

Cheryl Voake

A National Taught Course Centre in Operational Research (NATCOR): a student's perspective

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I would like to take this opportunity to thank everyone who has been involved with NATCOR, both in the creation and also the delivery of the courses. Particular appreciation is directed towards Professor Kevin Glazebrook, the Director of NATCOR, as well as Lindsay Newby, NATCOR's administrative assistant.



In 2006, the Engineering and Physical Sciences Research Council issued a call for proposals to develop taught course centres for doctoral students in the mathematical sciences. This was and is part of a drive to deepen and broaden PhD study in the UK across mathematics. From this call, NATCOR - a national taught course centre in Operational Research (OR) was born. While NATCOR's provision is of most obvious and immediate benefit for doctoral students in OR, it also gives students in other areas of mathematics an opportunity to develop a range of skills and knowledge of direct industrial relevance.

In July 2009 NATCOR completed its first two-year cycle of provision. Cheryl Voake, a doctoral student at Cardiff University, has attended all five NATCOR residential courses and relates her experiences.

Kevin Glazebrook, Director - NATCOR

Introduction

The National Taught Course Centre in Operational Research (NATCOR) is a new collaboration between six universities to develop and deliver taught courses in Operational Research (OR). These courses are primarily aimed at research students in the first two years of their doctoral training, so embarking on a PhD in OR at the start of the 2007-08 academic year meant it was perfect timing for me to attend the inaugural set of NATCOR courses. The six member universities are Brunel, Cardiff, Lancaster, Nottingham, Southampton and Warwick, each one hosting one of the five week-long residential courses, with the exception of Cardiff University, where I study in the School of Mathematics. These courses are run on a two-year rolling programme and started in early 2008.

Aim of courses

The aim of these courses is to broaden and deepen knowledge obtained by PhD students throughout their doctoral training, who are undertaking research in the field of OR. While it is usually the nature of a PhD that knowledge gained is somewhat specific to the study undertaken, NATCOR provides the opportunity to learn more general techniques in this subject area. Therefore although the courses may not be directly or obviously linked to a student's research area, they nevertheless provide a good grounding in OR at the postgraduate level.

Personal experience

I arrived at Nottingham University for the first course of the training programme, *Heuristics and Approximation Algorithms*, on a sunny day in late March 2008. A variety of lectures were given over the next five days by several well-known names from a range of academic institutions. While some prerequisite reading was distributed, very

little knowledge was assumed and the basics of the subject were covered early on.

Talking to other students in the coffee break, it soon became apparent that we were from a whole host of departments across many universities, from business schools to computer science departments. However, since there was the common link of OR between us, it made it easy to discuss my research with others, while learning about the work being undertaken elsewhere. It was particularly nice to not have to explain what OR was each time I met a new person! Similarly, the lectures took on a variety of perspectives, including underlying theory, case studies and a computer laboratory session.

Staying in student halls meant that it was easy to socialise away from lectures too. With the city centre just a bus ride away and friendly Nottingham students who volunteered to show us around, the evenings were filled with sampling the local restaurants, plus possibly the odd bar or two...! A formal meal was arranged for one of the evenings which was another good chance to meet more new people working in the same field.

The next two courses were similar in respect of the wide scope of material studied and variety of speakers present. Brunel University hosted the *Convex Optimisation* course in June 2008, while *Combinatorial Optimisation* was held at Southampton University in September of the same year. The latter of these saw two other postgraduates from my department attend for the first time. While neither of them are operational researchers, they both felt that the topic was relevant to their studies in number theory. Having spoken to them both since, it soon became apparent that the content of the course was relevant to those studying outside of the OR spectrum. I would therefore urge postgraduates whose research area is not formally OR to still inspect the syllabuses to see if there is any cross-over between the NATCOR courses and their own research interests. From a personal perspective, I found these courses to be both interesting and informative and a lot of new material was covered.

The computer sessions were particularly useful as new packages were introduced. Formal assessment on the three courses was varied, but a good opportunity to reiterate lessons learned. Accommodation was again provided in student residencies and a tasty evening meal organised for one of the evenings.

The penultimate course, on *Stochastic Modelling* and hosted by Lancaster University, took place in late March 2009, meaning a longer break between courses. Professor Jeff Griffiths, one of my PhD supervisors, was the lead organiser for this course so it goes without saying that I enjoyed it immensely! Areas of queuing theory and product maintenance planning were covered, beginning from the basics for students with no experience in this area. This time I was joined by two new OR PhD students from Cardiff, as well as another PhD student studying in the area of financial mathematics and statistics. The more detailed lectures, for example on Brownian motion, were of particular benefit to him. Again the usefulness

of NATCOR to students outside of the realm of OR are highlighted. This course included several case studies which were not only interesting but gave a nice break from the traditional lectures. In some sense they provided a finality to the learning, as the real world value of effectively applying the techniques we were being taught was proven.

While this meant a longer break between NATCOR courses, I was still kept busy. As a result of NATCOR, a new conference for postgraduates studying in the field of OR was created – and as a result of attending NATCOR, I found myself on the organising committee. The Student Conference in Operational Research (SCOR) was born. This was scheduled for the weekend directly following NATCOR, from Friday lunchtime to Sunday lunchtime. Approximately ninety students attended with the majority presenting their work. We were also delighted to have Sue Merchant, current president of The OR Society, and Professor Adam Letchford, of Lancaster University, give interesting and enjoyable plenary talks. The weekend was a resounding success and will take place biennially from 2010 onwards.

The fifth and final course, *Simulation*, was hosted by Warwick University in late June / early July of this year. Again the fundamentals of the topic were covered early on, before more in-depth lectures on topics such as bootstrapping and goodness-of-fit tests. We were given a whole host of computer examples which really are very helpful in testing oneself and recapping material taught in the lectures.

The final two courses in the programme were more relevant to my own research area and I took a lot away from them. It goes without question that the notes from these courses will be consulted in the near future as I continue with my research! Without attending NATCOR, I would not have been as aware of the theory, techniques and examples in these two subject areas.

That does not mean that the three other courses were not beneficial and I do not wish to take anything away from them. It simply remains to be seen whether I will use anything I have learned on these courses for my thesis, but I have found attending them advantageous for a number of reasons. The educational benefits are obvious; the courses have given a good grounding in the subjects mentioned, indeed in some respects introducing new OR topics and techniques to me. Each course provides a wealth of written notes for all students, as well as the computer files we have used throughout the week.

Additionally, I have enjoyed having the opportunity to meet with many other students from across the United Kingdom, as well as a couple from further a field. Since we are all at a similar stage of our research but have varying backgrounds and experiences, exchanging understanding and ideas has proved invaluable. Talking amongst ourselves between lectures meant that we could validate what we were learning or ask each other questions about any trickier parts of the course. Some firm friendships have been made and I am sure these will still continue now that I am part of the "NATCOR alumni".