

**UNIVERSITY OF GLASGOW**

**Academic Standards Committee - Friday 30 May 2008**

**Departmental Programmes of Teaching, Learning and Assessment:  
Report of the Review of Computing Science held on 7 March 2008**

**Mrs Marjory Wright, Clerk to the Review Panel**

**May 2008**

**Review Panel:**

Professor Steve Beaumont	Vice Principal (Research and Enterprise), Convener
Professor Ann Blandford	University College London, External Subject Specialist
Dr Stephen Gilmore	University Edinburgh, External Subject Specialist
Ms Jenny Wightwick	Students' Representative Council
Professor John Davies	Department of Electronics and Electrical Engineering, Cognate Department
Professor Mike French	Senate Assessor on Court
Dr Vicky Gunn	Learning and Teaching Centre
Dr Catherine Bovell	Learning and Teaching Centre (observer)
Mrs Marjory Wright	Senate Office, Clerk to the Review Panel

**1. Introduction**

- 1.1 The Department of Computing Science is one of four departments in the Faculty of Information and Mathematical Sciences (FIMS). FIMS has a strong research base and the Department was rated 5 at the last Research Assessment Exercise. The Department's accommodation has recently been enhanced by the addition of the Sir Alwyn Williams Building which was designed and funded to support research.
- 1.2 The Department last underwent internal review in December 2002. Most of its programmes are subject to a 5-year accreditation cycle by the British Computer Society (BCS) and the Institute of Engineering and Technology (IET). The most recent accreditation visit took place on 21 February 2008. The formal report had not been received at the time of writing. However, informal feedback has indicated that the outcome of the review was successful with good practice identified in relation to Professional Skills and Issues and consultation with industry, but that programme aims and intended learning outcomes require attention. Further documentation has been requested for the MRes, the MSc/PgDip named programmes and the BSc Designated degree all of which were presented for accreditation for the first time.
- 1.3 The Self Evaluation Report (SER) was prepared by Professor Ray Welland, Head of Department, Professor David Watt, Departmental Quality Assurance Officer, Professor Chris Johnson, Convener of the Teaching Committee and Dr Quintin Cutts, Associate

Dean, Learning and Teaching, FIMS, with input from the Teaching Committee and other members of staff. The Department's distinctive strengths were understated in the SER but the Review Panel found the document to be comprehensive and useful in all other respects.

- 1.4 The Review Panel met with the Dean, Professor David Fearn; the Head of Department, Professor Ray Welland and the Departmental Quality Assurance Officer, Professor David Watt. The Panel also met with 16 members of staff (including administrative staff), 2 hourly-paid staff (Graduate Teaching Assistants), 4 postgraduate taught students and 6 undergraduate students, representing all levels of the Department's provision, with the exception of Levels 4 and 5, and comprising Home, European and International students.

## 2. Background Information

- 2.1 The Department has 32 members of academic staff and 52 staff in total. Academic staff include one Research Professor, three Advanced Research Fellows and one Lecturer on unpaid leave of absence who are not allocated teaching duties within the Department, and also one member of staff partially bought out by another institution. Departmental office accommodation is located at 8-17 Lilybank Gardens, with research facilities located in the adjacent Sir Alwyn Williams Building and teaching laboratories located in the Boyd Orr Building directly opposite the Department.
- 2.2 In common with other institutions, the University of Glasgow has experienced a significant drop in the number of students entering Computing Science in the last 5 years. The number of intending Single Honours students entering in 2002-03 was 195 and in 2007-08 this had dropped to 81. The reasons for the change are identified in paragraph 4.5.1 of the Report.
- 2.3 Student numbers for 2007-08 are as follows:

Students	Headcount	FTE
Level 1	143	47.7
Level 2	80	39.8
Level 3	84 (+50)**	73.3 (+4.2)**
Level 4	44	42
Level 5	2	2
Undergraduate Total	403	209
Postgraduate Taught	42 (+20)**	42 (+4.8)**
Postgraduate Research*	61	59.5

\* (for information only - research is not covered by the Review)

\*\* (figures in brackets indicate headcount and FTE for service courses)

- 2.4 The Review Panel considered the following range of provision offered by the Department. A full list with notes is attached as Appendix 1.
- BSc (Hons) Computing Science
  - BSc (Hons) Software Engineering
  - MSci Computing Science
  - MSci Software Engineering

- BSc Designated Degree in Computing Science
- MSc/PgDip Advanced Computing Science
- MSc/PgDip Computing Science
- MSc/PgDip Information Technology

The Department contributes to the following *joint* degree programmes offered with other departments or other institutions:

- BSc/BEng (Hons) Electronic and Software Engineering (taught with Electronics & Electrical Engineering)
- BSc/MA (Hons) Joint Computing Science with another subject
- MSci Computing Science and Mathematics (offered; no current students)

The Department also contributes to the following degree programmes offered by other departments or other institutions:

University of Glasgow

- BEng Mechanical Engineering – Software Engineering M3 (10 credits)
- MEng Electronics and Software Engineering – level 5 optional courses
- MRes in Bioinformatics – selected MSc IT courses

Institute for System Level Integration (ISLI), Livingston

- Embedded Software (3 courses); MSc project supervision

**Departmental Management**

- 2.5 The Department has a clearly defined management structure led by a Management Committee, which proposes policy and advises the Head of Department on implementation of agreed policy across the entire range of departmental affairs. Management of key aspects of the Department's business is devolved to specific committees. The Teaching Committee is responsible for co-ordinating all aspects of undergraduate and postgraduate course teaching, including course organisation, examinations, curriculum development, tutors and demonstrators, and quality assurance. The Information Technology Committee is responsible for maintaining and implementing IT strategy, for planning the deployment of the departmental IT equipment budget and for formulating IT policy for the Department. The Department has an active Student Recruitment Group which liaises with the Faculty Recruitment Committee and Science Recruitment Committee for larger scale recruitment activities. The Department also has a Research Students Committee and a co-ordinator of external relations.
- 2.6 The Review Panel was pleased to learn that there had been competition for the recent Head of Department vacancy and that staff had no concerns about succession planning for this role. Academic staff valued the strong leadership provided by the current Head of Department. They were conscious of the heavy workload that he carried and were not averse to sharing the load. The Panel suggests that the Head of Department might consider delegating particular responsibilities to relevant members of staff.

