THE UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF MATHEMATICS
AND STATISTICS

MATH2060 Professional Issues and Ethics in Mathematics

2007 S2

Lecturer: Dr James Franklin,
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Consultation times will be advised, but you are welcome to call anytime.

Lectures will be Fri 10-12, RC M032. At Friday 11-12 (except wk 1), there will be visiting speakers (weeks 2-9), and talks by students in tutorials (weeks 10-14).

The course is worth 3 units of credit. It is compulsory for mathematics majors.

Rationale of the Course:

This is a course where students come to understand the relation of their technical mathematical studies to the ways in which mathematics is used in the world outside university. Visiting speakers explain their work experience. Lectures and class discussion will introduce a wide range of topics giving an overview of mathematics and its relation to practical and ethical issues in the workplace. In order to develop skills of planning, management, teamwork and communication that are highly valued in the workplace, most of the assessment is on a team project of students' own choosing, involving written and oral presentation.

An article on the course is at
http://www.austms.org.au/Publ/Gazette/2005/May05/franklin.pdf

Provisional Lecture Outline:

Wk 1. Employment in mathematics, and the skills required in employment and research.

Wk 2. Presentation from UNSW Careers and Employment.

Wk 3. Classification of mathematics and the formal sciences, and their place in the wider science and culture.

Wk 4. Overview of history of mathematics from the Greeks to the present.

Wk 5. Mathematical modelling: example of greenhouse models

Wk 6. Statistics, data, data mining, risk; differences from mathematics

Wk 7. Plato's *Meno*. Proof in mathematics versus experiment in science

Wk.8. Communicating mathematics: spoken word, diagrams, graphs

Wk 9. Ethics: codes of ethics, foundations

Wk 10. Presentation from APESMA. Ethics: case study

Wk 11. Ethical/legal issues: duty of care, conflict of interest

Wk 12. Ethical issues: military work, worthwhile careers

Wk 13. Ethical and professional issues: data, confidentiality, legal

Wk 14. Class test in lecture room

Notes of the lectures will be made available on the course My eLearning Vista page. There is no textbook.

Assessment:

- 10% Short writing assignment (set week 1, due week 3; see later)
- 30% Written version (essay or report) on a project, which will be done in teams of two (due in tut week 13) (5% of these marks will be given for a one-page plan of the project, due at lecture week 7)
- 30% class presentation on project (to be delivered by both of the team)
- 10% Participation in tutorials (that is, active involvement)
- 20% Short-answer class test (in wk 14 lecture time) on the lecture material and the talks by visitors

Late assessments are accepted, with a gradual decay of marks.

The graduate attributes that the course particularly aims to develop are communication skills, both written (in the project and class test) and

oral (in the class presentation); research and analytical skills (in the project); teamwork and management skills (in the project); and information literacy (in the research for the project). The wide choice of project topic encourages intellectual initiative.

Since part of the point of the course is to listen, a roll will be marked in tutorials, and occasionally in lectures. A satisfactory level of attendance (about 80%) is required to pass.

The content of this course is still being developed. Comments and suggestions are welcome. If you see any material (in newspapers etc) that would be of interest to the whole class, let the lecturer know and it will be copied and distributed.

A book token of $40 will be awarded for the best performance in the course.

Short writing assignment: (Due at lecture week 3)

Suppose you are asked to speak at a careers fair at your old school, for students aged about 14. Write a short talk (between 700 and 1000 words) about careers in maths, including some colourful and unusual examples of mathematics in the real world that would appeal to that age. (The examples below may give ideas, but find some of your own. Don't just list the examples – give a short description, so the hearers gain some understanding).

From: Phil.Owen@CSIRO.AU [mailto:Phil.Owen@CSIRO.AU]

Sent: Wednesday, 11 July 2007 2:49 PM

To: Mike Archer [Dean of Science, UNSW]

Subject: Exciting new opportunity for a Post Doctoral Fellow

CSIRO Mathematical and Information Sciences and the Australian Institute of Sport have an exciting new opportunity for a Post Doctoral Fellow to conduct novel research into fluid dynamic simulation of elite swimmers.

This unique post-doctoral opportunity exists at the leading edge of fluid dynamic research to help bring together advanced CFD modelling and swimming technique evaluation and enhancement for elite Australian swimmers.

This research involves the coupled prediction of deforming swimmer bodies interacting with turbulent bubbly fluid flow. The modelling is based on the

Smoothed Particle Hydrodynamics (SPH) method. The research will involve contributions to the development of the modelling capability, its validation and its use to assist in the evaluation and possibly modification of elite swimmer technique.

