Intensive Interdisciplinary Courses

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Some courses developed at Purdue University, West Lafayette

• Introduction to Computational Neuroscience (2004)
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Purdue University, West Lafayette

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THANKS!!:

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Purdue University,

and the Mathematical Biosciences Institute

http://www.math.purdue.edu/~cowen/CompNeuro.html
Some courses developed at Purdue University, West Lafayette

- Introduction to Computational Neuroscience (2004)
- Freshman Mathematics Seminar/Honors Seminar (1999)
- Linear Algebra for Engineers (1994)
- Introduction to Actuarial Science (1994)
- Linear Algebra II, with applications (1985)
Questions to answer before beginning

• Why is this interdisciplinary course necessary (desirable)?

• Which students are candidates for the course?

• Will this count as a graduation requirement for the target students?

• Who supports this idea? chair? counselors? colleagues? dean?

• Who will publicize the course?

• Will teaching this course fulfill part of your teaching obligation?

• How will you know if this course was a success?

• What is future of this course?
Introduction to Computational Neuroscience

• Prepared during a sabbatical and a ‘postdoctoral’ year

• Supported by NSF grant from IGMS program

• Target: mixed class ‘math’ & ‘bio’ students with junior or higher standing
  – Pre-requisite for ‘math’ students: differential equations
  – Pre-requisite for ‘bio’ students: at least one semester of calculus

• Arranged with faculty committees for graduation credit for both sets of students

• Advertised, got support of major advisors in both groups

• Students arranged in mixed groups
  – different assessments for ‘math’ and ‘bio’ students
  – one class each week separate for ‘math’ and ‘bio’ students
Interdisciplinary Course Issues

• Team teaching???

• Are you aware of cultural differences? How can they be overcome?

• Is it ‘FAIR’ to grade one set of students differently than another?

• How can you generate support if it’s initially absent?

• Is this kind of course ‘SAFE’ for an assistant professor?
Slides will be posted on my webpage:

http://www.math.iupui.edu/~ccowen/Interdisciplinary.pdf
Linear Algebra II, with applications

• Linear algebra is growing in importance and deserves a year of study

• Linear algebra is a good venue for doing both theory and applications and showing inter-relationships

• Can show full cycle from modeling to theory to application, with realistic problems

• Important for math majors, of all kinds, to be aware of this cycle and ‘real’ applications – a goal of course

• Course has become a de facto requirement for most math majors

• Includes computation using Matlab, in class, for homework, on tests
Potential topic list

- Partitioning matrices
- Norms of matrices; efficiency, accuracy of algorithms
- Application: Internal Cost Allocation
- Geometry of subspaces; orthogonal projections
- Application: Least Squares
- Applied Project: Circles in Space
- Convexity
- Application: Introduction to Linear Programming
Potential topic list (continued)

• Review of eigenvectors and eigenvalues

• Hermitian and normal matrices

• Application: Matrix Exponential, Systems of Differential Equations

• Application: Markov Chains

• Nilpotent matrices; Jordan Canonical Form

• Application: Systems of Differential Equations
Project on circles in space

- Problem came from Ford Motor Company
- Every student gets her/his own data, but students may work in groups
- Basic mathematical and software tools developed in course before presentation of problem
- No class time for theory but time for discussion
  - Class 0: presentation of problem
  - Class 2: discussion of ‘what is a circle?’
  - Class 4: when is point ‘on’ circle? least squares!
  - Class 6: project due
Project on circles in space (continued)

• “Resources for Teaching Linear Algebra”
  Carlson, et al., MAA Notes, Vol 42 (1997)

• also “Linear Algebra Gems” Carlson, et al.,
  MAA Notes, Vol 59 (2002)

• www.math.iupui.edu/~ccowen/Downloads/34CircleProj.html