### **3. Overall aims of the Department's provision and how it supports the University Strategic Plan**

- 3.1 The Review Panel noted the Department's aims which were appropriate and closely aligned to the University's Strategic Plan and to the Learning and Teaching Strategy, with a strong focus on employability and internationalisation. However, the Panel believed that these concepts could be articulated more clearly in programme documentation.

### **4. An Evaluation of the Student Learning Experience**

#### ***4.1 Aims***

- 4.1.1 The Review Panel noted from the SER and programme specifications that the broad aims of the Department's programmes were appropriate and reflected Departmental aims. The SER had also acknowledged that both undergraduate and taught postgraduate programme aims could, in some cases, be made more explicit to give a clearer match to the benchmark standard. The Department advised the Panel that it welcomed the opportunity to explore ways of achieving this with colleagues in the Learning and Teaching Centre.

#### ***4.2 Intended Learning Outcomes (ILOs)***

- 4.2.1 The Review Panel noted from the SER that there had been a tendency over time to expand the ILOs for each different undergraduate degree programme and that the Department had identified a need for some "pruning" of these ILOs. The Panel explored the matter with academic staff and with the Head of Department and noted that the Professional Accreditation Panel had also identified a need to modify programme aims and ILOs to more clearly differentiate degree programmes.
- 4.2.2 The Review Panel noted that the Department was committed to reviewing and modifying its programme and course ILOs to address identified weaknesses and **recommends** that the Department seek the advice of colleagues in the Learning and Teaching Centre on effective ways of re-mapping its programme and course ILOs against the relevant benchmarks, with a view to achieving clearer differentiation between degree programmes and demonstrating progression between the different levels of learning.
- 4.2.3 The Review Panel also noted from the SER that the Department's postgraduate taught programmes had recently been extensively redesigned and that the process had been informed by the Scottish Credit and Qualifications Framework and awareness of the Bologna agreement.

#### ***4.3 Assessment, Feedback and Achievement***

- 4.3.1 The Review Panel noted that the Department had robust assessment procedures and that it complied with the requirements of the University Code of Assessment.

##### **Assessment Methods**

- 4.3.2 The SER referred to the wide range of assessment methods employed by the Department, varying according to the nature of individual courses' ILOs. The Review Panel noted that the majority of the courses employed assessed practical exercises and examinations and that projects were used to test writing and oral presentation skills, with a strong emphasis on group work in Level 3, including a major team project which was strongly supported by employers. The Level 4 Professional Skills and Issues

course utilised peer assessment, where students were required to write formative reviews on their colleagues' work, as well as summatively marking the reviews of other students. The Panel **commends** the Department on the wide range of assessment methods utilised but considers that its documentation could be more explicit regarding where and when the various methods are used. The Panel therefore **recommends** that, whilst reviewing programme and course ILOs, the Department also takes the opportunity to map its assessment methods more explicitly to the individual courses and update programme and course documentation accordingly.

### **Feedback on Assessment**

- 4.3.3 The Department acknowledged in the SER the need to improve the quality and timeliness of feedback on assessed coursework and stated that it was currently working to address the matter, with a view to formulating a policy for implementation in 2008-09. Staff advised the Review Panel that they had held focus groups with Level 4 students to explore their feedback expectations and that they had also explored the matter with a pool of Level 3 students to find out what they considered to be important. The Panel noted that preliminary findings had been considered by the Teaching Committee and would be discussed further at a Departmental Away Day.
- 4.3.4 The Review Panel learned from postgraduate taught students that they had found assessment feedback mechanisms to be variable. There had been some instances where they were awaiting feedback from a previous assignment at the time of submitting the next, and they found it difficult to know how to improve when they lacked awareness of their weaknesses. They qualified this by saying that the feedback was very good when they received it. The Panel formed the impression that taught Masters students were perhaps regarded as being more advanced than many of them were in reality. The Panel believed that this was a potentially vulnerable group who could benefit enormously from more rapid feedback on assessed work in the early stages of the programme to inform their learning. The Panel also believed that it was important to recognise that international postgraduate taught students often required time to recalibrate their previous experience against new expectations. The Panel therefore **recommends** that the Department consider modifying the taught postgraduate assessment requirements in Semester 1 to include either more modest methods of assessment or fewer assessments with a faster turnaround time, to take account of the steep learning curve for those who have not previously studied in the UK.
- 4.3.5 Feedback on assessment appeared to be less of a problem for the undergraduate students who met with the Review Panel who perceived that, in general, feedback from lecturers was timely and comprehensive, although they sometimes had to wait for feedback from tutorials. The Panel learned from Graduate Teaching Assistants (GTAs) that they aimed to provide feedback in time for the next tutorial.

### **Code of Assessment**

- 4.3.6 The Review Panel had noted a lack of consistency in the Code of Assessment schedules provided to students, with Course Handbooks for Levels 1 and 2 erroneously referring to the "20-point scale" whilst the information in the remainder of Course Handbooks was correct. Discussion with the Head of Department and Departmental Quality Assurance Officer confirmed that this was an inadvertent error which would be corrected, and that the Department was utilising the 22-point scale in all its programmes.

### **Grade Descriptors and Marking Criteria**

- 4.3.7 The Review Panel was impressed with the detailed grade descriptors and comprehensive assessment criteria that were provided to students, supervisors and

readers in relation to Level 3 team projects. These were carefully set out and the process for taking account of the contribution of individuals who may have been doing more or less work than others was clearly explained. The Panel **commends** this practice and suggests that it may be worthy of dissemination within the Faculty and beyond.

#### **4.4 Curriculum Design, Development and Content**

- 4.4.1 The Review Panel noted from the SER that the curricula offered by the Department were designed to ensure that students received appropriate and up-to-date knowledge and understanding of a rapidly-changing subject. The programmes emphasised breadth at Levels 1–3, and depth at Levels 4, 5 and M and all placed strong emphasis on communication, analytical, and problem-solving skills, and the ability to work independently and/or in teams, these skills being developed primarily by means of project work. The programmes also aimed to prepare students for progression to employment and/or further study which was also a requirement for professional accreditation.
- 4.4.2 The Review Panel learned that all programmes were subject to periodic root and branch review which was undertaken on a year-by-year basis starting from Level 1. Students were consulted in the course of the review and provision was reviewed from both a horizontal and vertical perspective. Research groups were formally involved in the review process since staff believed that involvement in teaching was essential to support their research and also to attract future researchers to their research area. The Panel **commends** the Department on this initiative.