This is a challenging and rare opportunity for doing both high end and high impact CFD coupled with elite sports. The post-doctoral fellow will work with the established development and application teams, specialising in the extension and application of the SPH method and software to modelling all aspects of the swimming application.

This position will be advertised shortly, both in the print media as well as on our careers website www.csiro.au/careers. Would you please pass this information to anyone you think will be a suitable candidate?

Regards,

Phil Owen, Applications Specialist

Computational Fluid Dynamics Group, CSIRO Mathematical & Information Sciences

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Dodgy maths stopped bombers

The Australian, July 10 2007

THE four would-be suicide bombers who attempted to blow themselves up in London two weeks after the deadly 2005 attacks failed because their ringleader could not do simple mathematics.

The men, Muktah Said Ibrahim, Yassin Hassan Omar, Ramzi Mohammed and Hussain Osman, have been found guilty of conspiracy to murder at Woolwich Crown Court in London after a trial lasting almost six months.

They had tried to blow up trains and a bus on July 21, 2005, and had been planning attacks “bigger and better” than the bombings on three Tube trains and a bus in London a fortnight earlier that had killed 52 people, the court heard.

The explosives would have caused carnage on the transport network, but the plot mastermind, Ibrahim, miscalculated the ratios of ingredients when making the bombs, Britain's Daily Mail newspaper has reported.

The court heard Ibrahim personally bought the bleach and chapati flour used to make the devices in his flat, which was also booby-trapped. Police said the highly volatile triacetone triperoxide, known as "mother of Satan" was used as a detonator.

But Ibrahim, who failed maths at school, got his sums wrong when mixing the recipe, making the bombs - which were packed with nails and screws - harmless.

The Project:

First, you will need to choose a partner. Marks will be equally distributed, unless problems arise (which should be discussed with the tutor or lecturer).

The written version of the project should be an **essay or report**, as the team think appropriate. **About 5,000 words** would be usual, but that depends on the nature of the project, whether there are many illustrations, etc. The project should be submitted in hard copy to the tutor and by email to the lecturer (so plagiarism detection tools can be used).

It is important that the work is your own, and not plagiarised. More guidance on plagiarism is given later in the handout. Written or other sources, whether directly quoted or summarised, should have full references given in footnotes. There are different styles of giving references that can be used, but references must be full enough so that a reader can easily check them (for example, exact page numbers should be given for quotations). See more later in this handout.

A sample successful essay from a previous year is included in this handout (but note that projects were then individual, so it is shorter than what is required this year).

To encourage an early start on the project work, each team will submit a **one-page plan** on the project at the lecture in **week 7**. It will describe the idea of the project, and will include at least three of the references that will be used.

The talk on the project will not consist simply of reading the essay, although reading some parts may be appropriate. The talk should be a presentation that convinces the audience that the topic is interesting. Some suggestions on oral presentation, provided by a 1998 student, are included later in the handout. Students in the class will assist with evaluation of the talks.

It is important to search widely for information on the topic chosen. Good sources to begin with include:

The Internet, using such search engines as google (google.com) and google scholar (scholar.google.com)

Encyclopedias, notably the *Encyclopaedia Britannica*, Wikipedia

(don't trust everything in it…), the *Encyclopedia of Mathematics*, the *Companion Encyclopedia of the History and Philosophy of the Mathematical Sciences*, and the *Encyclopedia of Statistical Sciences*;

Popular books on mathematics by such authors as Keith Devlin, Ian Stewart, Morris Kline and Martin Gardner;

Online databases available in the Library or through the Library's web page, such as General Science Abstracts; Mathscinet; Web of Science;

Keyword search of the library catalogue;

People who know something.

The **topic** may be chosen by the team of students, but must be about some **ethical or social issue involving mathematics or statistics** (interpreted fairly widely). Examples of suitable topics might be:

- Misuse of statistical or actuarial evidence in some corporate scandal, such as the collapse of HIH
- Successful and socially beneficial uses of statistics in, for example some medical application
- "Smart" weaponry and whether it does or does not save lives
- Analysis of risks of disasters, such as of huge volcanic eruptions
- The (first) space shuttle disaster, involving a statistical bad inference
- Greenhouse climate models and their credibility
- The collapse of Long Term Capital Management

An interesting and original choice of topic will create a good impression. Consult the lecturer if in doubt if your topic is acceptable. The essay and the class presentation should maintain a balance between technical and ethical/social aspects: the necessary mathematical technicalities should be explained but about half the space at least should be devoted to ethical/social aspects, such as the social benefits or whether the people involved behaved rightly.

