



National Qualifications Review Investigation Report

***Computing and Information Systems
August 2003***

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(Further information on this review can be found at www.smartgroups.com/groups/arrangements)

Executive summary

This report is the outcome of an investigation into how to implement the agreed actions which were detailed in the Computing and Information Systems Subject Review Reports, published in 2001.

The main concerns identified in the Review of Computing and Information Systems to be addressed through this investigation were about the revision of the content, structure and assessment of Courses, addressing the following issues:

- ◆ Produce a new assessment rationale that directs, justifies and clarifies the relationship between internal and external assessment.
- ◆ All internal assessment of Intermediate 1, Intermediate 2, Higher and Advanced Higher Computing and Information Systems Courses will consist of only one test exercise and one practical activity. The volume of internal assessment at all levels will be reduced to within agreed parameters.
- ◆ Develop a viable model and practicable arrangements for assessing Intermediate 2, Higher and Advanced Higher Computing and Information Systems coursework. This model must clearly distinguish between the evidence requirements of internal and external assessment and must also rationalise the relationship between coursework and the examination.
- ◆ The relative weighting of coursework in the external assessment and the examination will be investigated in the light of changes to the internal assessment and the new model of coursework assessment.
- ◆ Rationalise coursework marking schemes and remove the need for scaling.

The consultation process, carried out between January and September 2002, involved consultation with stakeholders at various points and included:

- ◆ a questionnaire sent to all presenting centres
- ◆ consultation through interviews and other methods with representatives from schools and further and higher education and from bodies such as HMIE, British Computer Society, the e-skills National Training Organisation, the Assessment Panel, Advisory Group, teachers' groups and an HE Computing forum. Principal Assessors, Examiners, Setters, Markers and Moderators were consulted as part of this process
- ◆ monitoring of the online smartgroup
- ◆ reference to related reports and papers
- ◆ regional seminars attended by over 300 teachers and lecturers

The consultation feedback indicated that there was strong support for:

- ◆ updating of Course and Unit content
- ◆ retaining the existing framework of Courses in Computing and Information Systems, and of mandatory Units and a choice of optional Units to reflect the breadth of the field of study
- ◆ Units comprising two Outcomes — one covering knowledge and understanding, the other practical skills
- ◆ improvements to links between levels to facilitate progression, particularly between Intermediate 2 and Higher
- ◆ internal assessment — one written and one practical assessment per Unit to reduce the amount of Unit assessment
- ◆ external assessment
- ◆ the retention of the assessment of practical coursework (internally assessed and externally moderated)
- ◆ retaining the balance between coursework and the examination
- ◆ regulating the length, marks and format of the examinations

The following recommendations have been made:

1. The Course structure should be revised and the following structure adopted:

- ◆ at Intermediate 1, one Course (Computing Studies), consisting of 2 mandatory 40-hour Units and two optional 40-hour Units
- ◆ at Intermediate 2 and Higher, Courses in Computing and Information Studies, each consisting of two mandatory 40-hour Units and three optional 40-hour Units
- ◆ at Advanced Higher, Courses in Computing and Information Studies, each consisting of two mandatory 40-hour Units and three and two optional 40-hour Units respectively

◆ **Each Unit should have two Outcomes, one detailing the knowledge and understanding and the other the practical skills.**

◆ **Internal Unit assessment should consist of:**

- ◆ one test of knowledge and understanding, lasting no more than 45 minutes
- ◆ a Practical skills folio and observation checklist, with evidence generated from practical teaching and learning activities within the Unit

2. External assessment:

- ◆ This should consist of two components – an integrative practical task and a written examination at Intermediate 1 to Higher, and, at Advanced Higher, a report based on the project undertaken in the Project Unit and a written examination.
- ◆ The weighting of the components at each level should be revised at each level to reflect the balance between practical content and knowledge and understanding, with the duration of the question paper to be appropriate to each level. The marks allocation should be revised to remove the need for scaling.

3. The proposals for assessment will ensure that Unit and Course assessment are distinct with the Course assessment focusing on the ‘added value’.

4. The relevant Course documentation should be revised to reflect the above proposals, ensuring that the assessment rationale directs, justifies and clarifies the relationship between internal and external assessment.

1 Terms of reference

The Scottish Executive initiated a review of all National Courses in June 2001, with the purpose of considering how best to reduce the complexity, variety and total volume of assessment in each subject. Following the review process, Subject Review Reports were published between February and June 2002. The reports identified a number of actions to be taken forward for each subject. These agreed actions received Ministerial approval.

This report is the result of an investigation into the best ways of addressing the issues and implementing the agreed actions which were specified in the Subject Review Reports for Computing and for Information Systems (published in February 2002). These were:

- ◆ Course structure, including use of 20 and 60-hour Units
- ◆ the volume and complexity of internal assessment
- ◆ relationship between internal and external assessment, and between examination and coursework components of external assessment
- ◆ arrangements for assessing coursework
- ◆ the need to simplify marking schemes and maximum marks, and remove the need for scaling of marks
- ◆ revise the content, structure and assessment of Courses in Computing and Information Systems. In revising the Courses, the following actions will be taken:
 - Produce a new Assessment Rationale that directs, justifies and clarifies the relationship between internal and external assessment.
 - All internal assessment of Intermediate 1, Intermediate 2, Higher and Advanced Higher will consist of only one test exercise and one practical activity.
 - Develop a viable model and practicable arrangements for assessing Intermediate 2, Higher and Advanced Higher coursework. This model must clearly distinguish between the evidence requirements of internal and external assessment and must also rationalise the relationship between coursework and the examination.
 - The relative weighting of coursework in the external assessment and the examination will be investigated in the light of changes to the NAB framework, and the new model of coursework assessment.
 - Rationalise coursework marking schemes and remove the need for scaling. The number of alterations, changes or scaling calculations made to raw marks substantially increases the scope for error. Eliminating scaling would alleviate the problem. To be accepted by the field, marking schemes must also be rational, consistent and coherent across levels.

