COURSE OUTLINE – PMU199 2015-16 (Mathematics in Current Events)

Mathematics has been key to many spectacular discoveries of our times. Mathematics is fundamental to creating and analysing many of the models we use to understand the world around us and to inventing new technologies. From managing business risk to designing medical diagnostic equipment, mathematics provides insights inaccessible by other means. This seminar is based on a review of topics selected from popular publications such as Scientific American and American Scientist or from recent events. Most of the source information is now on the internet. Each student will make a presentation each term based on an article(s) describing a significant application of mathematics and may work in a team, depending on class size. The instructor will present the first one or two topics and then guide the discussion and assist in placing the applications in the context of modern mathematics in the student presentations, providing simple explanations whenever possible. After each presentation an independent written report will be required from each of the presenters on the material and the discussion. A test will be written by the whole class at the end of each term containing one question on each presentation in the preceding term. The first class of each term will be devoted to organising teams and choosing topics. We will try to start the presentations as early as possible, so please prepare. The presentation schedule is fixed in the first two classes

Marking scheme

The scheme below applies to the first term and will be repeated in the second term.

Participation and attendance	20%
Presentation	20%
Report	40%
Test	20%

Below are possible topics. Of course, you are also free to choose another suitable topic.

1. Encryption –secure internet communication eg. banking
2. GPS and how to calculate the best route from A to B
3. Game theory –modern economics, the Deep Blue chess program
4. Business risk, financial derivatives, mortgage securities - what went wrong?
5. Computational complexity and its impact
6. Linear programming, optimization and its impact
7. Reliability of complex mechanisms
8. Electric power distribution grids
9. Medical imaging –CAT scans, MRI – s, etc
10. Aircraft and flight –fluid flow and controllability
11. Mathematics models and epidemics
12. Mathematics in meteorology
13. Mathematics in climate change models
14. Mathematics and understanding earthquakes
15. Mathematics and understanding the tsunami
16. Mathematics and finding oil reserves
17. Mathematics describing sound propagation and the properties of gases
18. Mathematics describing the sonic boom
19. Mathematics and remote sensing

20. Mathematics behind artificial intelligence
21. How Google uses mathematics
22. Mathematics behind drones and robots
23. Mathematics in the evolution-creation debates
24. Mathematics in the practice of law

The course will make extensive use of the BLACKBOARD system and email. Students are expected to find source material in the library or on the internet. In case of the internet, information reliability should be considered. Presentation topics must be chosen and a proposal submitted to the instructor before the second lecture of the term. Students are encouraged to prepare presentations in teams of not more than three students. Reports must be individually written and should incorporate not only the original research but also any insights gained from class discussion.

Source materials can be found on the Internet by doing a search under the heading "popular articles on mathematics". A list of sources comes up in the Wikepedia entry under "Popular Mathematics". The following journals and magazines also form a good starting point: New Scientist; Scientific American; American Scientist – particularly articles by Brian Hayes; Nature. In most cases the complete table of contents for many years back is accessible on the web. The book - Excursions in Modern Mathematics by Peter Tanenbaum and Robert Arnold could also form a starting point for your research.

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