The School of Mathematics and Statistics evaluates each course each time it is run. Feedback on the course is collected from, e.g. the CATEI forms. Student feedback is taken into account and efforts are made to improve the course on the basis of feedback. This course has responded to suggestions to make the course structure clearer.

SCHOOL OF MATHEMATICS and STATISTICS, UNSW S2 2007

IMPORTANT INFORMATION FOR UNDERGRADUATE STUDENTS

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the policies of the University. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Page on the MathsStats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the MathsStats web site starting at:

http://www.maths.unsw.edu.au/students/current/policies/studentpolicy.html

The School of Mathematics and Statistics will **assume that all its students have read and understood the School policies** on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedures in it.

The following is a brief outline of some of the most important MathsStats policies.

1. Course Enrolment, Tutorial Enrolment
It is each student's responsibility to know the rules for their degree program and be enrolled in the correct courses by the census date. The School of Mathematics and Statistics can advise students if needed, but is not responsible for the student's program as it is not the Program Authority for any undergraduate program.

Students must be enrolled in a tutorial with the School of Mathematics and Statistics no later than week 3 if there are tutorials for a course. All assessment is recorded by tutorial and marked tests and assignments are normally handed back through tutorials. If a student is not in a tutorial then the student's marks may not be recorded.

2. Notices
Any general announcement to students will be given in lectures and placed on the Course Home Page.
An email sent to students at z<stuno>@student.unsw.edu.au will be viewed as an official communication and the School of Mathematics and Statisitcs will assume that it has been read within 3 working days.
Students communicating with the School must include their student number or a reply may not be given.

3. Attendance and participation during session
It is UNSW policy that attendance at lectures, tutorials etc is compulsory

unless the student has permission of the Registrar. Consequently the School expects students to fully participate in all classes during the session.

In line with this, the School of Mathematics and Statisitcs marks the roll at all tutorials. If a student does not attend at least 70% of the tutorials then they may not be eligible for any special consideration if that is requested.

It is expected that students attempt all tests, assignments, etc during the session unless prevented by illness or misadventure. Tests and assignments are designed to test student's current knowledge and to assist with ongoing learning. Special consideration for final exams will not be given to students who miss more than a small number of tests or assignments. An exception may be made for long-term documented illness or misadventure.

4. Cheating and Plagiarism

Cheating at tests, exams or copying of assignments or any other person's work are all treated as Academic Misconduct and are severely punished. The University also has a strong policy on plagiarism.
See http://www.lc.unsw.edu.au/plagiarism/index.html
Also see

http://www.maths.unsw.edu.au/students/current/policies/misconductpolicy.html

5. Release of Marks, Disputes over Marks

The School endeavours to return student's tests and assignments within a short time and the marks for these are then displayed on the MathsStats secure student web portal within 7 days of the work being returned.
If a student has a dispute over the mark awarded then they must take the matter up as soon as possible with the tutor who marked the piece of work (or otherwise the Course Convenor). If it is not resolved at that time, then the student may appeal (see http://www.maths.unsw.edu.au/school/students/assesspolicies.html for more information).
Disputes over incorrect recording of marks must be taken up no later than the first day of the final examination period. After that day no recorded during-session mark will be changed even if we have made an error.

The provisional final marks in each Mathematics and Statisitcs course will be available on the MathsStats secure student web portal on the Friday following the last day of exams. Note that this is earlier than the official final marks are released by the University so as to give students notice of possible additional assessment. The marks are not official until they are released by the University, usually a week after this.
Disputes over final marks awarded must be taken up following UNSW guidelines with the Course Convenor, Director of First Year or Director of Undergraduate Studies and if necessary UNSW Student Central within 15 working days of the release of the results.

6. Special Consideration for Illness or Misadventure
Special consideration may be granted for an illness or misadventure (that is, some other event that occurs that is outside the student's control) that affects a student's study in more than a minor way. This does not apply to anything that affects a student's study that is employment related as the University expects that employment will not affect a student's study. Anything related to a student's social or sporting life is also not included.
See also

http://www.maths.unsw.edu.au/students/current/policies/illnesspolicy.html
In all cases where a student wishes to ask for special consideration, then the student must present proper documentation – either a doctor's or counsellor's certificate for an illness or suitable documentation of the misadventure (such as a police report).