In addressing these issues, and meeting the requirements of the Subject Review Report, the review aims to:

- ◆ take account of technological developments that have occurred since they were originally written
- ◆ build on the experience of implementation to date
- ◆ enhance strengths and eliminate weaknesses of current Arrangements
- ◆ maintain academic rigour and appeal to students

2 Methodology

- 2.1 Two Development Officers (DOs) were appointed. The Development Officers' remit was to work with the Qualifications Manager for Computing and Information Systems, and the NQ Review team, to carry out the agreed actions of the Subject Review Report.
- 2.2 A Subject Advisory Group was set up to advise the development team at key stages of the review. An online forum was also established to allow stakeholders to take part in debate about proposals as they were being formulated.

Consultation – phase 1

- 2.3 In January 2002, questionnaires were designed and distributed to all centres offering Computing or Information Systems, seeking the views of teachers, lecturers and students. 101 teacher/lecturer questionnaires and 83 student questionnaires were returned. This represented the views of 181 teachers/lecturers (departments and individual responses) and 83 students respectively.
- 2.4 In March 2001, a debate was initiated on an electronic community named *Arrangements Review* hosted on www.smartgroups.com. The DOs monitored the online discussions, and contributed to the on-going debates. To date this e-group has a membership of 309, who have posted 503 messages.
- 2.5 From January to April 2002, the Development Officers conducted 56 interviews in 40 schools, 7 FE colleges and 9 universities around the country. The interviewees were mainly individual teachers/lecturers, but also included departments and groups. The individuals included Principal Assessors, Examiners, Setters, Moderators, Markers and teachers.
- 2.6 Groups of interested individuals were consulted. These included: the subject Assessment Panel; the Subject Advisory Group; teachers' groups in a number of LEAs; and a higher education Computing forum initiated as a result of the review, hosted by Glasgow University.
- 2.7 Interviews with individuals with a specialised interest were also conducted. These included: HMIE; a British Computer Society (BCS) representative, and the Standards Manager for the e-skills National Training Organisation (NTO).
- 2.8 Previous and current reports and papers relating to the NQ Review were consulted.
- 2.9 A presentation of the data arising from phase 1 was made to a number of groups and individuals. The Development Officers then formulated some early draft proposals on Course structure and content, Course and Unit assessment, and format of Arrangements.

Consultation – phase 2

- 2.10 During June 2002 regional seminars took place in Edinburgh, Stirling, Dundee, Glasgow, Renfrew, Inverness and Aberdeen. These were attended by over 300 teachers and lecturers. The seminars addressed the rationale behind the review and the findings from the phase 1 consultation. Those attending the seminars took part in discussion groups to give a response to any aspect of the early draft proposals. These extensive written comments were collated by the Development Officers, and were used to modify the proposals. In addition, all stakeholders were invited to continue to make their views known through the Arrangements smartgroup, and through an online questionnaire.
- 2.11 The draft Course proposals were discussed with the Principal Assessors, SQA staff and HMIE in September 2002. In addition, BCS, e-skills NTO, and higher education representatives were invited to provide further comment.
- 2.12 The Development Officers conducted additional consultation with stakeholders on Access 3 and Advanced Higher to firm up proposals at these levels.

3 Findings

3.1 Findings from phase 1 of the consultation

Overall framework

The overwhelming majority view (95%) was that changes should be made to Course content but the existing framework should remain in place. There was a strong desire (82%) that the two separate Courses — Computing and Information Systems — should continue at Intermediate 2, Higher and Advanced Higher.

Respondents felt that it was important to revise Courses to increase the similarities at different levels to make progression more straightforward, and to allow candidates to drop down a level without having to cover new content. This was a particular concern between Intermediate 2 and Higher in both subjects (93% raised this issue). Respondents suggested that Units at different levels should match each other, to allow for bi-level assessments.

It was widely proposed that a mechanism should be in place to allow for regular Course updates in future years, possibly every two or three years.

Courses — structure and content

Computing Studies Access 3

The limited responses (13 questionnaires) suggest that only minor changes are required to existing Units. (Further consultation was carried out in September 2002. At that time, the proposal that the Access 3 Cluster should have the same structure as the Intermediate 1 Course (but no external assessment) was widely supported by centres currently offering the cluster.)

Computing Studies Intermediate 1

Respondents suggested that more topics should be covered, but in less depth — this might require changes to Unit content or to the Course structure. A minority raised concerns about the relationship between Intermediate 1 and 2, and between Intermediate 1 and Standard Grade.

Computing Intermediate 2

Progression from Intermediate 2 to Higher was an issue of concern. Many suggested replacing the *Project* Unit with a range of optional ‘taught’ Units, matching those in Higher Computing. An additional *Computer Applications* Unit was widely supported, as were minor changes to the content of the two mandatory Units.

Computing Higher

Respondents were happy with the structure of this Course, but changes to the content of most Units were suggested. The programming content was an issue concerning higher education institutions. The complex exam structure was also a cause for concern.

Computing Advanced Higher

Changes have to be made to reduce the volume of assessment, eliminate duplication of assessment, and improve the Course structure.

Information Systems Intermediate 2

The main concern was the poor progression between Intermediate 2 and Higher. Achieving better progression would need significant changes in the content of Units. The concerns focused on the depth of study in the *Computer Applications in Society*, *IT in Society*, and *Multimedia* Units, and to a lesser extent, the *Database Systems* Unit. A few respondents suggested that a new Unit on *Expert Systems* should be developed.

Information Systems Higher

The content of many of the Units was criticised, particularly *Information Organisation* and *Hypermedia*. Progression from Intermediate 2 was seen as important — improving this would require significant changes to the mandatory Units and to the *Expert Systems* Unit. There was a clear desire for *Database Systems* to extend normalisation to 3NF.

Information Systems Advanced Higher

Changes must be made to reduce the volume of assessment, eliminate duplication of assessment, and improve the Course structure.

Course Arrangements and Unit specifications

A majority (57%) wanted a different format for the sake of clarity about the required depth and breadth of treatment of topics. There was wide support for use of a tabular format (as in Standard Grade Arrangements) which would incorporate information currently in the Support Notes.

Assessment

Unit assessment

The overwhelming majority (86%) held the view that there was too much Unit assessment. The suggestion of one written and one practical assessment per Unit, vastly reducing the time spent on assessment, was widely favoured.

There was a guarded interest in exploring the use of online assessment, where this is appropriate and possible.

