MATH 233A (2009), PROGRAM

Week 1.
Day 1: No class
Day 2: Sheaves and presheaves, kernels, problem for cokernels.

Week 2.
Day 1: Thm about associated sheaf (3/4 through the proof). Cor.: sheaves are an abelian category.
Day 2: Proof of the associated sheaf construction, direct and inverse images, Cech complex for a cover.

Week 3.
Day 1: Recap Zariski topology, construction of the the structure sheaf, construction of sheaves associated to modules as an adjoint functor. Notion of quasi-coherent sheaf on $Spec(A)$. Notion of ringed and locally ringed spaces. Psroof that $Spec$ is functor Rings-¿ Locally Ringed Spaces.
Day 2: Definition of differentiable manifolds as locally ringed spaces, proof that $Hom_{Rings}(A, B)$ is the same as map between spectra as locally ringed spaces. Definition of schemes. Open subscheme of an affine is a scheme. Map to an affine via functions. Example of punctured plane.

Week 4.
Day 1: Quasi-coherent sheaves (inverse and exact images), closed embeddings, local proprties (reduceness, Noetherianness, etc.)
Day 2: Away from class.

Week 6.
Day 1: Yoneda functor (S-points), Zariski sheaves, representable morphisms, criterion for representability of a functor, relative Spec, attempt to define the projective space as a functor.
Day 2: Problem solving sessions–vector bundles.

Week 7.
Day 1: Projective space, proof of existence as a scheme, the line bundles, coordinates, calculation of sections of O(n), defn. of projective and quasi-projective varieties, introduction to Serre's theorem about graded modules.
Day 2: Recap projective space, relative version, Grassmannians, Segre, Veronese and Plucker embeddings.

Week 8.
Day 1: equations for Segre, Veronese and Plucker. Statement of Serre's theorem (graded modules over Sym vs. QCoh on the projective space). Corollaries: generation by global sections. Serre subvategories and quotients (beginning).
Day 2: Serre quotient (end). Blow up of the vector space at 0. Interpretation of the functor {QCoh(P(V)) - Graded Sym-modules} via V-0. Algebraic groups, actions, equivariant q.c. sheaves (beginning).

Date: November 12, 2009.

Week 9.
Day 1: Discussion of HW problem: affine schemes characterized by the exactness of global sections functor. Equivariant q.c. sheaves; representations, equivariant with respect to $\mathbb{G}_m$. End of proof of Serre's theorem.
Day 2: Equivariance via S-points. Projective space as a quotient: idea of sheafifying the quotient presheaf. Statement of Serre's theorem (finite-dimensionality of sections of coh. sheaves on the projective space). Attempt to prove Chevalley's theorem (reasigned as HW). Separated schemes. Cech cohomology (beginning).

Week 10.
Day 1: Proof of finite-dimensionality theorem of cohomoogies of coherent sheaves on the projective space.
Day 2: Proj(A). Proj(A) is projective.

Week 11.
Day 1: Proper maps. P(V) is proper.
Day 2: Valuative criteria. Distribution of projects.

Week 12.
Discussions of projects.