

Q520 (Math and Logic for Cognitive Science), Spring 2008
<http://www.indiana.edu/~iulg/moss/Q520.htm>
Tuesday/Thursday 11:15 - 12:30 in Ballantine 340

Instructors

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Office Hours: after class 12:30 - 1:00 PM, and Friday 10:00 - 11:00 AM. I may change these times in the first few weeks of class, so please check back with me. Also, I'm happy to talk to people at other times, so please feel free to write me on this.

Gabi Teodoru is the assistant instructor for the course, and he may be available for help as well. His email address is gabiteodoru@gmail.com.

Goal of the class is to introduce a wide variety of mathematical topics pertinent to cognitive science, artificial intelligence, and related fields. Those topics are primarily taken from probability and linear algebra, and secondarily from logic. The intended applications will be to models for uncertain reasoning, such as Bayesian nets and other graphical models, hidden Markov models, latent semantic analysis. In addition, the class will also present the basics of logic, both in its classical form and some systems for areas like default reasoning. It will also introduce concepts like information and entropy. So the class will see many application areas. But it will not be a class in using or even building application tools. And although the applications include some of the main tools in cognitive science and artificial intelligence, the overall point is to introduce a large body of related mathematical ideas in a friendly way, so that you will be stimulated to continue learning in your own areas.

After teaching this class a few times, I can say confidently that it's an impossible class to teach, for the following reasons: (a) people come to the class on different levels; (b) there is a huge variety of mathematical tools used cognitive science and AI, and one semester could not even begin to cover it; (c) for some topics, a few weeks would not be enough to really cover the mathematical material in the first place, and so I have to choose between leaving the subject out or doing a very rough and quick version; (d) the main points are to both learn the math and to see the very interesting applications, and sometimes these conflict.

All in all, despite (or because) the class is impossible, it's one of my very favorites to teach.

Do I have the background to take the course? Clearly for a course like this, the more background one has with mathematical notation and ideas, the better. But the class is taught as if one had little background. In particular, I'll develop most of the math from scratch. (One exception is the linear algebra material, where I'll start from scratch and then tell you the theorems without proofs.)

The first week or so of the class is designed to be a quick unit on a self-contained topic (Hopfield nets). If you can follow those lectures and do the homework, then you would be fine for the rest of the semester.

I also think that a course should take between 5 and 10 hours of work per week, outside of the class.

Texts: There is no required text for the course. The reason is that there are no books that cover the material at the right level. There *are* lots of sources that I look at when I teach the course, and I'll mention them to you in class and on the course web site. The fact that there is no overall textbook means that I try to have the lectures be self-contained.

Homework: will be assigned every week. There will be too much of it to do the night before it is assigned. I'm happy to talk about it in class as people work on it, and also to answer email on it. The homework is an important part of the course, mainly because if you are not working with actively mathematical concepts, you won't learn them. Also, the homework problems that I assign usually have a bigger point. So in doing the homework, it's a good idea to try to look for that point!

Grades will tentatively be based on homework (50%), two take-home exams (15% each), and a final exam (20%).