Course assessment – practical coursework

The overwhelming majority (89%) were in favour of retaining practical coursework, and most (64%) were in favour of internal assessment with external moderation. A majority suggested retaining the status quo regarding the balance between coursework and the exam to determine the Course award. However, a significant minority suggested a reduction in the value of coursework, particularly at Intermediate 1 and 2.

Course assessment - examination

There was almost unanimous agreement (97%) that the length, marks, and format of the exams across both subjects should be more consistent. Particular attention should be paid to the Computing Higher exam in terms of simplifying its structure, and to the balance of core and optional Unit weightings in all exams.

3.2 Findings from phase 2 of the consultation

Course content and structure

- ◆ general approval of overall structure proposed - overwhelming support for better progression from Intermediate 2 to Higher
- ◆ general acceptance of single Course at Intermediate 1 level
- ◆ strong approval for tabular presentation of content - more detail required to indicate depth of treatment
- ◆ some minor changes to specific Units suggested

Assessment

- ♦ general approval of proposals for Course assessment, including simplification of the overall pattern of allocation of marks and weightings to components of external assessment and removal of choice of coursework tasks in Higher Computing
- ♦ general support for retaining practical coursework (open book)

Unit assessment

- ♦ general approval of proposals, but some doubts expressed about some specific aspects (see Appendix 4).

3.3 Findings from further feedback through Smartgroups (July – September 2002)

A number of stakeholders used the Arrangements Smartgroup to express views on the proposals. There was no disagreement expressed with the overall Course structures proposed. Constructive criticism on the detailed content of some of the Units has been incorporated into the detailed proposals where appropriate. Responses to the online questionnaire (58 respondents) were broadly supportive of the proposals — 98% were satisfied or very satisfied overall with the proposed changes.

3.4 Findings from further consultation (September 2002)

Advanced Higher

Taking account of the views of Examiners and other stakeholders, a change to the proposals for Advanced Higher was presented — an online consultation using the Smartgroup outlined several possibilities (these can be viewed at www.smartgroups.com/groups/arrangements). Members of the group were asked to vote on their preferred option. The response to this request was low and inconclusive. Proposals in Section 5 of this report are based on responses to the main phase 1 and phase 2 consultations.

Unit structure

A draft Unit structure was developed. This aimed to address the issues of clarity raised during the consultation. The draft structure has the following innovative features:

- ♦ two outcomes per Unit (demonstrate knowledge and understanding, and demonstrate practical skills)
- ♦ content statements incorporated in grid format in the Guidance on Content and Context section

(Note: these content grids will also be included in the Course Arrangements)

The Unit structure was exemplified for *Computer Systems* and *Software Development* at both Higher and Intermediate 2, and published for comment on the Arrangements Smartgroup.

This format found widespread support from teachers/lecturers and from the Principal Assessors, and will be developed further.

4 Conclusions

The conclusions in this section are based on the findings outlined in section 3. They reflect the aims and objectives of the review, and have the widespread support of stakeholders.

Course structures

- ◆ There should remain separate Courses in Computing and Information Systems from Intermediate 2 to Advanced Higher.
- ◆ The structure of Courses in the two subjects should be similar to help with achieving parity of esteem between them.
- ◆ There should remain a single Computing Studies Course and Cluster for Intermediate 1 and Access 3.
- ◆ Courses in each subject at Intermediate 2 and Higher should be of similar structure, for progression and fallback.
- ◆ The breadth of topics covered by Computing and Information Systems justifies the need to retain Courses with two or three optional Units. This is further justified in the present uptake of the optional Units.
- ◆ Units should have a balance between knowledge and understanding and practical problem-solving skills.
- ◆ The practical nature of the Courses requires a significant amount of coursework to be assessed in addition to the external examination.

(A draft generic Course rationale for each subject can be seen at: www.smartgroups.com/groups/arrangements)

Assessment

- ◆ Unit assessment should assess knowledge and understanding and practical skills in each Unit at each level.
- ◆ Practical problem-solving skills based on knowledge and understanding of mandatory Units in each Course should continue to be assessed using practical coursework.
- ◆ The ability of the candidate to integrate knowledge and understanding across component Units, to demonstrate long-term retention, and to demonstrate higher-order cognitive abilities, should continue to be assessed at each level by an examination.
- ◆ The length of each examination will be appropriate to the level of the Course. The structure and length of the examinations in Computing and Information Systems at each level will be the same.
- ◆ At all levels, the Course award should reflect the two main complementary aspects required of any IT professional — namely, knowledge and understanding of relevant concepts, and applied practical skills. The first of these is best assessed through an examination, whilst the second is best assessed by practical coursework tasks. There should be an appropriate balance between these two aspects of external assessment, with the practical coursework contributing 30 to 40 per cent of the overall award.

Recommendations

5.1 Proposed Course structures

(Appendix 4 gives details of existing and proposed course structures.)

Computing Studies Access 3 Cluster

The proposed structure is three mandatory 40-hour Units. This will:

- ♦ provide a more practically-based Course
- ♦ articulate with the proposed Intermediate 1 Computing Studies Course
- ♦ with Intermediate 1 Computing Studies, provide an introductory Course which can lead into either Information Systems or Computing (or both)

The name Computing Studies should be retained to emphasise that the Cluster (and Intermediate 1 Course) is in hierarchy with both Intermediate 2 Computing and Intermediate 2 Information Systems.

Computing Studies Intermediate 1

The proposed structure is two mandatory 40-hour Units (*Computer Applications* and *Multimedia Applications*) and a choice of two optional 40-hour Units (*Information and the Internet* and *Computers and the Internet*). This will:

- ♦ retain a single Course at this level
- ♦ reduce the number of optional Units
- ♦ provide a more practically-based Course
- ♦ allow progression to either Intermediate 2 Computing or Intermediate 2 Information Systems

The name Computing Studies should be retained to emphasise that the Course is in hierarchy with both Intermediate 2 Computing and Intermediate 2 Information Systems.

