Parabola Volume 35, Issue 3 (1999)

MATHEMATICAL JOBS FOR THE TALENTED

Jim Franklin[1]

This article will be published in Reflections, the journal of the Mathematical Association of NSW later this year. Permission to publish it in Parabola is gratefully acknowledged.

So, you're a high school student with mathematical talent, and you face a decision on whether to develop it at university, or aim for a career like medicine or law that won't use it. You need to know whether there are good job opportunities if you do continue with mathematics. There are. Which ones are of interest to you depend on what you want from your job.

Scenario 1.
I want to use my mathematical talents and make a lot of money.

In that case, you need to go and see the employers who have the really big money: the merchant banks, insurance companies and investment houses. They move large sums of money around in a fast-changing environment, and need sophisticated mathematics to give them the margins over their competitors that keep them in business. On page 2 is a reproduction of a typical recent job ad in that area. The ad has some interesting features. It wants a higher degree in a "numerate discipline" – that is, in mathematics, though it need not be called mathematics. Qualifications in finance are specifically not mentioned – this is an exercise in trawling new waters for talent. The mathematical skills particularly wanted are in mathematical modelling, that is, in extracting the structure of real-world problems and expressing it in mathematical terms. Also wanted are some generic computing skills of the kind graduates in many disciplines would possess, and some even more generic communication and personal skills. In short, they are prepared to pay big money for a mathematician who can apply his or her knowledge to real problems and explain the results clearly.

[1]Jim is a Senior Lecturer in Pure Mathematics at UNSW.

CREDIT SUISSE | FIRST BOSTON

QUANTITATIVE ANALYST EQUITY & EQUITY DERIVATIVE MARKETS

Credit Suisse First Boston is a leading global investment banking firm, providing comprehensive financial advisory, capital raising, sales and trading and financial products for users and suppliers of capital around the world.

An opportunity in the Quantitative Analysis team exists for a highly motivated, numerate graduate based in our Sydney office. The successful applicant will be involved in the analysis of derivative securities, developing trading opportunities and the construction of proprietary trading and risk management systems. The individual we are seeking should possess the following attributes:

- Masters or PhD in mathematics, physics or a numerate discipline;
- Strong mathematical modelling skills;
- Excellent computer skills and an interest in programming analytics and real-time interfaces with the electronic markets;
- knowledge of object-orientated design principles with some experience in C++;
- Strong communication skills;
- Highly motivated self-starter with a strong team orientation.

Experience within the financial markets would be advantageous, however recent graduates and candidates from outside the industry are encouraged to apply.

The remuneration package will include a performance related bonus.

Written applications, in strict confidence,
should be sent no later than 28th may 1999 to
Joseph Barbara, Credit Suisse First Boston Australia Equities,
PO Box R1474 Royal Exchange, Sydney NSW 2000
or email joseph.barbara@csfbae.com.au

A similar recent ad which asks for rather less in the way of formal mathematical qualifications is from another global finance house, SSGA, offering work in portfolio risk analysis (that is, in the different risks arising from the various ways of distributing large investments in different kinds of assets, such as Australian and overseas shares, property, government bonds, and so on.) It asks for a "graduate with a computer science or mathematics degree, with a strong interest in funds management . . . a strong work ethic with excellent academic results and extra-curricular activities. An honours degree will be an added advantage . . . generous remuneration package."

These ads are too coy to mention just how generous, exactly, the remuneration packages are. Salaries are subject to negotiation at the job interview. But the rewards are certainly there for the top players. Some twelve years ago, a senior lecturer in Pure Mathematics at UNSW left to join AMP, where he rose steadily in their Investment Department, working mainly on portfolio allocation. He recently moved to a similar position in New York, and is believed to be earning a seven-figure sum annually.

Work in the related area of data mining, or market analysis, also offers substantial salaries. Many supermarkets, banks, credit card agencies and the like have accumulated huge data warehouses of very detailed sales figures, collected electronically from sources such as supermarket scanners. They hope to obtain a competitive advantage from analysing these mountains of data – to be able to see directly the effects of advertising campaigns and price reductions, for example. But the ability to collect and manipulate the data has vastly outstripped the capacity of mathematical techniques to summarise and understand it. There is a premium on sound statistical and mathematical talent that can tackle such problems. In one recent ad, a headhunting firm acting on behalf of a "world leading brand name" in telecommunications offers "c 60k plus performance bonus up to 20%" for a marketing analyst. What is wanted is a "graduate in a business related or statistics discipline with a minimum of 3 years experience in a database analysis/marketing role" and "experience in statistical modelling and predictive scenarios. With a logical mind, commercial acumen and outstanding written and verbal communication skills, you will be a strong team player."

Another industry with plenty of money to spend is the gambling industry. Aristocrat Leisure advertises for a "Game designer – mathematician" to "create and develop game ideas and their expected mathematical returns" for poker machines. ("Tertiary qualified in mathematics, you will have knowledge of spreadsheets, loads of enthusiasm and creative flair.")