The procedure in cases of illness or misadventure is:

a. If you miss a lecture, you do not need to notify us.
b. If you miss a tutorial, give the tutor documentation at the next tutorial and ask that it be indicated on the roll.
c. If you miss a class test at a tutorial, give the tutor documentation at the next tutorial and ask that they indicate it on the mark list and roll. If the test is at a lecture, give documentation to the Course Convenor.
d. If you miss a class test worth at least 20% of the final mark, then apply for special consideration through UNSW Student Central and give the Course Convenor a copy of the application as soon as possible.
e. If you miss an assignment, give documentation to the Course Convenor. Note that as assignments are available for an extended period, the illness or misadventure must be of an extended nature and not just on the last day or so before the due date.
f. If you miss a final exam through illness or misadventure or are significantly affected by such during the exam period, then apply for special consideration through UNSW Student Central. There is no need to give a copy to the School.
g. If you have long-term illness or misadventure then you should consult and register with the Director of First Year or Director of Undergraduate Studies as early as possible. Claims for long-term problems will normally not be accepted once the examination period has started and definitely not after the results are released.

7. Additional Assessment Exams
See the full policy at

http://www.maths.unsw.edu.au/students/current/policies/addasspolicy.html
There are two types of Additional Assessment: Normal and Concessional. The actual exam is the same for both.

The School runs all its Additional Assessment Exams on the first Tuesday to Thursday after the official marks are released by the University. **For S2 2007 the dates are 11-13th December.** The detailed Timetable is normally available on the MathsStats web site the week before the Additional Assessment Exams are held.
If awarded an Additional Assessment Exam you must take it at the

announced time within that period (unless you have two Mathematics or Statistics exams at the same time). For Normal Additional Assessment only, exceptions to this rule may be made if there is a long-term illness or misadventure registered in advance with the Director of First Year or Director of Undergraduate Studies. Students do not need to notify the School that they are attending.

a. Normal Additional Assessment

Permission to take a Normal Additional Assessment Exam may be granted to students who miss the final exam through illness or misadventure. For such students the Additional Assessment Exam mark will take the place of the final exam mark in the calculation of their final mark.

Permission to take a Normal Additional Assessment Exam may also be granted to students who are seriously affected by illness or misadventure during the exam period and who have failed or whose performance is significantly less than expected on the basis of during-session assessment. For such students any Additional Assessment Exam mark will replace the final exam mark and the final mark re-calculated (**up or down**) accordingly (unless that reduces the final mark from a pass to a fail in which case the final mark will be 50).

In both cases the student must apply and provide proper documentation through UNSW Student Central.

Note that NO Normal Additional Assessment Exam will be awarded unless the student has adequately participated in their class during the session. This is taken as meaning: attending at least 70% of the tutorials and having an overall during-session (before final exam) mark of at least 40%.

Permission to take the Normal Additional Assessment Exams will be shown on the provisional and official final marks by a **grade of WC.**

The School will try to notify students who are awarded Normal Additional Assessment by email, but it is still the student's responsibility to check if they have been awarded it.

Disputes over non-awarding of Normal Additional Assessment must be taken up with the Director of First Year or Director of Undergraduate Studies **before** the Additional Assessment exam period commences.

b. Concessional Additional Assessment

Concessional Additional Assessment is **automatically awarded** to any student taking a MATH2### or MATH3### course (but to no others) who gets a mark of 40 to 49. The maximum mark that can be awarded after Concessional Additional Assessment is 50.

Permission to take Concesssional Additional Assessment is **not notified in any way other than this notice**.

John Steele, Director of Undergraduate Studies - for Head of School
July 2007

UNSW Statement to Students on Plagiarism

Plagiarism is the presentation of the thoughts or work of another as one's own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at: www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

† Adapted with kind permission from the University of Melbourne.