Computing Intermediate 2

The proposed structure is two mandatory 40-hour Units (*Computer Systems* and *Software Development*) and a choice of three optional 40-hour Units (*Computer Networking*, *Artificial Intelligence* and *Multimedia Technology*). This will:

- ♦ remove the *Computing Project Unit*, and its associated assessment difficulties
- ♦ include three optional Units corresponding to those in the Higher Course to facilitate progression and fall-back

The *Multimedia Technology* Unit should have a strong Computing focus, clearly differentiating it from the *Applied Multimedia* Unit in Intermediate 2 Information Systems

Each of the three optional Units should allow the candidate to apply learning from the two mandatory Units into an important contemporary application of computing.

Computing Higher

The proposed structure is two mandatory 40-hour Units (*Computer Systems* and *Software Development*) and a choice of three optional 40-hour Units (*Computer Networking*, *Artificial Intelligence* and *Multimedia Technology*). This will:

- ♦ reduce the number of optional Units from four to three (in line with Higher Information Systems)
- ♦ remove the optional *Programming* Unit (chosen by less than 3% of candidates in 2002)
- ♦ retain the two mandatory Units, *Computer Systems* and *Software Development*, which define the essential elements of the Computing Course
- ♦ retain three optional Units which reflect the breadth and diversity of the subject at this level, and allow students to apply learning from the two mandatory Units within the main contemporary areas of development

- ◆ reflect current uptake (each of the corresponding Units in the existing Course is chosen by over 30% of candidates)
- ◆ provide clear progression from Intermediate 2 Computing

The *Multimedia Technology* Unit should have a strong Computing focus, clearly differentiating it from the *Applied Multimedia* Unit in Higher Information Systems.

Some of the content of the existing optional *Programming* Unit should be incorporated into the Advanced Higher Computing Course.

The existing *Programming* Unit should remain in the SQA catalogue for those students (33 in 2002) who took this Unit as a freestanding Unit.

Computing Advanced Higher

The proposed structure is two mandatory 40-hour Units (*Software Development* and *Developing a Software Solution*) and a choice of three optional 40-hour Units (*Computer Architecture*, *Artificial Intelligence* and *Computer Networking*). This will:

- ◆ remove the anomalous 20-hour and 60-hour Units
- ◆ retain a significantly practical Unit (*Developing a Software Solution*), considered to be a defining element of Advanced Higher Computing
- ◆ retain the mandatory *Software Development* Unit, increasing its content to provide a better bridge to Computer Science degree courses
- ◆ retains three optional Units which reflect the breadth and diversity of the subject at this level, and allow students to focus on a developing area of Computing

The Arrangements should clearly separate the requirements for a Unit pass in the *Developing a Software Solution* Unit from its contribution as coursework to the overall Course award.

The optional *Computer Systems* Unit should be renamed as *Computer Architecture* to distinguish it clearly from the mandatory *Computer Systems* Unit at Intermediate 2 and Higher.

Information Systems Intermediate 2

The proposed structure is two mandatory 40-hour Units (*Database Systems* and *Using Information*) and a choice of three optional 40-hour Units (*Applied Multimedia*, *The Internet* and *Expert Systems*). This will:

- ◆ consolidate the mandatory Units to provide better progression to Higher
- ◆ introduce Expert Systems at an appropriate level
- ◆ include three optional Units corresponding to those in the Higher Course to facilitate progression fall-back

The *Applied Multimedia* Unit should have a strong Information Systems focus, clearly differentiating it from the *Multimedia Technology* Unit in Intermediate 2 Computing.

The Unit on *Using Information* — at Intermediate 2 and Higher — is intended to amalgamate and rationalise the study of Computer Applications Software, IT in Society and Information Organisation to provide a coherent structure across the levels.

Information Systems Higher

The proposed structure is two mandatory 40-hour Units (*Relational Database Systems* and *Using Information*) and a choice of three optional 40-hour Units (*Applied Multimedia*, *The Internet* and *Expert Systems*). This will:

- ◆ provide clear progression from Intermediate 2 Information Systems
- ◆ consolidate the content of *Information Organisation* and *Computer Applications Software* into a single Unit
- ◆ retain three optional Units which reflect the breadth and diversity of the subject at this level, and allow students to focus on a developing area of Information Systems

The *Applied Multimedia* Unit should have a strong Information Systems focus, clearly differentiating it from the *Multimedia Technology* Unit in Higher Computing.

The Unit on *Using Information* — at Intermediate 2 and Higher — is intended to amalgamate and rationalise the study of *Computer Applications Software*, *IT in Society* and *Information Organisation* to provide a coherent structure across the levels.

Information Systems Advanced Higher

The proposed structure is two mandatory 40-hour Units (*Relational Database Systems* and *Developing a Database System*) and a choice of two optional 40-hour Units (*Systems Analysis and Design, and Multimedia*). This will:

- ♦ remove the anomalous 20-hour and 60-hour Units
- ♦ retain a significantly practical Unit (*Developing a Database Solution*), considered to be a defining element of Advanced Higher Information Systems
- ♦ retain the mandatory *Database Systems* Unit, increasing the depth of study in particular areas eg normalisation to 3NF
- ♦ retains optional Units that reflect the breadth and diversity of the subject at this level, and allow students to focus on a developing area of Information Systems

The Arrangements should clearly separate the requirements for a Unit pass in the *Developing a Database Solution* Unit from its contribution as coursework to the overall Course award.

5.2 Proposals on assessment

Details of the proposals for internal and external assessment can be found in Appendix 5.

Unit assessment

Unit assessment should assess knowledge and understanding and practical skills in each Unit at each level. The proposed instruments of assessment are:

- ♦ one test of knowledge and understanding lasting no longer than 45 minutes
- ♦ a Practical Skills folio and observation checklist, with evidence generated from practical teaching and learning activities within the Unit

Course assessment — practical coursework

- ♦ Practical problem-solving skills based on the knowledge and understanding of mandatory Units in each Course should be assessed using coursework. It is envisaged that a coursework task will be provided by SQA in each presenting year for each level.
- ♦ At Intermediate 1, this should be an integrative practical task, drawing on the mandatory Units, counting for 40% of the Course assessment.
- ♦ At Intermediate 2 and Higher, in both Computing and Information Systems, this should be a single integrative practical task based on the mandatory Units, counting for 30% of the Course assessment.
- ♦ At Advanced Higher, in both Computing and Information Systems, the coursework mark should be determined from a report based on the project undertaken in the practical Unit (*Developing a Software Solution* or *Developing a Database Solution*), and worth 40% of the Course assessment.