#### **Undergraduate Provision**

- 4.4.3 Level 1 of the curriculum had been designed to suit the needs of students with a wide range of experience and ability and to include enquiry-led learning. Prior experience of computing is not a prerequisite for entry and many students have no prior experience of programming. The undergraduate students who met with the Review Panel said that they had found the skills span motivational and that there had been a richness in their first year experience. They believed that it was equally motivational for the Lecturers who had to draw together a course with a broad range of learning opportunities from which all students would get benefit. Peer support at Level 1 was constrained by the recently introduced Disclosure requirements, but students said that the structure of the course lent itself to informal peer support which was beneficial to both those who sought it and to those who provided it.
- 4.4.4 The Review Panel learned that feedback to staff had indicated that the more able Level 1 students sometimes found the course “boring” and that the Department was seeking to address this through a proposed 3-year accelerated honours programme.
- 4.4.5 The students who met with the Review Panel were very positive about the 4-year curriculum and believed that it was an asset. They were aware of the Department’s proposal for advanced level entry and had concerns that if the Level 1 course largely comprised beginners there might be a danger of over simplification which could slow down the rate of a student’s progression.
- 4.4.6 Whilst recognising that the views of the 6 students who had met with them did not necessarily reflect the views of the wider student population, the Review Panel drew the students’ observations to the attention of the Head of Department, the Dean and academic staff and suggested that the Department might wish to reflect on these observations to ensure that they did not lose something that students valued. The Panel was reassured to learn that the traditional routes would remain available and that the purpose of the proposed accelerated programme was principally to provide an attractive

option for well qualified home students, though it might also prove attractive to well-qualified international students.

### **Postgraduate Taught Provision**

4.4.7 The Department explained in the SER that MSc programmes were reviewed regularly in response to perceived market demands and feedback from current students and graduates and that a review of the MSc Computing Science and MSc Advanced Computing Science programmes in 2007 had led to proposals to re-badge the latter as an MRes programme and to add specialised pathways in Information Retrieval, Information Security, Mobile and Ubiquitous Computing, and Software Engineering.

### **4.5 Student Recruitment**

4.5.1 It was noted that the Department was suffering from a prolonged downturn in recruitment of undergraduate students, impacted in particular by the “dot-com” bust. The Review Panel noted that the Department was taking commendable steps to improve the understanding of computer science within schools and to make the subject a more attractive option for university entrants. It was collaborating with other Computing Science Departments in Scotland in this mission. Nevertheless, the impact of these efforts had not turned around their recruitment difficulties, yet elsewhere in the University (notably in Physics) similar efforts in schools appeared to be having a positive effect and the Panel was somewhat surprised that the Department’s undoubted strengths were not having greater impact. They noted excellent employment outcomes, opportunities for placements leading to employment, outstanding software development experience, and commendable outcomes from the National Student Survey as being factors which ought to enhance the competitiveness of the Department in recruitment, and suggested that these “unique selling points” were not being adequately conveyed to potential undergraduates. The Panel **recommends** the Department to review its marketing and recruitment strategy with a view to ensuring that the undoubted and highly competitive strengths of the Department be given prominence in materials, messages and promotional activities.

4.5.2 The Review Panel learned that the Department was working towards improving recruitment in a number of innovative ways, notably its outreach programme to schools, known as *Computing Science Inside* (CSI). The SER described both the project and the Department’s involvement in it in detail. The project had developed a range of educational resources for schools, and had undertaken school visits to work with pupils in their classrooms and Continuing Professional Development events to train teachers to use the materials. Staff were enthusiastic about the project and believed that it would help to improve the image of computing in schools and would have a positive impact on recruitment in the longer term.

4.5.3 The Review Panel noted that the Department had very few students with non standard entry qualifications since the requirement for mathematics proved to be a stumbling block. The Panel explored this with the Department and was satisfied that the Department could overcome this difficulty by adapting an existing bridging course to accommodate the needs of non standard applicants.

4.5.4 Staff indicated to the Review Panel that the Department found the Faculty entry system a barrier to conveying strong messages about individual subjects. Discussions with undergraduate students revealed that they believed that there were distinct advantages in the Faculty entry system and thought that the University should clarify and emphasise these in its recruitment materials. None of the students who met with the Panel had fully understood the concept of Faculty entry at the time of entering the University and had only gradually become aware of the flexibility that it offered in relation to course choices. A few of the students who met with the Panel had taken

advantage of this flexibility to transfer to Computing Science when they had found it to be more attractive than the pathway that they had originally intended to follow, and reported that the transfer process had been accomplished smoothly. The Panel believes that there could be benefit for the institution as a whole in providing an effective explanation of the Faculty entry system in centrally provided recruitment materials. The Panel therefore **recommends** that the University review its existing recruitment materials with a view to ensuring that they contain a clear explanation of the Faculty entry system and the benefits afforded to students by its flexibility.

- 4.5.5 Undergraduate students told the Review Panel that, for applicants south of the border there was little awareness of the strengths that distinguished the University of Glasgow from its principal Scottish competitors and therefore less likelihood of their choosing to come to this University. Those for whom Glasgow had been second choice were, without exception, very pleased that they had come to Glasgow and would recommend the University to others.
- 4.5.6 The Review Panel had learned from the SER that the Department was supporting the Recruitment and Participation Service's (RAPS) initiative to widen recruitment efforts into England and the Dean advised them that the Faculties of Science had recently funded a Recruitment Officer for Science within RAPS, who started about six months ago, to take this initiative forward. In the light of this, the Panel **recommends** that the Department of Computing Science explore with RAPS how it might make maximum use of this resource to promote its undergraduate programmes south of the border through showcasing their distinctive qualities alongside the flexibility of the Faculty entry system, and that it also explore ways of maintaining the momentum in future years.
- 4.5.7 The Department advised the Review Panel that there was a strong demand for computing in Eastern Europe which presented excellent opportunities to recruit good applicants to both undergraduate and taught postgraduate programmes. There appeared to be strong awareness in Eastern Europe of the University of Glasgow's reputation for science. This was confirmed in the Panel's discussions with undergraduate students but students from outside Scotland believed that there was a need for greater clarity about the Scottish system of higher education. The Panel **recommends** the University to review its recruitment materials and the navigational routes through them to ensure that the merits of the Scottish Higher Education system are brought prominently to the attention of potential applicants.
- 4.5.8 Undergraduate students were complimentary about their experience of Applicants' Open Day. They had found the Department to be welcoming and friendly and discussions with staff very informative.
- 4.5.9 There was evidence that the Department worked collaboratively with the International and Postgraduate Service (IPS) to attract international students to its programmes and staff advised the Review Panel that, until now, the Department had managed its postgraduate admissions locally. However, a recent University decision meant that all postgraduate admissions would now be managed by IPS. Staff told the Panel of their concern about whether IPS recruitment officers had sufficient expertise to select candidates for specialised subject areas such as Computing Science and of their concern that there could be a risk of admitting candidates who lacked relevant experience. They had concerns that inadvertent selection of poorly prepared candidates could create unnecessary pressures for the students concerned and increase staff workload. It could also raise the failure rate, to the detriment of the University's reputation. The Panel encouraged the Department to raise its concerns with the Senior Management Group and learned that this was in hand and that a member of staff had recently drawn the Department's concerns to the attention of the Vice Principal (Learning, Teaching and Internationalisation).