MATH2060 Professional Issues and Ethics in Mathematics

University of New South Wales, Sydney

Lecturer: James Franklin

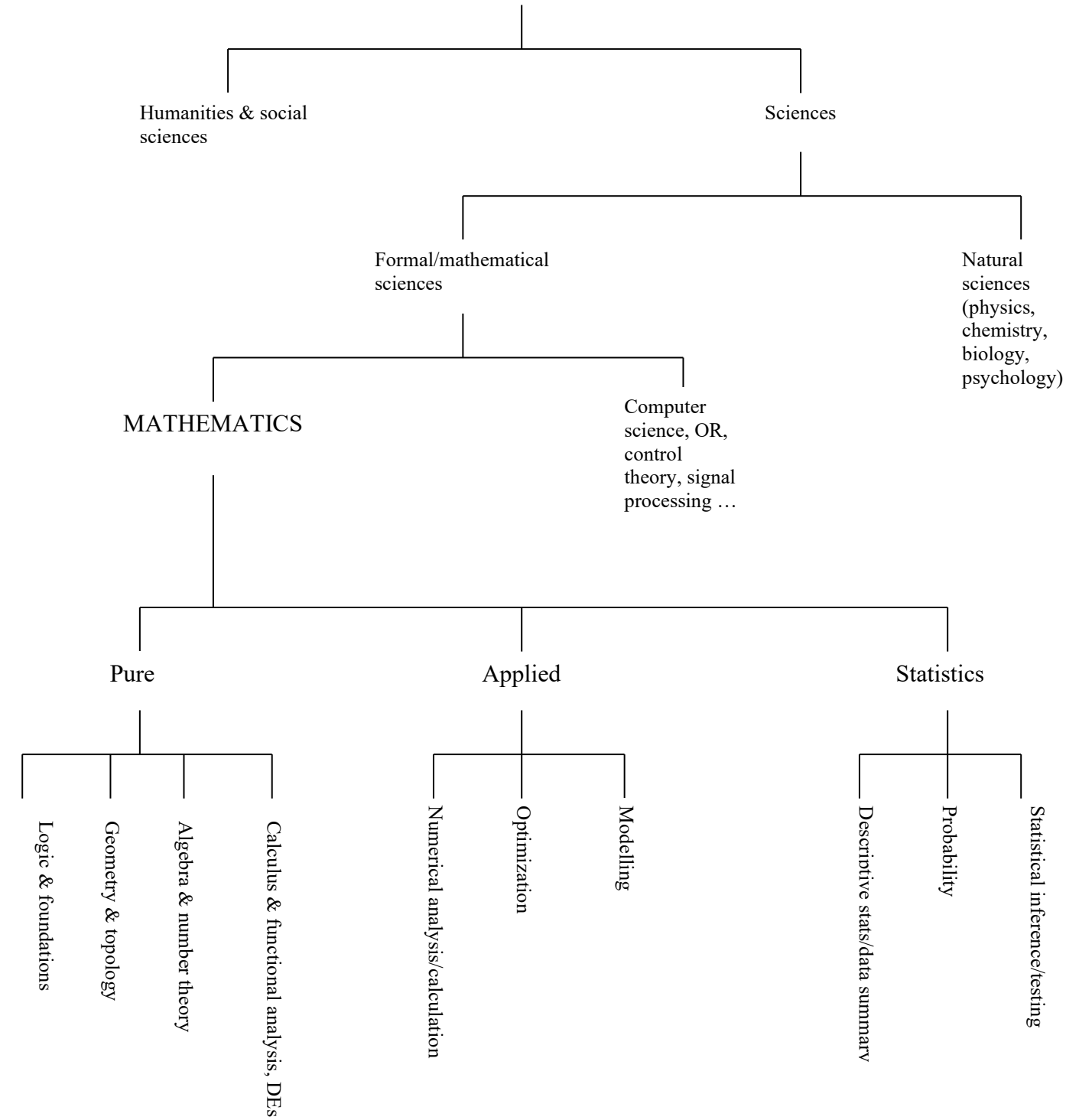
S2 2007 Lecture Week 3

Overview/classification of mathematics

In a normal mathematics degree, it can be hard to "see the wood for the trees": one does courses on algebra, differential equations etc, but no course on just "mathematics" that gives an overview. It is very desirable to have an overview for such reasons as:

- Planning your future study: maybe the area for you is one you've never heard of yet
- Explaining to prospective employers the potential applicability of your mathematical skills
- Motivating your study of current courses and thus leading to better results, by giving an understanding of the point of the course content

We survey mathematics and its wider context using the diagram on the next page. For each area of mathematics, we consider a typical problem considered there, so as to gain some initial understanding of what the area is about.


Humanities & social sciences
Sciences
Formal/mathematical sciences
Natural sciences (physics, chemistry, biology, psychology)
MATHEMATICS
Computer science, OR, control theory, signal processing …
Pure
Applied
Statistics
Logic & foundations
Geometry & topology
Algebra & number theory
Calculus & functional analysis, DEs
Numerical analysis/calculation
Optimization
Modelling
Descriptive stats/data summary
Probability
Statistical inference/testing

MATH2060 S2 2007 Lecture Week 5

Mathematical Modelling: Mathematics' connection to the real world

We looked at the powerpoint presentation on the industrial work of MASCOS, the ARC Centre of Excellence for Mathematics and Statistics of Complex Systems, with which the School of Mathematics and Statistics is associated. (mascos07.ppt in the Lecture Notes folder).