Course assessment — examination

- ♦ Candidates' ability to integrate knowledge and understanding across component Units, to demonstrate long-term retention, and to demonstrate higher-order cognitive abilities, should be assessed at each level by an examination.
- ♦ The length of each examination should be appropriate to the level of the Course. The structure and length of the examinations in Computing and Information Systems at each level should be the same.

Course assessment – the balance between coursework and examination

- ♦ At Intermediate 1, the value of the practical component should be 40%, reflecting the need to develop learning in a practical context.

- ♦ At Intermediate 2 and Higher, candidates move into more theoretical and abstract concepts, with less emphasis on practical details, so 30% is a more appropriate value for the practical component.
- ♦ At Advanced Higher, candidates are required to synthesise their previous learning and apply it to a significant practical task, which justifies a higher value of 40% for the practical component at this level.

Unit assessment and coursework

Under the new proposals, the current anomaly of Unit tasks double-counting as coursework tasks, and the associated practical difficulties, should be removed. Unit and coursework assessment should be treated as separate entities.

5.3 Further recommendations

Format of Arrangements

- ♦ The layout of the Arrangements should be simplified to improve clarity and give a clearer indication of depth of treatment.
- ♦ Each Unit should have two Outcomes, one detailing the knowledge and understanding required, and one specifying the practical skills related to the Unit content.
- ♦ Content grids should be adopted to allow for updating on a regular basis (every two –three years).
- ♦ Underlying themes should be developed to bring coherence to the detailed knowledge and understanding specified in the content grids.

Assessment issues

- ♦ Objective testing for knowledge and understanding should be considered and introduced, where appropriate
- ♦ The use of online assessment should be explored, where appropriate.

Progression from Standard Grade

- ♦ The planned review of Standard Grade should take account of proposals for Intermediate Courses.

IT Core Skills

- ♦ Although under a separate review, it is envisaged that both Information Technology and Problem Solving Core Skills should be reflected in Computing and Information Systems Courses, in line with SQA policy.

Appendix 1: Agreed actions from the Subject Review Report

Computing is given as an example. The agreed actions from the Subject Review Report for Information Systems differed only in that Action 2 did not apply.

Actions for session 2001 - 2002

Retain 20-hour and 60-hour Units at Advanced Higher

In the short term, the 20-hour and 60 hour Units will be retained at Advanced Higher. However, in the long term, the revisions to the Courses must consider Course structures (at Advanced Higher in particular) within the newly developed design parameters, ie Advanced Higher should move to using 40-hour Units (see section 2.1).

Actions which will begin in 2002-2003

Reduce the volume of internal assessment at Higher

Produce new NABs (ie NAB 004) for the Higher Course, with priority being given to the mandatory Units. Each NAB will consist of only one test exercise and one practical activity per Unit. This action will be implemented for session 2002 - 2003.

Replace visiting moderation at Advanced Higher with central moderation

Replace visiting moderation with central moderation as the quality assurance mechanism for Advanced Higher Computing coursework. This action will be implemented for session 2002 - 2003.

Revision of courses in Computing

Revise the content, structure and assessment of Courses in Computing — centres have already been informed of plans for these revisions, which are scheduled to be complete for implementation in session 2003–04. In revising the Courses, the following actions will be taken:

- ◆ Produce a new assessment rationale that directs, justifies and clarifies the relationship between internal and external assessment.
- ◆ All internal assessment of Intermediate 1, Intermediate 2, Higher and Advanced Higher Computing Courses will consist of only one test exercise and one practical activity.
- ◆ Develop a viable model and practicable arrangements for assessing Intermediate 2, Higher and Advanced Higher Computing coursework. This model must clearly distinguish between the evidence requirements of internal and external assessment and must also rationalise the relationship between coursework and the examination.
- ◆ The relative weighting of coursework in the external assessment and the examination will be investigated in the light of changes to the NAB framework, and the new model of coursework assessment.
- ◆ Rationalise coursework marking schemes and remove the need for scaling. The number of alterations, changes or scaling calculations made to raw marks substantially increases the scope for error. Eliminating scaling would alleviate the problem. To be accepted by the field, marking schemes must also be rational, consistent and coherent across levels.

Appendix 2: Subject Advisory Group membership

Name	Organisation
Gordon Milne	Lochaber HS
Khalid Hussain	The Glasgow Academy
Jo Colmar	Langside College
Shiona MacDonald	LTS representative
Frank Frame	Bannerman High
Joy Thompson	Inverurie High
Walter Patterson	HMIE
Ken McLaughlin	University of Glasgow
Ken Carew	Development Officer
David Bethune	Development Officer
Derek Park	Development Officer

Appendix 3: Summary of responses to phase 2 of the consultation

Draft proposals presented in phase 2 of the consultation

The following Course models, devised by the Development Officers in response to the issues raised in phase 1 of the consultation, were presented to stakeholders at seminars in June 2002. More detailed grids showing proposed content were also presented (see www.smartgroups.com/groups/arrangements for more details).

Draft proposals for Course structure at Intermediate 2 and Higher

Computing Higher		
Computer Systems	Software Development	Further programming
		Networking
		Artificial Intelligence
		Multimedia Technology

Information Systems Higher		
Database Systems	Using Information	Multimedia Applications
		The Internet
		Expert Systems

Computing Intermediate 2		
Computer Systems	Software Development	Computer Applications
		Networking
		Artificial Intelligence
		Multimedia Technology

Information Systems Intermediate 2		
Database Systems	Using Information	Multimedia Applications
		The Internet
		Expert Systems

This Course structure:

- ◆ maintains the two existing Courses at each level
- ◆ has matching Units to allow easier progression and regression between levels
- ◆ differentiates between *Multimedia* as studied in Information Systems and Computing
- ◆ replaces the *Project* Unit in Intermediate 2 Computing
- ◆ provides a *Computer Applications* Unit in Intermediate 2 Computing
- ◆ incorporates the best of (and discards the weaknesses of) *Information Organisation*, *Computer Applications Software* and *IT in Society* into a single new Unit in Information Systems, called *Using Information*

Note:

- ◆ Including a *Computer Applications* Unit in Intermediate 2 Computing would provide a balanced Course with a similar breadth to Standard Grade for those students not intending to proceed to Higher.
- ◆ The uptake for *Further Programming* at Higher Computing is very low (less than 3% of candidates in 2002), and so there would be even less demand for a corresponding Unit at Intermediate 2.