4.5.10 Postgraduate taught students praised the quality of their admissions experience which had included the support of a “mentor” from the point of being made a conditional offer. International students who had been assigned a mentor of the same nationality told the Panel that they had found the advice provided by someone who shared their culture particularly helpful. The Review Panel **commends** the Department on this initiative.

#### **4.6 Student Progression, Retention and Support**

##### **Level 1 progression and retention**

4.6.1 The SER explained that the major issue in relation to student retention and progression was the retention of first year undergraduates and their progression into Level 2. It was, however, difficult for the Department to identify which students were at risk since those who were performing well in Computing Science might be experiencing difficulties in another of their Level 1 courses. For this reason, the Department was participating in the Faculties of Science Early Warning project which aimed to identify students at risk by co-ordinating data on non-attendance from all their subjects. Once such students were identified, the Science Faculties Support Unit warned them about their progress and offered support. Advisers were also notified so that they could take appropriate action.

4.6.2 The Review Panel explored the retention issue with undergraduate students. The students speculated that there would always be individuals who would devote too much time to extracurricular activities to the detriment of their studies, but they also believed that some of those who entered University at age 17 were not sufficiently mature to cope with the experience. They said that programming tended to be a solitary activity and students therefore had less reason to interact with each other. They suggested that introducing group work at Level 1 could go some way towards encouraging mutual support and social interaction and would also prepare students for the group work that they would encounter at later stages of the curriculum. The Panel shared the view that creating opportunities to build social cohesion amongst Level 1 students could have a positive effect on retention and, for this reason, **recommends** that the Department give serious consideration to introducing group work into the first year of the Computing Science curriculum.

4.6.3 The Review Panel **commends** the Department on its system of weekly tutorials and the support that they provide for students. Discussions with GTAs indicated that they monitored students’ attendance and the Panel shared the view that these tutors were uniquely placed to demonstrate the Department’s interest in the welfare of its students by following up unexpected absence with them at an early stage by means of a friendly e-mail. The Panel encourages the Department to provide uniform guidance to GTAs in this matter.

##### **Employability**

4.6.4 The Review Panel learned that employability had always been a prominent feature in the Computing Science curriculum. The Department was actively discussing the provision of opportunities for students to become more reflective and how best to achieve the integration of personal development planning (PDP) into the curriculum, and told the Panel that it would welcome the opportunity to discuss the matter with the Learning and Teaching Centre. The Panel **recommends** that the Department liaise with its named contact in the Learning and Teaching Centre with a view to seeking advice on mapping its existing PDP opportunities across the entire curriculum.

4.6.5 From discussions with undergraduate and postgraduate students the Review Panel ascertained that students were aware of the employability agenda and that there were suitable opportunities for them to engage in activities to enhance their employability.

All students who met with the Panel believed that the Department's programmes prepared them well for employment and were confident of achieving employment in their chosen field after graduation. There was evidence that the Department worked proactively with potential employers and that undergraduate students had regular exposure to industry through employers' visits to the Department. Level 3 students on the Software Engineering and Electronics & Software Engineering programmes also undertook a mandatory placement in industry which they valued greatly and the Panel learned from the SER that liaison between the Department and the University Careers Service ensured that these students received advice on curriculum vitae preparation and interview techniques before applying for placement vacancies. The SER also noted that there had been some opportunities for students to gain work experience within the University, a current example being the support for moving departmental websites to the T4 content management system.

### **Support**

4.6.6 All students who met with the Review Panel spoke highly of the quality of support available to them within the Department. They reported that members of staff were readily accessible and responsive to any issues that they raised. Undergraduate students reported that they had also enjoyed good peer support throughout their time in the department and were particularly impressed with the student-driven "accelerator course" where students from the year above delivered extra classes to support the year below them. They said that those who made use of this facility had found that their knowledge improved and that those who provided the support also benefited from the additional form of learning that they encountered in this experience. The Panel **commends** the Department for encouraging this initiative which it believes to be worthy of dissemination within the University.

### **4.7 The Quality of Learning Opportunities**

4.7.1 The Review Panel learned from the SER that, on the whole, academic staff had a range of expertise that enabled the Department to deliver its teaching effectively at all levels. The undergraduate students who met with the Panel were impressed with the quality of the learning opportunities available to them and said that the Department's programmes offered both an academic and "real world" experience. Postgraduate taught students considered staff to be "high quality teachers".

4.7.2 The undergraduate students who met with the Review Panel were enthusiastic about their learning and said that they enjoyed the challenging nature of their courses. They praised the richness and breadth of the undergraduate curriculum which enabled them to acquire programming skills in eight different computing languages by the time they had completed Level 3. They believed that this enhanced their employability and made students from the University of Glasgow particularly attractive to employers.

4.7.3 The Review Panel learned from the SER and from discussions with staff that the *Computing Science Inside* (CSI) project (see paragraph 4.5.2) was integrated into the Department's teaching and that a final year option course, "Computing Science in the Classroom" had been introduced under the aegis of the Undergraduate Ambassadors Scheme (<http://www.uas.ac.uk/>). The SER explained that students received instruction on working in schools with pupils and teachers, and then teamed up with a particular school teacher to support his/her teaching as appropriate. Students were required to deliver at least one of the CSI workshops during their visits and to design a new workshop and deliver it. Initial feedback from teachers, students and pupils on these visits was reported to be very promising. Participating students were also signed up to the University's Science and Engineering Ambassadors Scheme and were therefore in a position to assist in the broader outreach programme. The Panel **commends** the

Department for its strong involvement in outreach activity with schools and for the distinctive transferable skills that involvement in the project affords to students.