Scenario 2.
I want to use my mathematical talents and benefit humanity (without starving in the meantime).

A natural first choice might be something in the medical or pharmaceutical field. Roche, the large pharmaceutical company, recently advertised four positions simultaneously in its Biometrics Unit: a Head of Biostatistics (requiring a Masters or PhD in statistics and six years' experience), a Senior Statistician, and two Statistician/SAS Programmers. This kind of work involves using statistics to evaluate the success of new drugs in clinical trials. Sound mathematical judgement is needed to decide when new drugs are working, with the least possible amount of experimentation – especially

when the experiments are being performed on humans.

Since the Federal Government is planning to double the money spent on medical research over the next few years, there will be many opportunities in that area. It is not widely understood that a straight medical degree is a suitable base only for certain kinds of medical research. Other kinds require other skills. For example, in neurophysiology, while it requires medical specialists and biochemists to understand how a nerve cell works and sends out messages, finding out how a network of nerve cells behaves is an entirely different kind of question. That is a matter of how the nerve messages work together, and can only be discovered by the science of complexity – that is, mathematics.

There are important jobs in the mathematical modelling of much larger systems than the human body, such as ecological systems, the weather, and the global climate. Australian universities and the Bureau of Meteorology use large and computationally intensive computer models to predict the tracks of cyclones and hailstorms, and the economic necessity of improving these predictions ensures there will be interest in the field for many years to come. In another area, CSIRO Wildlife and Ecology advertises for a Resource Modeller ($45K-$51K + Superannuation, PhD in "disciplines such as resource modelling and management, biological population modelling, applied mathematics or similar") to research options for the long-term use of Australia's fisheries resources.

The Public Service provides many opportunities for interesting work that also benefits society. In view of the power of the financial institutions that offer the jobs mentioned above, it is encouraging to see that the Australian Prudential Regulation Authority, which exercises some supervision over the financial world, is also interested in employing talented people. Their recent Graduate Recruitment ad asks for "a strong quantitative degree with a credit average or above in economics, finance, mathematical studies, law, accounting or actuarial studies. Good communication skills and a high degree of personal organisation are a must." There are similar ads for the Federal Treasury, the Police, the Bureau of Crime Statistics and Research, and many others.

Perhaps it is time to think creatively about extending mathematics into new areas of benefit to everyone. It may be there are few prospects of applying mathematics to such urgent tasks as helping the world's refugees or finding the meaning of life (though who knows? There may be hidden possibilities), but an area where there may be immediate potential is the measurement of legal rights. There are accepted techniques for quantifying certain kinds of rights, for example, those to compensation for personal injury, but for others there are as yet no such methods. When BHP closed the Newcastle steelworks, the workers lost opportunities for work, while BHP's share price went up. If a credible mathematical method could be found for measuring the cost of lost employment opportunities, there would be the basis of a legal claim for compensation.

And as a final way of using mathematical talent for good, one should not forget schoolteaching.

Scenario 3.
I want to use my talents and do something really intellectually interesting.

You will be looking at academic life. The pay may be suboptimal, but the freedom to pursue one's own vision outweighs that. Some teaching is involved (which most academics enjoy) and some administration (which most don't enjoy) but there is still time for thinking about what one judges to be important. Outstanding academic results are needed, and the motivation to spend years of relative poverty getting a PhD.

A partial compromise between academic life and industrial research is defence science. The Defence Science and Technology Organisation offers interesting research positions in such highly mathematical areas as signal processing and large-scale multiagent systems. An appropriate political orientation may be desirable. If you think defence research contributes to the military-industrial complex grinding the face of the proletariat, these jobs may not be for you. Think "heroes defending the free world against dictatorship".

Scenario 4.
I want to use my mathematical talents and meet people.

What kind of people do you want to meet? If you want to talk to, say, tourists or patients, then the hospitality or medical industries may be of more interest than anything in mathematics. But if you want to meet people like yourself, all of the above jobs give you the chance to do so. The ads ask for "teamwork" and "communication skills" because dealing with people is such an important part of modern mathematical practice. Especially in the business world, the skills of listening to clients' needs, discussing problems with co-workers, and explaining possible solutions to those who will use them is central to the tasks at hand. The best way to meet people is usually not in purely social situations where you have to start with inane remarks like "Do you come here often?" It is in being focused on common tasks with people of equal intelligence.

For those with an urge to specialise in communication, there are many paths opening up in the general area of science and mathematics communication. They include not only traditional areas like print and television journalism, but web authoring, the writing of technical documentation and company reports, the promotion of pharmaceuticals and medical diagnostic equipment, the provision of sound environmental policy advice, and the like. All of them involve explaining how complex systems and products work, and require exceptional skills in quickly absorbing and interpreting scientific and technical information. The first undergraduate degree of BSc Communication is offered by the University of New South Wales, beginning in 2000.

For further information, two recent American books are useful: *Great Jobs for Math Majors*, by Stephen Lambert and Ruth DeCotis, and *101 Careers in Mathematics*, edited by Andrew Sterrett.