Draft proposals for Course structure at Intermediate 1

Three alternatives for Intermediate 1 were presented at the seminars. Each has merits and drawbacks.

Version 1: separate Courses

Computing Intermediate 1		
Computer Systems	Software Development	Computer Applications
		Networking
		Artificial Intelligence
		Multimedia Technology

Information Systems Intermediate 1		
Database Systems	Using Information	Applied Multimedia
		The Internet
		Expert Systems

Advantage: clear articulation with Intermediate 2

Disadvantages: increases number of Courses; not possible to provide 40 hours teaching and learning at an appropriate level for each component Unit

Version 2: three mandatory Units

Computing Studies – Intermediate 1

Computer Software/ Software Development	Computer Applications Software	Using Information/the Internet
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Advantage: retains a single Course at this level; and allows progression to both Intermediate 2 Courses

Disadvantages: requires all Intermediate 1 candidates to study Information Systems-specific (or Computing-specific) aspects (eg Using Information or Software Development)

Version 3: two mandatory + two optional Units

Computing Studies – Intermediate 1

Computer Applications Software	Multimedia and the Internet	Introduction to Information Systems
		Computer Software/ Software Development

Advantage: retains a single Course at this level; allows fairly good progression to Intermediate 2 Courses; allowing centre to choose Information Systems or Computing optional Unit

Disadvantages: none

Draft proposals on assessment

Based on consideration of the responses to phase 1 of the consultation, the following assessment models were presented to the seminars.

Unit assessment

- ◆ knowledge and understanding test per Unit (< 1 hour)
- ◆ a practical tasks checklist

Coursework (Intermediate 2 and Higher)

- ◆ a single integrative practical task
- ◆ based on the two mandatory Units
- ◆ notional time 8 hours
- counting 30% (at both levels)
- marking scheme

Coursework (Intermediate 1)

- ◆ candidates complete two practical tasks out of a choice of three (2 x 3 hours?)
- ◆ each based on a single Unit
- ◆ counting 40%

Exam

- ◆ Intermediate 1 - no change (60 marks, 1 hour)
- ◆ Intermediate 2 - both subjects (70 marks, 1 hour 30 minutes)
- ◆ Higher - both subjects (100 marks, 2 hours 30 minutes)
- ◆ simplify H Computing exam structure

Feedback from seminars

These draft proposals were presented to over 300 delegates at seven regional seminars. Feedback from delegates at the seminars is summarised below.

Overall structure

General approval of overall structure proposed - overwhelming support for better progression from Intermediate 2 to Higher.

General acceptance of single Course at Intermediate 1.

Strong approval for tabular presentation of content — more detail required to indicate depth of treatment.

Computing Higher (content)

- ◆ Some questioning of viability of *Multimedia* in both Information Systems and Computing.
- ◆ Suggestion to move *Further Programming* to Advanced Higher.
- ◆ Minor changes suggested to *Systems and Software Development* Unit content.

Computing Intermediate 2 (content)

- ♦ Minor changes suggested in *Systems and Software Development* Unit content.
- ♦ Need for clear equivalence in depth with Credit Standard Grade.

Information Systems Higher (content)

- ♦ General approval for the concept of new combined *Using Information* Units, but it was felt that there was too much content in the proposed new Unit at Higher.
- ♦ Minor changes to *Database Systems* Unit suggested.
- ♦ Depth of treatment of *Expert Systems* to be considered.

Information Systems Intermediate 2 (content)

- ♦ Clarity of content and theme of new *Using Information* Unit required.
- ♦ Centres' access to internet to be considered.

Computing Studies Intermediate 1 (content)

- ♦ Majority accept need for a single Course at this level.
- ♦ Debate over relative merits of model 2 (three mandatory Units) or model 3 (two mandatory Units + two options).

Course assessment

- ♦ Approval of making total mark allocation for both Higher exams 100 marks.
- ♦ Approval for removing choice in Higher Computing.
- ♦ General support for retaining practical coursework (open book).
- ♦ General support for 40% at Intermediate 1, 30% at Intermediate 2 and Higher.
- ♦ General agreement that 8 hours is insufficient time for a valid coursework task (Intermediate 2, Higher).

Unit assessment

- ♦ Doubts expressed about the validity of objective testing as the sole method of testing knowledge and understanding.
- ♦ Cautious support for practical skills checklist.

Further feedback through Smartgroups (July–September 2002)

A number of stakeholders used the Arrangements Smartgroup to express views on the draft proposals. There was no disagreement expressed with the overall Course structures proposed. Constructive criticism on the detailed content of some of the Units was incorporated into the detailed proposals where appropriate. Responses to the online questionnaire (58 respondents) were broadly supportive of the proposals:

- ♦ 75% supported a common course at Intermediate 1
- ♦ 100% supported a common structure for Intermediate 2 and Higher levels
- ♦ 92% considered progression and fall-back important or very important
- ♦ 72% supported the retention of coursework
- ♦ 49% supported a reduction in the value of coursework while 45% supported no change from the present

- ◆ 79% supported 'open book' coursework
- ◆ 54% believed computer-assisted assessment to be important or very important
- ◆ 98% were satisfied or very satisfied overall with the proposed changes

Appendix 4: Existing and proposed Course structures

Summary of proposed Course hierarchy and progression routes

Computing Studies – Access 3 (cluster)

Computer Applications	Multimedia Applications	Internet Applications
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Computing Studies – Intermediate 1

		Information and the Internet
Computer Applications	Multimedia Applications	Computers and the Internet

Note: Int 1 Computing Studies is in hierarchy with both Int 2 Computing and Int 2 Info Systems)

Computing Intermediate 2		
Computer Systems	Software Development	Computer Networking
		Artificial Intelligence
		Multimedia Technology



