1. Hand in Assignment

The following hand in assignment is due on April 4th. It will be pass or fail, but it will be possible to retry and hand in a revised version later provided the first attempt was a serious one. You may write questions via email, and if necessary I will update the web page with additional hints.

I would suggest writing it using LaTeX and emailing me a pdf-file. If you are not familiar with LaTeX it may be a good opportunity to learn. I will be happy to answer any questions you have if you choose to learn it and I will also put the latex version of this file on the course web page `http://www2.math.uu.se/~tkragh/1MA259-2013/Kurs.html`. I have written in comments in the pre-amble of the file to help you understand each part of it. I would suggest opening it in a text editor which color codes latex files - if not it will look completely confusing. I usually use Emacs (GNU Emacs 23). How precisely you turn the tex-file into a pdf-file depends on your operating system and setup, but it should be installed and work easily on the math departments computers. Of course you are also welcome to use other formats, and even hand write it. However, if you hand in a hard copy and not via email you should make sure it arrives on April 3rd at my box here at the math department.

Exercise 1.1 (Example 11.12 from notes). Let M be the Möbious strip (as a manifold) and let $S^1 \subset M$ be the inclusion described in example 11.11 and 11.12 (or equivalently as the zero section in the Möbious band - thought of as a vector bundle over S^1). Taking the product with the open interval $(0,1)$ we get an inclusion $S^1 \times (0,1) \subset M \times (0,1)$.

Prove that a global chart of $S^1 \times (0,1)$ is not the restriction of a chart of a neighborhood in $M \times (0,1)$.

Hint: tangent bundles.

Exercise 1.2 (Collar neighborhood theorem). Prove that the boundary $\partial M \subset M$ of a compact manifold w.b. has a neighborhood diffeomorphic to $\partial M \times [0,1)$.

Hint: try and construct the map from a neighborhood to $\partial M \times [0,1)$ (each of the two components at a time). There are several ways of solving this exercise, and this hint just refers to one.

The following is somewhat different, but I found several blogs online praising this type of assignments - even in math. So I am curious how it turns out.

Exercise 1.3. Write a so called reflective journal about the course (so far). That is, write a short text (max 1 page - can be shorter) addressing the general topic of the following questions (those you find relevant).

- What in the course do you believe is most important?

- How do parts of this course relate to other courses you have had or things you have learned? E.g. have you now seen proofs of theorems/lemmas that you have used elsewhere, but never seen proved before.
- Are there any parts of the course you had not heard of before and/or seems unrelated to anything else you have learned?
- Are there any parts of the course that seems contradictory to things you have learned in other courses? (this is interesting even if you know why the difference is there - e.g. if a small variation of a definition changes some subtle points or even the entire landscape of the subject).

I would suggest that after you read these questions you go through the curriculum considering all of them (and questions similar to them), and then write the short text.