Then we looked at last year's problems in the COMAP International Modeling Contest. Hopefully some in the class will form next year's UNSW team.

The first example one usually learns at school of a mathematical model is the exponential growth model of population growth: if a population grows (continuously) at 4 %

Similar examples of mathematical models:

* Weather and ocean current modelling (as described in Russel Morison's talk)
* Climate models, e.g. Greenhouse Effect
* Stress analysis, e.g. in ship hulls
* Macroeconomic models, e.g. to predict effect of interest rate rises on unemployment
* Traffic systems, e.g. to predict effect of new tunnels on traffic

Problems with mathematical modelling

* May not know the structure of the real situation, e.g. fail to recognise some of the causes
* "Game world problem" of believing the model is the real thing, e.g. spreadsheet projections of company profits
* Insufficient data to test the model on, e.g. short run of climate data in Greenhouse models
* Unsolvability of equations in model can mean only a few scenarios can be run
* Possible numerical problems, e.g. roundoff error accumulates after many steps

MATH2060 S2 2007 Lecture Week 9

Ethics: the foundations

We now start on the second half of the course, dealing with ethics and social questions.

Teaching in ethics often begins with "dilemmas", but instead we start with some basic questions: What is ethics about? What are the axioms of ethics (or can anyone choose their own?) Is ethics taken seriously (for example, in the workplace)?

We started with a handout from Rai Gaita's book, *Good and Evil: An Absolute Conception* (p. 319 of 1st ed), concerning "moral scepticism" (the view that there is no objective right and wrong but only different people's opinions). He writes:

"... imagine a tutorial in which one of its members had been a victim of terrible evil of which all the other members were aware, and in which the tutor invited them to consider whether the our sense of the terribleness of evil was not an illusion. Everyone would be outraged if their tutor was not serious and struck by unbelieving horror if he was."
Gaita draws the conclusion that our sense of evil is solid, and that denying it would be not only false but an evil act against those who had suffered evil.

Our moral vocabulary is certainly very ingrained. Codes of ethics in the professions assume we all know what's meant by moral words like "fair", such as the words in italics in the selections below from some codes of ethics:

Australian Computer Society Code of Ethics

* 1a. A member must be forthright, honest and impartial
* 3.1 Priorities: I must place the interests of the community above those of personal or sectional interests
* 3.4 Social implications. I must strive to enhance the quality of life of those affected by my work
* 8.3 I must respect my employees and refrain from treating them unfairly
* 10.2 I must not knowingly engage in, or be associated with, dishonest or fraudulent practices

In later lectures, we will examine what that means in the workplace.

But first, what is ethics really about? Where to start? There are three basic views, and as with any philosophical question, the way to approach it is to list the possibilities and consider the reasons for and against.

3 views on the foundations of ethics

	FOR	AGAINST
NATURALIST: Customs tribes have evolved	Fits well with science; Explains well both similarities and differences among tribes (e.g. can see how wishes for self-protection lead to certain rules)	Doesn't allow moral criticism of other tribes (e.g. Nazi tribes); Doesn't give a reason to *be* moral; Moral progress meaningless
NATURAL LAW: Based on "natural" preciousness (inherent worth) of humans, which would be wrong to destroy	Fits well with actual intuitions?: We understand our own worth, and know others are the same	Hard to fit with scientific world picture?
THEOLOGICAL: What God(s) command(s)	Clear answers in scriptures?	Doubts if God exists; Conflict of alleged revelations; Socrates: "Is something good because gods command it or do the gods command it because it is good?"

MATH2060 S2 2007 Lecture Week 10

Ethical/Legal Concepts

The law enforces some ethical concepts, especially those that forbid harming other people.

Duty of Care

Having dealt with the foundations of ethics, we move to consider some ethical/legal issues. The law has a strong moral foundation, and is concerned to back up ethical requirements, especially those involving harm to others.

The law recognises that people making goods, providing services etc have a duty of care to the users of the goods and services. They must take care not to harm the users. There is a classic legal case, Donoghue v. Stevenson. In 1928 in Scotland, May Donoghue ("possibly the most famous litigant of all time") bought a bottle of ginger beer, made of opaque glass. After she drank some, her friend found that the remainder contained the decomposed remains of a dead snail. Miss Donoghue suffered shock and gastro-enteritis. She sued the manufacturer, Stevenson, and eventually won. It was held that manufacturers have a "duty of care" to buyers of their products.