Computing Higher		
Computer Systems	Software Development	Computer Networking
		Artificial Intelligence
		Multimedia Technology



Computing – Advanced Higher		
Software Development	Developing a Software Solution	Computer Architecture
		Artificial Intelligence
		Computer Networking

Information Systems Intermediate 2		
Database Systems	Using Information	Applied Multimedia
		The Internet
		Expert Systems



Information Systems Higher		
Relational Database Systems	Using Information	Applied Multimedia
		The Internet
		Expert Systems



Information Systems – Advanced Higher		
Relational Database Systems	Developing a Database System	Systems Analysis and Design
		Multimedia

Existing and proposed structures

Computing Studies – Access 3 cluster

Existing			Proposed		
Computer Systems	Computer Applications	Multimedia	Computer Applications <i>WP</i> <i>Spreadsheet</i> <i>Database</i>	Multimedia Applications <i>DTP</i> <i>Presentation</i> <i>Multimedia</i>	Internet Applications: <i>Internet</i> <i>IT in Society</i>

Computing Studies – Intermediate 1

Existing			Proposed		
Mandatory Units		Options			
Computer Applications Software	Computer Systems	Information Systems	Computer Applications <i>WP</i> <i>Spreadsheet</i> <i>Database</i> <i>IT in Society</i>	Multimedia Applications <i>DTP</i> <i>Presentation</i> <i>Multimedia</i> <i>Internet</i>	Information and the Internet:
		Software Development			Computers and the Internet
		Internet			

Computing Intermediate 2

Existing			Proposed		
Computer Systems	Software Development	Computing Project	Computer Systems	Software Development	Computer Networking Artificial Intelligence Multimedia Technology

Computing Higher

Existing			Proposed		
Computer Systems	Software Development	Programming	Computer Systems	Software Development	Computer Networking
		Networking			Artificial Intelligence
		Artificial Intelligence			Multimedia Technology
		Multimedia Technology			

Computing Advanced Higher

Existing			Proposed (all Units 40 hours)		
Software Development (20 hours)	Computing Project (60 hours)	Computer Systems	Software Development	Developing a Software Solution	Computer Architecture
		Artificial Intelligence			Artificial Intelligence
		Data Communications			Computer Networking

Information Systems Intermediate 2

Existing			Proposed		
Database Systems	Computer Applications Software	Multimedia	Database Systems	Using Information	Applied Multimedia
		The Internet			The Internet
		Applications of IT in Society			Expert Systems

Information Systems Higher

Existing			Proposed		
Database Systems	Information Organisation	Hypermedia	Relational Database Systems	Using Information	Applied Multimedia
		Computer Applications Software			The Internet
		Expert Systems			Expert Systems

Information Systems Advanced Higher

Existing			Proposed (all Units 40 hours)		
Database Systems (20 hours)	Information Systems Project (60 hours)	Multimedia	Relational Database Systems	Developing a Database System	System Analysis and Design
		Natural Language Processing			Multimedia
		Systems Analysis and Design			

Appendix 5: Assessment

Existing and proposed requirements for external assessment are outlined below.

Course assessment — practical coursework

Existing

Course	Marks	Weighting
Int 1 Computing Studies	100	50%
Int 2 Computing	42	40%
Int 2 Information Systems	54 (60)	40%
Higher Computing	20	30%
Higher Information Systems	60	30%
AH Computing	50	50%
AH Information Systems	50	50%

Proposed

Course	Marks	Weighting
Int 1 Computing Studies	40	40%
Int 2 Computing	30	30%
Int 2 Information Systems	30	30%
Higher Computing	60	30%
Higher Information Systems	60	30%
AH Computing	80	40%
AH Information Systems	80	40%

(no half marks)

Course assessment — examination

Existing

Course	Time	Marks	Weighting
Int 1 Computing Studies	1 hour	50	50%
Int 2 Computing	1.5 hours	60	60%
Int 2 Information Systems	1.5 hours	60	60%
Higher Computing	2.5 hours	100	70%
Higher Information Systems	2.5 hours	70	70%
AH Computing	2 hours	50	50%
AH Information Systems	2 hours	50	50%

Proposed

Course	Time	Marks	Weighting
Int 1 Computing Studies	1 hour	60	60%
Int 2 Computing	1.5 hours	70	70%
Int 2 Information Systems	1.5 hours	70	70%
Higher Computing	2.5 hours	140	70%
Higher Information Systems	2.5 hours	140	70%
AH Computing	2.5 hours	120	60%
AH Information Systems	2.5 hours	120	60%

(no half marks)

Draft assessment rationale for Computing (Higher/Intermediate 2)

Internal assessment

Internal assessment is designed to assess the Outcomes and Performance Criteria of each Unit.

Within each Unit, candidates are required to demonstrate both knowledge and understanding of Computing concepts, and related practical skills. Unit assessment reflects both of these aspects.

The assessment of knowledge and understanding will be by means of objective and short answer questions undertaken under examination conditions. The test for each Unit will take less than 45 minutes, and will employ cut-off scores.

The assessment of practical skills will be by means of a folio and observational checklist. The folio will contain evidence of the candidate's practical abilities in appropriate contexts generated during the teaching and learning of the Unit, under 'open book' conditions.

Both the knowledge and understanding and practical assessment will sample Unit content in a holistic way, thereby significantly reducing the assessment burden of the Unit.

The result of Unit assessment is recorded on a pass/fail basis and is not graded.

External assessment

The Courses are assessed externally against the Grade Descriptions, as detailed in the Course Arrangements.

The external assessment has two components:

- ◆ a written examination
- ◆ a practical coursework task

These two components reflect the combination and integration of competences required from a Computing practitioner – including knowledge and understanding, practical skills and higher-order cognitive abilities such as application, analysis, synthesis and evaluation, each cognitive ability being assessed at an appropriate level.

The purpose of the written examination is to assess the candidate's competence to integrate and retain knowledge and understanding and higher-order cognitive abilities across all component Units and in varied contexts, and to demonstrate their ability to communicate computing concepts clearly.

The practical coursework task provides candidates with an opportunity to apply and integrate the practical skills and knowledge they have developed within the component Units of the Course to solve problems in a more complex context.

