2)$ is the x_2-axis, and $Z(x_2^2 - x_1)$ is a parabola opening toward the right. Declare a set $U \subseteq \mathbb{R}^n$ to be open if and only if U is a union of sets of the form $\mathbb{R}^n - Z(p)$.

C.A. Prove that this declaration of open sets constitutes a topology.

C.B. When $n = 1$, this topology happens to be one of the examples of Section 12. Which one?

(This *Zariski topology* is sometimes used in algebraic geometry, although $\mathbb{R}$ is usually replaced with an algebraically closed field such as $\mathbb{C}$.)

Let X_T and Y_S be spaces. A function $f : X_T \to Y_S$ is a *homeomorphism* if f is a bijection, f is continuous, and f^{-1} is continuous. We say that X_T is *homeomorphic* to Y_S if there exists a homeomorphism $f : X_T \to Y_S$. (I might not have had time to define these concepts in class today.)

D. Prove that "is homeomorphic to" is an equivalence relation on spaces.