Midterm 2, Theoretical questions

December 8, 76 points in 5 questions

Name and the student number:

Q1. (12 pts) (a) What is a Morse function ?

(b) What does mean "non-degenerate critical point"?

(c) What is the Morse Chain Complex (the generators of groups C_k and the differentials)?

Q2. (12 pts) (a) What is an almost complex manifold ?

(b) What is a complex manifold ?

(c) What is a complex algebraic variety ?

(d) What is the relation between the notions (a), (b) and (c) ?

Q3. (16 pts) (a) Give definitions of a deformation and of an isotopy of symplectic structures.

(b) State Moser's stability Theorem.

(c) Give definitions of a deformation and of an isotopy of contact structures.

(d) State Gray's stability Theorem.

Q4. (12 pts) (a) Give an invariant (not using coordinate systems) definition of the canonical symplectic form in the cotangent space T^*M .

(b) What is a tubular neighborhood of a submanifold in a smooth manifold ?

(c) State Weinstein's Tubular Neiborhood theorem.

Q5. (24 pts) (a) State the Poincare Last Geometric Theorem. How it was reformulated for a 2-torus ?

(b) State Arnold's Conjectures (a weal and a strong version). In which case it was "easy" ?

(c) State the Arnold-Givental Conjecture for Lagrangians.

(d) What does say Arnold's Conjecture in the case of a torus T^{2n} ?

(e) What is the idea of the solution to Arnold's Conjecture using Floer's homology?

(f) What is the Floer Chain complex: what are the generators of its Chain groups ? (Consider the cases of Lagrangian Floer Homology and a Hamiltonian diffeomorphism Floer Homology).