- 4.7.4 International postgraduate taught students reported that they believed that the intensive courses offered by the Department were designed to get the best from them. However, they found the workload high and said that they did not have as much time to focus on their specialist topic as they would like. The students had varying experiences of specialist topic choices depending on the programme that they had chosen to follow. Some students speculated that it might be easier to choose a project topic and career path if fewer choices were available, whilst others said that, in reality, the choice of topics was not as broad as it appeared since the scheduling of lectures resulted in some excluded combinations of topics that are run at the same times. The Review Panel learned from the Head of Department that the Department endeavoured to offer a reasonable breadth of options.
- 4.7.5 The student member of the Review Panel had heard anecdotally that undergraduate students undertaking Computing Science found the workload difficult to manage in comparison with other subjects. She explored this with undergraduate students who acknowledged that the workload was significantly higher than for other subjects within their experience but said that they enjoyed the work and felt that it was worth the effort because they gained so many skills, some of which were transferable to other subjects, for example, the organisation of data for analysis. The GTAs who met with the Panel viewed the undergraduate student workload as being appropriate.
- 4.7.6 The Head of Department was conscious that, despite the Department's emphasis on time management and the guidance provided on learning effort, some students tended to spend a disproportionate amount of time on projects, particularly at Level 3. He undertook to consider how more explicit guidance on time management might be built into a core Level 3 course. The Review Panel was satisfied that the matter was being addressed appropriately.

## **4.8 Resources for Learning and Teaching**

### **Staffing – Workload Model**

- 4.8.1 The Department acknowledged that its staff-student ratio was low in comparison with the rest of the Faculty and had reported in the SER that the introduction of Full Economic Costing (FEC) for research had raised questions about using the staff-student ratio as an isolated workload measure, since staff could now quantify the hours they had committed to research. The Review Panel learned that the Department's workload model was currently in a state of flux and that staff felt that one of the difficulties in the model had been the inclusion of an increasing amount of detail. In practice, members of staff were allotted the equivalent of two courses and were able to bid for the courses of their choice. However, the pattern of uptake of project topics by students could distort the workload balance. The Panel learned that the Head of Department planned to reinstate a workload model and **recommends** that the development of the model be informed by current Faculty practice.

### **Staffing - General**

- 4.8.2 The SER drew attention to the Department's age profile and the impending retirement of five senior members of staff, all of whom made a major contribution to teaching. It also drew attention to the Department's particular vulnerability in relation to expertise in software engineering. These would be key considerations in future planning.
- 4.8.3 The Department had good provision of technical support and, although there had been a significant reduction in administrative staff as a result of the recent Early Retirement and Voluntary Severance initiative, the Department was better served than

other departments in the Faculty in this respect and was currently reviewing its use of administrative resources.

### **Learning Resources**

- 4.8.4 A tour of the Department's teaching laboratories in the Boyd Orr Building provided the Review Panel with insight into the quality of the learning resources available to students. As stated in the SER, the teaching laboratories had been rationalised because of the fall in student numbers and the Department now had one laboratory for all MSc students, separate laboratories for Level 3 and Level 4 undergraduates, and a shared laboratory for Level 1 and Level 2 undergraduates with a small adjacent laboratory that could accommodate an additional group during peak teaching times for supervised laboratory classes.
- 4.8.5 The Review Panel acknowledged the Department's aim to provide its students with experience of up-to-date computing technologies through practical and project and appreciated that well equipped IT laboratories were not only a necessary learning resource, both to achieve the Department's aim and to satisfy the requirements of the professional accreditation bodies, but also key to maintaining a leading edge in terms of student recruitment.
- 4.8.6 The Review Panel noted the difference between computers as the key study tools (as objects of study, particularly for programming) for the discipline and the more general computers as IT provision. For the latter, a 5 year replacement policy is adequate, for the former it is not. On the whole, the Review Panel considered laboratory resources to be adequate for most purposes at the present time and noted that the students found them adequate for their needs and were always able to access a computer when they wanted to. However, the Panel appreciated the Department's concerns about whether it would be able to maintain the desired standard of equipment in the longer term if student numbers remained at the present level and the University continued to have a 5-year replacement cycle for IT equipment in teaching laboratories. (See also Paragraph 4.8.11.)
- 4.8.7 The Review Panel was concerned at the absence of multi-core processors in the Honours laboratory and considered whether a reduction in the number of computers provided for Level 1 and 2 students and encouragement of the use of personal laptops at this level might allow the Department to invest in "state-of-the-art" equipment for the use of senior students. The Panel explored this possibility with both students and staff and sought undergraduate students' views on the use of personal laptops at Levels 1 and 2, on the understanding that high speed equipment would be available to them at the later stages of the curriculum. Since most had access to a home computer or laptop, often of a higher specification than those provided by the Department, students saw this as a logical progression. However, they believed that in view of the social diversity in the student body, the use of a personal laptop should be an option rather than an expectation. They also questioned how such a scheme might be administered since permission was currently required to use personal portable equipment in laboratories.
- 4.8.8 Discussion of the potential use of personal laptops with staff suggested that the limitations imposed by portable appliance testing (PAT) legislation, together with the purchase cost of testing equipment and the associated testing costs for individual laptops could present difficulties for such a scheme. Staff also had concerns that the lack of a common computing environment could present challenges for detecting the causes of errors in students' work. Despite these reservations, the Review Panel believed that there was merit in exploring the potential for optional use of personal laptops by students at Level 1 and 2 as a possible means of freeing up resources to provide higher specification computers for the use of senior students. The Panel **recommends** that the University investigate the following with a view to providing

the necessary information to assist the Department with the development of a realistic strategy for providing and maintaining appropriate IT equipment facilities to allow it to compete on equal terms with its competitors in attracting high calibre applicants to its programmes:

1. Whether there are potential safety implications in permitting students to utilise personal laptops in laboratories and classrooms and, if so, how these might be overcome;
2. The individual fee incurred in portable appliance testing (PAT) and the estimated annual cost in terms of staffing resources to deliver the required PAT service to permit widespread use of personal laptops by students in Computing Science laboratories.

4.8.9 The Review Panel's discussions with the Head of Department and the Dean included discussion of the teaching timetable for Level 1 and 2 Computing Science and the constraints on the timetabling of laboratory teaching. The Dean undertook to ascertain whether there was scope for revision of the Faculty of Science timetables to allow Level 1 Computing Science laboratories to be held in the morning and Level 2 laboratories to take place in the afternoon.