Lord Atkin wrote in his judgment:

> "The rule that you are to love your neighbour becomes in law you must not injure your neighbour; and the lawyer's question: Who is my neighbour? receives a restricted reply. **You must take reasonable care to avoid acts or omissions which you can reasonably foresee** would be likely to injure your neighbour. Who, then, in law, is my neighbour? The answer seems to be - persons who are so closely and directly affected by my act that I ought reasonably to have them in contemplation as long as so affected when I am directing my mind to the acts or omissions that are called in question."

Note the two uses of "reasonable": the judgement of what is reasonable care and what can be reasonably foreseen is left to individuals, but it is presumed everyone can make these judgements. Note also how the law backs up ordinary ethical practice.

Other examples of duty of care:

* Employers have a duty of care to ensure safety in the workplace (for both employees and customers).
* Schools have a duty of care to make sure their pupils do not have access to pornography through the School's internet connection, so they need to use `net nanny' type software ... Other duties of care of teachers

Writers of defective software have not often been held liable for the loss arising from their mistakes, possibly because the effects of bugs are often hard to foresee. But the law is probably becoming more strict.

Conflict of interest

A conflict of interest occurs where there is conflict between the requirements of a person's job and their desires, for example desires for money or to help friends or relatives. A typical example is that one may not appoint a relative to a job, as one will be tempted not to choose the best person for the job. If someone is on a job selection committee and a relative or friend is a candidate, the person should leave the room when that candidate is discussed. For the same reason, academics are not permitted to mark the work of a student with whom they have a close personal relationship (e.g. uncle, partner).

An instance of conflict of interest was the case of the Educational Testing Centre at UNSW, where the head appointed several relatives who assisted him to cover up some other illegal activities including smuggling money from foreign countries (story).

In very bad cases, conflict of interest may amount to bribery, the giving of money or favours to influence decisions. We looked at the guidelines from ICAC (Independent Commission Against Corruption), especially the case study and excuses in p.6 of the report `Gifts, benefits or just plain bribes?',

We debated whether the sponsorship of the School's new second-year courses MATH2871 Data Management and MATH2881 Quantitative Risk by SAS and the CBA constituted conflict of interest (since the sponsors obtained benefit from students learning their software and working as interns).

The workplace sometimes provides temptations to misuse information for personal gain, for example in insider trading. Someone who knows through their job of inside information that will affect a share price when it becomes public, for example a mineral discovery or takeover bid, may make money by buying shares. A handout gave the story of Simon Hannes, a former Macquarie Bank executive director, who was gaoled for insider trading.

Communicating Mathematics

Some suggestions on communication in general:

- Start by having something worth saying
- Keep in mind an internal model of the audience, so that what you communicate connects with what they know and is not too complex (KISS: "keep it simple, stupid"), but on the other hand doesn't repeat what they know and bore them
- Use where appropriate visual aids/diagrams/powerpoint but only where they help get the message across; don't just read what's on powerpoint; and check first that any technology works
- Remember basics like speaking at medium speed, writing legibly
- Active learning, like forcing the audience to respond, can work if used sparingly for variety
- Provide offline resources/handouts/evidence/webpages

Unlike philosophy etc which is all text, mathematical communication uses formulas/graphs/diagrams etc. Useful, but need to go slowly with a non-mathematical audience (or even a mathematical one), to make sure they know, e.g. what axes on a graph represent.

We looked at the remarkable moving graphs of world poverty at http://www.gapminder.org to get an idea of the possibilities in the visual display of numerical information.

MATH2060 S2 2007 Lecture Week 11

Ethical/Legal Concepts II: Information ethics

(The first half of the lecture was presented by Jenny de Luca, representing APESMA; her presentation is in a separate file.)

Most of what a mathematical worker does is dealing with information: interpreting data, writing reports, giving advice etc. So ethical issues surrounding information are especially important in that area of work: issues such as truthfulness, confidentiality, intellectual property, plagiarism.

Truthfulness

Mathematics and statistics professionals, like many others, are employed to give technical advice on matters that are hard for most people to decide on. They therefore have a responsibility to make their conclusions soundly based and fully informed - people are depending on them to get it right. Mathematics has a high reputation because people know there are right answers, so a professional attitude is expected.

We looked at the Sydney case of James Hardie and Trowbridge Deloitte. James Hardie, after admitting liability for causing asbestosis to many former workers, employed the actuarial firm Trowbridge to do the calculations on how many claims could be expected in the future. It turned out within a year that their conclusions were a gross underestimate. James Hardie had failed to provide Trowbridge with recent data, but Trowbridge were still criticised in court for not being more active in finding information that might have been contrary to the interests of the firm that employed them.

