Deduction and Computation with Coq

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The course is focussed on the articulation of deductions and computations in informal and formal mathematical proofs. The axiomatic method put the emphasis on deduction steps, but since the seventies several notions of proofs have given an important role to both notions and recent mathematical proofs such as proof of the four color theorem, the double bubble theorem or Hale's theorem have shown that computation seems to be unavoidable.

The first part of the course will be dedicated to the use the articulation of deductions and computations in proof theory, in particular in the study of cut elimination processes. We will show that computation rules allow to avoid axiom in many theories and that a general cut elimination theorem can be proved for all these theories.

The second part of the course will be dedicated to the use of the articulation of deductions and computations in proof processing systems such as Coq. We will show that some theorems cannot be proved in practice when we do not have computation rules and how computation rules give a new status to proofs of programs.

References

1. G. Dowek. *Proof Theory*, in: Proof and Computation, Proc. the Marktoberdorf Summer School 2003, H. Schwichtenberg, K. Spies (eds), IOS Press, 2005
2. J.-Y. Girard, Y. Lafont, P. Taylor. *Proofs and Types*, Cambridge University Press, 1989
3. *The Coq Proof Assistant*, `http://coq.inria.fr`