Boosting Automated Verification using Cyclic Proof: Justification of Resources

J. Brotherston (PI), B. Cook (CI), N. Gorogiannis (RCI)

This application is for a three-year EPSRC grant to fund two full-time RA posts in the PPLV group at UCL — one filled by Gorogiannis, and the other externally — working with the supervision and assistance of Brotherston and Cook.

Staff – directly incurred posts

Gorogiannis is a named Researcher Co-Investigator on this proposal due to his skills and expertise in several of the specific problem areas of this proposal, namely: cyclic entailment proving; program analysis; abduction of inductive definitions; and the development of automated tools implementing the above. In particular, he is the main developer and implementer of the Cyclist theorem prover. We believe his employment on the project will be a major asset. We request a salary for Gorogiannis commensurate with his salary spine point at the start of the project on 1 June 2013, with standard increments each year.

We also request an RA to work alongside Gorogiannis in the PPLV group as the second main researcher on this project. It is our view that the research programme outlined in the case for support, with at least four distinct lines of attack, cannot reasonably be accomplished mainly by one researcher, however talented; in order to achieve the substantial and wide-ranging impacts we hope for, we believe a second person working at 100% time is required. We believe that having two RAs working on the same project will have a multiplier effect due to the benefits of collaboration, "team spirit" and cross-fertilisation between their knowledge areas; so that the benefits will be greater than that of having two RAs work on two separate projects. The difficult technical nature of the research programme requires the successful applicant to possess academic expertise in at least some of logic, theorem proving and verification in addition to programming and tool development skills, which means that an RA with a PhD in a relevant area is required. Accordingly, we request a salary for the RA starting at spine point 32 on the salary scale (3 points above the UCL minimum for an RA with a relevant PhD) with standard increments each year.

The Department of Computer Science at UCL provides support to individual projects from a pool of research technicians. Funding for 10% of a technician is requested to cover the costs of helping with software installation and hardware maintenance. As per the EPSRC requirement, timesheets will be kept for the technician post.

Staff — directly allocated posts

We request that Cook, as Co-Investigator, be funded at 10% time for the project duration for his contribution to supervision of, and collaboration with the two RAs. As the Principal Investigator, Brotherston will contribute 15% of his time to the project in order to supervise and collaborate with the RAs; but we do not request a salary contribution or other expenses for him, as all such expenses will be met from his EPSRC fellowship.

Travel and subsistence

We hope and expect to publish papers at reputable venues and at regular intervals during the project. In computer science, the default approach is to submit papers to conferences rather than journals in the first instance, since conference publication has a much shorter turnaround time compared to journal publication and is typically seen as having higher impact, at least in the case of the top conferences (e.g. LICS / POPL). The specific conferences we hope to target during the project include: POPL; LICS; PLDI; CAV; SAS; TACAS; ESOP; ICALP; APLAS; and TABLEAUX. Publishing at a conference confers an obligation on at least one author to present the paper at the conference, and conference attendance also offers excellent opportunities for networking and promotion of one's research. Thus we request funding of £3k per year for each of the two RAs to cover travel, subsistence and registration costs associated with attendance at two or three conferences per year, depending on location.

We also expect that the RAs will travel, mainly within the UK, in order to collaborate and exchange ideas with their research colleagues; we mention

in particular groups based in Microsoft Research, Cambridge, Aberdeen, Edinburgh, York, and Leicester. We request funding of £1.2k per year for each of the two RAs to cover travel and subsistence costs for such research visits, based upon a rough estimate of 3 trips per year of 2 nights each costed at £400.

In total, the requested travel and subsistence budget is £8.4k per year.

Other directly incurred costs

We expect the two RAs to spend a considerable proportion of their time in computationally demanding tasks — i.e., designing, coding and testing tools for automatic program verification and ancillary problems based on cyclic theorem proving — as well as in standard computing tasks including the preparation of paper manuscripts and electronic mail. Thus they will require access to good quality computing facilities (and we remark that, as a matter of policy, UCL does not supply computers to research staff hired on non-permanent contracts for time-limited research projects). In addition to this, we consider that a portable computing capability for the RAs is also essential, partly for home working and collaborative work, but also because one of the main ways in generating interest and impact is by demos during visits to stakeholder organisations or at conferences. In our experience, modern high-performance laptops (utilising quad-core processors, 8GB+ RAM and at least 256GB disk) are adequate for development and testing in CPU-intensive tasks such as inductive theorem proving and program analysis over large code bases, as we are proposing for this project. Accordingly, we request laptop computers and "docking stations" for the two RAs at £2.5k each to be purchased at the outset of the project. The laptop "docking stations", which are intended for office use, will include a large screen and other accessories such as an ergonomic keyboard, which we consider to be essential for the expected protacted periods of computer use at UCL. The total requested spend on computers is £5k.

In addition, we request £1.1k in total for such books, software licenses and computer peripherals as become needed during the course of our research programme. This has been costed as £500 in year 1 and £300 in years 2 and 3.

Other directly allocated costs

The Dept. of Computer Science at UCL makes a standard charge for research projects of £1750 per RA per year to cover the project's share of the purchasing and maintenance costs associated with their specialist computing facilities such as network infrastructure, data storage, and processing clusters. In total, the specialist computing facilities costs over the project lifetime come to £10500.