4.8.10 The Review Panel noted the comment in the SER about the unsuitability of some of the teaching spaces allocated to the Department, some being too distant from the Department for staff to carry specialist items required for demonstrations and others where the lecture theatre environment is relatively "hostile" to expensive and fragile computational equipment. The Panel **recommends** the University to ensure that its current review of teaching spaces gives due consideration to the specialist technical needs of certain departments and that the central room booking system is upgraded, in due course, to ensure that a course's technical needs can be better matched to the available provision.

#### **Clerk's Note**

4.8.11 Since conducting the review, the Panel had received draft copies of the accreditation reports from the Institute of Engineering and Technology and the British Computer Society. It noted the strongly voiced opinion of the accreditation committees that the 5-year replacement policy of the University, the lack of Departmental control over mainstream equipment purchase and the shortage of funding were having an impact on the quality of provision for teaching software skills. It had also received comment from staff that the performance of "standard" equipment did not permit the effective use of up-to-date software development environments in teaching as these tended to be compute-resource intensive. Mindful of its own concerns with regard to the availability of high-end computers for practical and project work in later years of the curriculum, the Panel **recommends** that the Director of IT Services and the Department, in conjunction with the Vice Principal (Strategy & Resources) and the Dean, should conduct an in-depth review of the impact of the University's computer replacement policies and the funding available for computer purchase in the Department on the practical experience of students and the external perception of the Department.

#### **Moodle**

4.8.12 The Department embraced University policies for information dissemination in teaching and was in the process of moving its teaching materials for core courses to the Moodle platform. Staff advised the Review Panel that they believed that Moodle could have strong benefits, particularly for Level 1 and 4 students and they hoped that it

might also assist them in obtaining improved feedback from students. The Panel appreciated that Moodle might have limited application for departments in FIMS and that it would not necessarily be compatible with some of the more sophisticated software available to students.

### **Social Space for Students**

4.8.13 Social space was provided for postgraduate taught students within their teaching laboratory but there was currently no equivalent facility available to undergraduate students. In recent times, the Department had been in a position to provide a room for Honours students and it had been well used. The Department therefore appreciated the value of social space in encouraging cohesion amongst students and providing them with a sense of “belonging” to the Department, and was considering how it might again offer this facility for Honours students.

4.8.14 Undergraduate students advised the Review Panel that students at all levels made extensive use the laboratory facilities beyond “normal” opening hours and that students at Level 3 and above had 24-hour access to the laboratory facilities. However, the café in the Boyd Orr Building closed at 3.30 pm and they found it frustrating not to have somewhere where they could take a break to eat, drink and converse with each other. The Panel believed that there were more than enough computer terminals in the teaching laboratories to accommodate student needs and that learning opportunities would not be compromised by reducing the number of computers in one of the laboratories to create a social area for students. The Panel therefore **recommends** that the Department give consideration to setting aside a suitably sized section in one of the teaching laboratories in the Boyd Orr Building for the provision of a social space equipped with tables, chairs and vending machines for the use of students in the Department, with a view to enhancing opportunities for social interaction amongst students at all levels.

## **5. Maintaining the Standards of Awards**

### **External Examiners**

5.1 External examiners were satisfied with the standard of the Department’s programmes and reported that courses were rigorous, well taught, kept up-to-date, and enabled most students to reach their potential. They also reported that the Department was responsive to suggestions for improvement and that it utilised the full range of the assessment scale.

### **Professional Accreditation**

5.2 The Department benefited from the rigorous scrutiny provided by the Professional Bodies that accredited its programmes.

### **Plagiarism**

5.3 The Department publishes a *Plagiarism Policy and Guidelines* on its intranet and uses its own in-house plagiarism-detection software routinely for programming assignments. The Review Panel explored students’ understanding of the concept of plagiarism and how to avoid it. The students who met with the Panel had a clear understanding of plagiarism in relation to written coursework and assessments but were not clear about what constitutes plagiarism in relation to programming and software development and said that they would welcome additional guidance from the Department. The Panel **recommends** that the Department review the advice that it provides to students on what constitutes plagiarism in relation to programming and software development and incorporate, where appropriate, specific examples to assist students’ understanding of the concept.

- 5.4 International postgraduate taught students informed the Review Panel that, despite their having a good understanding of what constitutes plagiarism, an imperfect command of the English language made the avoidance of plagiarism challenging and time consuming since it was not an easy task to summarise the ideas of others without losing the original meaning intended by the author(s).
- 5.5 Staff advised the Review Panel that they had concerns about the *Turnitin* software that was currently being piloted by the University and indicated that they would have welcomed wider consultation at an earlier stage. In their view, the package contravenes data protection legislation since it stores students' work in perpetuity. The Panel stressed the importance of drawing this to the attention of the University and encouraged staff to engage routinely in constructive dialogue with the University in relation to current pilot initiatives to ensure that concerns and shortcomings were properly addressed.

### **Generic Regulation for Taught Postgraduate Programmes**

- 5.6 The Review Panel noted that the Annual Monitoring Reports for all three postgraduate taught programmes had raised concerns about the application of the generic regulation for postgraduate taught programmes, particularly in relation to the criteria for the award of Distinction. It was believed that the criteria resulted in the lowering of standards in comparison to the previous assessment regime and that the manner in which distinction was calculated could also, in certain circumstances, disadvantage potentially outstanding candidates. The Panel **recommends** that, in the course of its scheduled review of the generic regulation for taught postgraduate programmes, the Academic Regulations Sub Committee explore with the Department of Computing Science the concerns identified in Annual Monitoring Reports regarding the criteria for the award of Distinction.

## **6. Assuring and Enhancing the Quality of the Students' Learning Experience**

### **Student Feedback**

- 6.1 The undergraduate and postgraduate taught students who met with the Review Panel were satisfied that they had sufficient opportunities to provide feedback to staff and said that staff were responsive to issues that were raised.
- 6.2 The postgraduate taught students said that they found the use of Electronic Voting Systems in classes particularly useful as it encouraged student interaction and exchange of ideas and made them more aware of the views of others.
- 6.3 Students believed that Staff-Student Liaison Committees (SSLCs) were effective. Although they did not think that anyone was particularly enthusiastic about undertaking the role of a Student Representative, they believed that issues raised through this route did make a difference, especially for students in the following year. Minutes of meetings were made available and students were aware of changes made as a result of suggestions from the previous year. Staff were surprised to hear that students currently considered the SSLC mechanism to be effective since they had noted that attendance at SSLCs this year was poorer than in previous years, with staff outnumbering students at meetings. In their view, students sometimes had a tendency to say that things were alright when this was not necessarily the case and they would prefer to be told when there were problems.

