Assignment 1

MAST90097 Algebraic Geometry
Semester II 2018
Lecturer: Arun Ram
to be turned in before 2pm on 10 August 2018

1. Carefully, precisely and accurately (i.e. in proof machine) define the following and give an illustrative example (with proof, i.e. you must prove that your example is made up of the data required by, and satisfies the conditions of, the definition).

(a) topological space

(b) metric space

(c) ringed space

(d) affine space

(e) projective space

(f) affine variety

(g) variety

(h) affine scheme

(i) scheme

(j) (topological) manifold

(k) smooth manifold

(l) C^r-manifold

(m) complex manifold

(n) projective space

(o) CW complex

(p) simplicial set

(q) spectrum

(r) orbifold

(s) algebraic stack

(t) curve

(u) surface

(v) hypersurface

(w) moduli space

(x) perfectoid space

(y) coarse moduli space

(z) fine moduli space

2. (This assignment section is only very slightly modified from the teaching resources of Zajj Daugherty
https://zdaugherty.ccnysites.cuny.edu/teaching/research_papers.html)

Choose one or two papers from the volumes
Algebraic Geometry: Salt Lake City 2015 (Parts 1 and 2) Proceedings of Symposia in Pure Mathematics Volume **97**, 2018
ISBN: 978-1-4704-4667-3 American Mathematical Society
https://bookstore.ams.org/pspum-97/
This is in the high use section of the ERC library.

Write a outline/summary of each. The goal is to get a very general understanding of the story each paper is trying to tell, and how it fits into mathematics as a whole; the goal is not to understand every detail of the mathematics it explores or develops.

What to hand in: In a 1-3 page document written in paragraph form, your summary should include the following:

- What (sub)field does this research fall under? What is the general context of this research? If it makes connections to areas outside of this field, what are they and how are they connected?
- What are the major theorems/results? When possible, include a small example to illustrate. What are the authors' favorite examples?
- If they make a point of it, what are the authors' favorite tools for proving their results or doing calculations?
- Why is this paper of interest to the general mathematical community? Why is it of interest to you?

Additionally, include information about the context/style of the paper, such as the following:

- Is there anything about the style of the writing (examples, formatting, etc.) that made this paper particularly easy or difficult to read?
- Who are the authors? For example, can you find out, when they wrote the paper, what stage of their career were they in? Were they professors? researchers from industry? Where are they based right now? If possible, provide links to their webpages.
- If you work with any of your classmates reading through the same paper, include that information.

Don't get lost. Again, you **should not try to become an expert** in the paper, nor to understand every definition or detail. The skills this assignment are designed to teach you are (1) skimming papers for highlights, and then maybe looking a little deeper for context and techniques; and (2) learning the language of professional mathematicians and the standard structure of their writing.

A reasonable place to start is in a paper's abstract. Next read the reference list at the end to put the paper in context. Your document should read something like an extended abstract, and include specific references to the paper and its theorem numbering etc. *On your first pass through, skip any sections titled "preliminaries".* If you need help getting started or processing definitions, you're welcome to come ask for help. But, in general, it's ok to focus on what nouns and adjectives are important to the paper without fully processing what those nouns and adjectives mean.