WISM100 Lecture 1 assignment options

Viktor Blåsjö

1 Historical assignment

In the lecture I described some historical developments in terms of different mathematical personality types. See `http://intellectualmathematics.com/blog/four-types-of-mathematicians/`.

The assignment is: discuss the work of a mathematician or episode from the history of mathematics in terms of the themes raised in these personality type classifications (that is, such things as motivation, style, research strategy, etc.). Use other examples than the ones I already described. You can discuss mathematicians and topics from any era of history from antiquity up to and including the 19th century. You can use my system and/or the other similar ones that I summarise in my table (see link in my blog post for further details on those systems). You can also develop your own variations on these systems if you think they are missing something.

A convenient starting point for brief mathematical biographies is `http://www-history.mcs.st-and.ac.uk`. It is advisable to follow the references they give for their biographies to published scholarly sources. In particular, they usually link to the entry for that mathematician in the Dictionary of Scientific Biography, which is a useful standard reference work.

The purpose of this assignment is to give you a taste of the history of mathematics and how it can give us valuable perspective and occasion for analytic reflection on questions that are still fundamental today. The purpose of using the lens of the personality types is to lead you to engage reflectively with the material and try to synthesise it into an interpretation of your own and hence go beyond merely rehashing known facts.

2 Mathematical assignment

In this paper I describe some colourful aspects of Leibniz's work on the catenary: `https://www.maa.org/sites/default/files/pdf/awards/college.math.j.47.2.95.pdf`. The catenary was an important example in the early history of the calculus, not only for its intrinsic interest but also because it was an early test case for incorporating exponential functions into the calculus. Indeed, it was in this context that the decimal form of the number e was first written down (source: `https://t.co/5iBO4Isol6`).

The assignment is: explain, in modernised terms, how Leibniz obtained the (differential or exponential solution) equation of the catenary. In my paper cited above, I give a standard derivation based on an equilibrium of forces argument. That approach was used by Bernoulli, a contemporary of Leibniz. Your task is to explain the alternative approach used by Leibniz, which instead of equilibirium of forces is based on the assumption that the catenary has the lowest center of gravity among all curves with the same arc length and endpoints. Explain this in modern terms. As a bonus, you may want to include some reflections on how Leibniz's own text differs from how we would do things today, or on the relative merits of the Leibnizian approach as compared to that by Bernoulli.

Two of Leibniz's original papers on the catenary are available in English translation: `https://archive.schillerinstitute.com/fidelio_archive/2001/fidv10n01-2001Sp/fidv10n01-2001Sp_054-gw_leibniz_two_papers_on_the_cat.pdf`. But that does not help you with this assignment because in these papers Leibniz only describes properties and applications of the catenary without saying anything about how he derived the fundamental differential equation or mathematical representation of the catenary in the first place. He never published that part. But he did describe it in some letters. It is found in a mixture of German and Latin on pages 152–155 of: `http://www.gwlb.de/Leibniz/Leibnizarchiv/Veroeffentlichungen/III5A.pdf`. And again in French on page 180 of: `http://www.gwlb.de/Leibniz/Leibnizarchiv/Veroeffentlichungen/III6A.pdf`.

A modern discussion of Leibniz's work on this is provided by: `http://www.mikeraugh.org/Talks/RIPS-2017-LeibnizCatenary.pdf`, `http://www.mikeraugh.org/Talks/JMM17-LeibnizBodenhausen.pdf`, `https://youtu.be/TZ6mjPbmUyU?t=1730`. There is also a brief discussion on pages 71–72 of: `https://www.gwern.net/docs/math/1980-euler-rationalmechanicsflexibleelasticbodies16381788.pdf`.