### **National Student Survey**

- 6.4 The Review Panel noted that the Department had been placed first in its subject group for overall student satisfaction and intellectual challenge in the 2007 National Student Survey and congratulated the Department on this achievement.

## **7. Summary of Perceived Strengths and Areas for Improvement in Learning and Teaching**

### ***Key Strengths***

- The quality of the overall student experience, demonstrated by the Department being rated first in its subject group for overall student satisfaction and intellectual challenge in the 2007 National Student Survey
- Friendly and approachable staff
- Well qualified teachers
- The leadership of the Head of Department
- The strong collegiate support amongst staff
- The wide range of assessment methods employed
- The detailed grade descriptors and comprehensive assessment criteria provided to students, supervisors and readers in relation to Level 3 team projects
- The cycle of root and branch programme review which is undertaken on a year-by-year basis starting from Level 1
- The Department's strong involvement in outreach activity with schools and the distinctive transferable skills that involvement in the project affords to Level 4 students
- The system of weekly tutorials and the support that they provide for students
- Peer support
- The student-driven "accelerator course" where students from the year above deliver extra classes to support the year below them
- The Department's strong links with employers
- The opportunities available to students for exposure to industry through employers' visits to the Department and industrial placements at Level 3
- The range of opportunities for personal development planning (PDP) offered within the curriculum
- The quality of the taught postgraduate admissions experience which had included the support of a "mentor" from the point of being made a conditional offer

### ***Areas to be improved or enhanced***

- Recruitment
- The mapping of assessment methods
- Feedback on assessment
- The articulation of programme aims and intended learning outcomes
- The articulation of existing PDP opportunities
- Students' approach to time management
- Postgraduate Taught Programmes – minor refinements in Semester 1



## *Conclusions and recommendations*

### **Conclusions**

The Review Panel **commends** the Department on the quality of the overall student experience and on its outstanding performance in the 2007 National Student Survey in relation to overall student satisfaction and intellectual challenge. The Panel was pleased to note the strong collegiate support within the Department and the staff's satisfaction with the leadership skills of the Head of Department. The Panel also **commends** the Department's proactive links with industry which have significant benefits for students in terms of the overall student experience and expectations for employment.

The Department clearly has considerable strengths and a strong reputation amongst peer institutions and there are a number of distinctive features in its undergraduate curricula that could have a positive effect on recruitment if channelled effectively. The Review Panel was impressed with the Department's strategic involvement with schools to improve young people's awareness and understanding of Computing Science, with a view to enhancing recruitment in the longer term, but believes that there is work to be done in the shorter term to promote the distinctive features that the Department can offer to applicants and to dispel the mismatch between the reality of job expectations for computing scientists and the outdated perceptions of school pupils and their parents.

Students drew attention to their poor understanding of the Faculty entry system prior to commencing University and their gradual recognition of the advantages in its flexibility. The External Subject Specialist had also found this challenging and had likewise found it challenging to understand the nuances of the Scottish University system, particularly in relation to what was meant by "final year" since this could mean different things, depending on the nature of the curriculum followed by an individual student. The Panel therefore **recommends** that a brief explanation of the Scottish University system and the Faculty entry system be provided routinely to external Panel members involved in the Review of Departmental Programmes of Teaching, Learning and Assessment, and made available for departmental use for the purposes of external accreditation.

### **Recommendations**

The recommendations interspersed in the preceding report are summarised below. It is important to note that the majority of these recommendations refer to tasks or issues identified by the Department for action either prior to the Review or in the SER. Some of these actions are already in hand.

The recommendations have been cross-referenced to the paragraphs in the text of the report to which they refer and are ranked in order of priority.

#### *Recommendation 1*

The Review Panel noted that the Department intended to review and modify its programme and course intended learning outcomes (ILOs) to address identified weaknesses and **recommends** that it seek the advice of colleagues in the Learning and Teaching Centre on effective ways of re-mapping them against the relevant benchmarks, with a view to achieving clearer differentiation between degree programmes and demonstrating progression between the different levels of learning.  
*[Paragraph 4.2.2]*

For the attention of: **The Head of Department**

*Recommendation 2*

The Review Panel **recommends** that, whilst reviewing programme and course ILOs, the Department also takes the opportunity to map its assessment methods more explicitly to the individual courses and update programme and course documentation accordingly. [Paragraph 4.3.2]

For the attention of: **The Head of Department**

*Recommendation 3*

The Review Panel **recommends** that the Department consider modifying the taught postgraduate assessment requirements in Semester 1 to include either more modest methods of assessment or fewer assessments with a faster turnaround time, to take account of the steep learning curve for those who have not previously studied in the UK. [Paragraph 4.3.4]

For the attention of: **The Head of Department**

*Recommendation 4*

The Review Panel **recommends** the Department to review its marketing and recruitment strategy with a view to ensuring that the undoubted and highly competitive strengths of the Department be given prominence in materials, messages and promotional activities. [Paragraph 4.5.1]

For the attention of: **The Head of Department**

*Recommendation 5*

The Review Panel **recommends** that the University review its existing recruitment materials with a view to ensuring that they contain a clear explanation of the Faculty entry system and the benefits afforded to students by its flexibility. [Paragraph 4.5.4]

For the attention of: **The Director of the Recruitment, Admissions and Participation Service**

*Recommendation 6*

Since the Faculties of Science have funded a Recruitment Officer for Science within the Recruitment, Admissions and Participation Service (RAPS), the Review Panel **recommends** that the Department of Computing Science explore with RAPS how it might make maximum use of this resource to promote its undergraduate programmes south of the border through showcasing their distinctive qualities alongside the flexibility of the Faculty entry system, and that it also explore ways of maintaining the momentum in future years. [Paragraph 4.5.6]

For the attention of: **The Head of Department**

*Recommendation 7*

The Review Panel **recommends** the University to review its recruitment materials and the navigational routes through them to ensure that the merits of the Scottish Higher

Education system are brought prominently to the attention of potential applicants.  
[Paragraph 4.5.7]