The responsibility to deliver the answer that the data implies may extend to publishing it even when the client is not happy with the conclusion. We looked at the case of a drug company that tried to block the publication of a study they had commissioned, when the study showed their AIDS drug did not work.

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Ethical/Legal Concepts III: Other information ethics/Jobs

Other than basic truthfulness, other concepts include:

Confidentiality

Perhaps the most common ethical issue in the kind of workplace in which university graduates typically work involves keeping information confidential. Personal information, data etc is given to an organisation for a specific purpose, such as to enable informed decisions by the organisation, and the data (e.g. addresses) should not be used for other purposes (e.g. given to marketers). For example, UNSW does not allow your marks to be displayed in public. This ethical requirement is to some extent backed up by privacy legislation.

`Whistleblowing'

On the other hand, there is some information that organisations would like to keep secret but which ought to be disclosed, e.g. evidence of the organisation's wrongdoing. If an employee finds that his employer is doing something wrong, e.g. selling goods to the public that are dangerous or not made as per specifications, he may have a duty to disclose that, e.g. to journalists or to the Independent Commission Against Corruption. Someone in that position, who becomes a `whistleblower', may suffer persecution and/or lose his job, so it is not to be done lightly. Whistleblowers Australia's site has more info.

Intellectual Property (IP)

Someone who creates a book, artwork, software, invention etc has intellectual property in it and a right to receive the benefits of creating it, so that those who use it must pay a fee (royalties) to the creator. Not paying the fee, e.g. by downloading pirated software, is stealing, as it deprives the creator of the fee for his work.

It is not possible to have IP in a pure idea, or a law of nature or a number, but only in its expression. It is possible but rare to patent detailed mathematical algorithms (info). One of the few Australian legal cases dealing with mathematics, Milwell v Olympic Amusements (Federal Court of Australia, 1999), dealt with a poker machine company that had copied the scale of prizes from another, and found that a scale of prizes (i.e. list of how much is paid for all draws) is a `work of art' subject to IP and cannot be copied without payment. The prize scale had required extensive work by a mathematician.

Plagiarism

Plagiarism involves pretending information from another source is one's own work. We've said enough about this already.

Ethically worthwhile jobs in mathematics

We began with a debate on whether it was ethical to work in the military (where there is and always has been considerable demand for mathematical skills, e.g. in weapons design and cryptanalysis for intelligence).

FOR	AGAINST
Defend country, way of life, values The aim is not to kill anyone, but to be so strong everyone will be deterred from attacking Smart research can reduce collateral damage Spinoffs: computer, internet etc	It's about killing people The huge sums spent on defence would be better spent on poverty, the environment etc

The issue was dramatised in two poems/songs. We listened to Tom Lehrer's satirical song about Wernher von Braun, the Nazi rocket scientist who later worked for the US. The line "That's not my department, says Wernher von Braun" especially expresses his lack of ethical concern about the results of his actions. Then we read Rudyard Kipling's poem `Tommy', about a British soldier being abused by civilians. The line "making mock of uniforms that guard you while you sleep" expresses how easy it is to criticise the military, until they are needed.

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Ethical/Legal Concepts IV: Inspiring Jobs in Mathematics

Ethics should be about not only telling the difference between what's wrong and what's permissible, but also the difference between what's permissible but merely OK and what's really morally worthwhile and inspiring.

For example, is it ethical to work for a bank? Banks do provide a necessary service (such as safety for deposits, loans for homes and business, foreign exchange, stabilising the financial system). For which they charge well. The opportunities for an individual bank employee to contribute positively to the world may be limited – but work in a bank may be a good training ground for later contributions elsewhere.

Worthwhile careers in mathematics

Some suggestions are:

- Statistics of human rights (as in the work of former MATH2060 student Romesh Silva … story)
- Statistical research on the effectiveness of drugs and medical procedures, better diagnosis
- Mathematical modelling of the environment, e.g. to understand global warming
- Designing safer systems, e.g. proof of computer program correctness
- Optimization for resources planning, e.g. water supply
- Pure research (providing we agree that discovery is in itself a good thing; perhaps we should see it as enhancing the range of human experience like art)
- Teaching, to inspire the next generation

That's all. It's a pity we didn't have time to get to some other interesting topics, like women in mathematics, the philosophy of mathematics, the psychology of mathematics learning.