Math 273 Homework #2, Fall 2010
Instructor: Ezra Miller

Solutions by: ...your name...

Collaborators: ...list those with whom you worked on this assignment...

Due: Tuesday 28 September 2010

READING ASSIGNMENTS in [Vakil]

- by Tuesday 21 September: Chapter 4; all but §4.5–§4.6 should be review
- by Thursday 23 September: §5.1–§5.4; note that §5.2 should be review
- by Tuesday 28 September: §5.5, Chapter 6 (should be mostly review)
- by Thursday 30 September: Chapter 12, §13.1–§13.3; this plus Chapter 6 is a lot of material, but most of it is review (skip any item mentioning morphisms of schemes)

EXERCISES: In [Vakil], exercises have labels C.S.N, for "Chapter C, Section S, Exercise N", where $C, S \in \mathbb{Z}_+$ and $N \in A, \ldots, Z$. It is not expected that everyone will complete all of the assigned exercises, but those marked "[required]" are essential.

3.5.H

3.6.C

3.6.G [required]

   (a)

   (b)

3.7.D [required]

4.2.M [required]

4.4.C (a)

   (b)

   (c)

4.4.G [required]

4.6.F

4.6.H (a)

(b)

4.6.M

4.6.O [required]

4.6.S

4.7.E

5.1.A

5.3.F [required]

14.1.A

14.1.C [required]

14.1.E [required]

Additional exercise.

1. Fix a coherent sheaf $\mathcal{F}$ on a scheme $(X, \mathcal{O}_X)$. Prove that the set of points $\mathfrak{p} \in X$ where $\mathcal{F}(\mathfrak{p})$ has dimension at least r is closed in X, for each $r \geq 0$. Hint: what condition on an $m \times n$ matrix with entries in a field guarantees that it has rank at most $n - r$? [You need only what we did in class concerning coherent sheaves for this.]

References

[Vakil] Ravi Vakil, *Foundations of algebraic geometry*, notes dated August 26, 2010.