For the attention of: **The Director of the Recruitment, Admissions and  
Participation Service**

#### *Recommendation 8*

The Review Panel shared the view that creating opportunities to build social cohesion amongst Level 1 students could have a positive effect on retention and, for this reason, **recommends** that the Department give serious consideration to introducing group work into the first year of the Computing Science curriculum. [Paragraph 4.6.2]

For the attention of: **The Head of Department**

#### *Recommendation 9*

The Review Panel **recommends** that the Department give consideration to setting aside a suitably sized section in one of the teaching laboratories in the Boyd Orr Building for the provision of a social space equipped with tables, chairs and vending machines for the use of students in the Department, with a view to enhancing opportunities for social interaction amongst students at all levels. [Paragraph 4.8.14]

For the attention of: **The Head of Department and the Dean of the Faculty of  
Information and Mathematical Sciences**

#### *Recommendation 10*

The Review Panel learned that the Head of Department planned to reinstate a workload model and **recommends** that the development of the model be informed by current Faculty practice. [Paragraph 4.8.1]

For the attention of: **The Head of Department**

#### *Recommendation 11*

Mindful of its concerns with regard to the availability of high-end computers for practical and project work in later years of the curriculum, the Panel **recommends** that the Director of IT Services and the Department, in conjunction with the Vice Principal (Strategy & Resources) and the Dean, should conduct an in-depth review of the impact of the University's computer replacement policies and the funding available for computer purchase in the Department on the practical experience of students and the external perception of the Department. [Paragraph 4.8.11]

For the attention of: **The Director of IT Services and The Head of Department**

In conjunction with: **The Vice Principal (Strategy & Resources) and The Dean of  
the Faculty of information and Mathematical Sciences**

#### *Recommendation 12*

The Review Panel **recommends** that the Department review the advice that it provides to students on what constitutes plagiarism in relation to programming and software development and incorporate, where appropriate, specific examples to assist students' understanding of the concept. [Paragraph 5.3]

For the attention of: **The Head of Department**

*Recommendation 13*

The Review Panel **recommends** that, in the course of its scheduled review of the generic regulation for taught postgraduate programmes, the Academic Regulations Sub Committee explore with the Department of Computing Science the concerns identified in Annual Monitoring Reports regarding the criteria for the award of Distinction. *[Paragraph 5.6]*

For the attention of: **The Convener of the Academic Regulations Sub-Committee**

*Recommendation 14*

The Review Panel **recommends** that the Department liaise with its named contact in the Learning and Teaching Centre with a view to seeking advice on mapping its existing PDP opportunities across the entire curriculum. *[Paragraph 4.6.4]*

For the attention of: **The Head of Department**

*Recommendation 15*

The Review Panel **recommends** that the University investigate the following with a view to providing the necessary information to assist the Department with the development of a realistic strategy for providing and maintaining appropriate IT equipment facilities to allow it to compete on equal terms with its competitors in attracting high calibre applicants to its programmes:

- (i) Whether there are potential safety implications in permitting students to utilise personal laptops in laboratories and classrooms and, if so, how these might be overcome; *[Paragraph 4.8.8]*

For the attention of: **The University Safety Officer**

- (ii) The individual fee incurred in portable appliance testing (PAT) and the estimated annual cost in terms of staffing resources to deliver the required PAT service to permit widespread use of personal laptops by students in Computing Science laboratories. *[Paragraph 4.8.8]*

For the attention of: **The Director of IT Services**

*Recommendation 16*

The Review Panel **recommends** the University to ensure that its current review of teaching spaces gives due consideration to the specialist technical needs of certain departments and that the central room booking system is upgraded, in due course, to ensure that a course's technical needs can be better matched to the available provision. *[Paragraph 4.8.10]*

For the attention of: **The Vice Principal (Learning, Teaching and Internationalisation)** and **The Director of Estates and Buildings**

*Recommendation 17*

The Review Panel **recommends** that a brief explanation of the Scottish University system and the Faculty entry system be provided routinely to external Panel members involved in the Review of Departmental Programmes of Teaching, Learning and Assessment, and made available for departmental use for the purposes of external accreditation. *[Conclusions]*

For the attention of: **The Director of the Senate Office**

## **Appendix 1**

### **Full List of Programmes and additional notes**

#### ***Undergraduate programmes - BSc***

- BSc (Hons) Computing Science
- BSc (Hons) Software Engineering
- MSci Computing Science
- MSci Software Engineering
- BSc Designated Degree in Computing Science

#### ***Postgraduate programmes – MSc***

- MSc/PgDip Advanced Computing Science
- MSc/PgDip Computing Science
- MSc/PgDip Information Technology

#### ***Joint programmes***

- BSc/BEng (Hons) Electronic and Software Engineering (taught with Electronics & Electrical Engineering)
- BSc/MA (Hons) Joint Computing Science with another subject
- MSci Computing Science and Mathematics (offered, no current students)

The department also contributes to the following degree programmes/courses offered by other departments or other institutions:

##### University of Glasgow

- BEng Mechanical Engineering – Software Engineering M3 (10 credits)
- MEng Electronics and Software Engineering – level 5 optional courses
- MRes in Bioinformatics – selected MSc IT courses

##### Institute for System Level Integration (ISLI), Livingston

- Embedded Software (3 courses); MSc project supervision

#### ***Accreditation by Professional and Statutory Bodies***

BSc (Hons) degrees in Computing Science, Software Engineering and Electronics and Software Engineering are currently accredited by the British Computer Society (BCS) and the Institution of Engineering and Technology (IET) (due for renewal in February 2008). Other joint degrees are accredited by the BCS only. Accreditation by the BCS and IET for MSci degrees, MSc Advanced Computing Science and MSc Computing Science has been requested and was considered during the accreditation visit in

February 2008. Accreditation (IEng) for the BSc Designated Degree has also been requested from the BCS.

The formal outcome of the February accreditation visit was not available at the time of writing.

***In 2008-09, the Department plans to offer the following new postgraduate taught programmes:***

- MRes Advanced Computing Science (replacing MSc Advanced Science)
- MRes Information Retrieval
- MRes Information Security
- MRes Mobile and Ubiquitous Computing
- MRes Software Engineering
- MSc/PgDip Information Retrieval
- MSc/PgDip Information Security
- MSc/PgDip Mobile and Ubiquitous Computing
- MSc/PgDip Software Engineering

*Prepared by: Janet Fleming, Senate Office*

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