The combination of written examination and practical coursework in the external assessment ensures that both of these essential aspects contribute to the candidate's overall Course grade. The written examination will contribute 70% and the practical coursework 30% of the overall grade.

Practical coursework is internally marked and subject to external moderation.

Relationship between internal and external assessment

Although mutually supportive, there is a clear distinction between internal and external assessment.

The sole purpose of internal assessment is to demonstrate the candidate's performance in each Unit separately. External assessment is holistic, integrating across Units, and forms the basis of a Course award.

Internal and external assessments seek to assess different abilities. Internal assessment assesses short-term learning and focuses on Unit Outcomes; external assessment is holistic and focuses on the integration of abilities across component Units.

Internal Unit tests focus on lower order cognitive abilities (knowledge and understanding) and ask candidates to state, identify, describe etc, whereas external Course examination questions also assess higher-order abilities by asking candidates to explain, compare, evaluate etc.

Unit practical folios demonstrate that the candidate has acquired the essential skills of the Unit; the practical coursework task requires the candidate to apply KU and practical skills obtained within more than one Unit to analyse and design a solution to a practical problem.

Estimates and appeals

Due to their nature (short-term and assessing low-level cognitive abilities), Unit assessment NABs will only provide a rough indication of candidate's likely attainment in the external components.

Centres should therefore consider other evidence as well when estimating grades and appealing against awards, eg prelims and class tests. Evidence assembled for estimates and assessment appeals must show sufficient breadth and coverage of the content of all the Units of the Course. This evidence must also fully cover the components and weightings of the external assessment, and be based on the Course Grade Descriptions.

Draft assessment rationale — Computing (Advanced Higher)

Internal assessment

Internal assessment is designed to assess the Outcomes and Performance Criteria of each Unit.

Within the Units, candidates are required to demonstrate both knowledge and understanding of Computing concepts, and the use of practical skills. Unit assessment reflects both of these aspects.

The assessment of knowledge and understanding will be by means of objective and short answer questions undertaken under examination conditions. The test for each Unit will take less than 45 minutes, and will employ cut-off scores.

The assessment of practical skills will be by means of a folio and observational checklist. The folio will contain evidence of the candidate's practical abilities in solving problems in appropriate contexts generated during the teaching and learning of the Unit, under 'open book' conditions.

Both the knowledge and understanding and practical assessment will sample Unit content in a holistic way, thereby significantly reducing the assessment burden of the Unit.

The internal assessment of the *Developing a Software Solution* Unit will be based on a folio of evidence that the candidate has chosen a software development task at an appropriate level, and has completed all the essential steps – analysis, design, implementation and testing – of the software development process. The Unit pass will be awarded on the basis of the process rather than on the quality of the final product.

The result of Unit assessment is recorded on a pass/fail basis and is not graded.

External assessment

The Course is assessed externally against the Grade Descriptions, as detailed in the Course Arrangements.

The external assessment has two components:

- ◆ a written examination
- ◆ a report based on a software development project

These two components reflect the combination and integration of competences required from a Computing practitioner – including knowledge and understanding, practical skills and higher order cognitive abilities such as application, analysis, synthesis and evaluation, each cognitive ability being assessed at an appropriate level.

The purpose of the written examination is to assess the candidate's competence to integrate and retain knowledge and understanding and higher-order cognitive abilities across all component Units and in varied contexts, and to demonstrate their ability to communicate computing concepts clearly.

The project report provides candidates with an opportunity to demonstrate their ability to apply the practical skills and knowledge they have developed within component Units of the Course, and through their own investigation in a more complex and extended context, to evaluate and to communicate clearly technical understanding.

The combination of written examination and project report in the external assessment ensures that both of these essential aspects contribute to the candidate's overall Course grade. The written examination will contribute 60% and the practical coursework 40% of the overall grade.

The project report is internally marked and subject to external moderation.

Relationship between internal and external assessment

Although mutually supportive, there is a clear distinction between internal and external assessment.

The sole purpose of internal assessment is to demonstrate the candidate's performance in each Unit separately. External assessment is holistic, integrating across Units, and forms the basis of a Course award.

Internal and external assessments seek to assess different abilities. Internal assessment assesses short-term learning and focuses on Unit Outcomes; external assessment is holistic and focuses on the integration of abilities across component Units.

Internal Unit tests focus on lower order cognitive abilities (knowledge and understanding) and ask candidates to state, identify, describe etc, whereas external Course examination questions also assess higher-order abilities by asking candidates to explain, compare, evaluate etc.

Unit practical folios demonstrate that the candidate has acquired the essential skills of the Unit; the practical project requires the candidate to apply KU and practical skills obtained within Units (and from their own investigation) to analyse, design, implement, test, document and evaluate a solution to a complex practical problem.

Estimates and appeals

Due to their nature (short-term and assessing low-level cognitive abilities), Unit assessment NABs will only provide a rough indication of candidates' likely attainment in the external components.

Centres should therefore consider other evidence as well when estimating grades and appealing against awards, eg prelims and class tests. Evidence assembled for estimates and assessment appeals must show sufficient breadth and coverage of the content of all the Units of the Course. This evidence must also fully cover the components and weightings of the external assessment, and be based on the Course Grade Descriptions.

Appendix 6 Uptake figures

Unit uptake			
		2002	2003
Computing Int 1			
D094 10	Computer Application Software	2,091	2,098
D093 10	Computer Systems	1,400	1,369
Options			
D097 10	Information Systems	534	476
D095 10	Software Development	690	658
D096 10	The Internet	1,691	1,635
Computing Int 2			
D093 11	Computer Systems	2,743	2,738
D095 11	Software Development	2,570	2,860
D098 11	Computing Project	2,369	2,326
No options available			
Computing Higher			
D093 12	Computer Systems	4,391	4,822
D095 12	Software Development	4,422	4,794
Options			
D101 12	Artificial Intelligence	1,308	1,369
D100 12	Computer Programming	121	255
D099 12	Computer Networking	1,662	1,845
D102 12	Multimedia Technology	1,401	1,530
Computing Advanced Higher			
D095 13	Software Development	477	508
D098 13	Computing Project	451	503
Options			
D101 13	Artificial Intelligence	194	219
D093 13	Computer Systems	143	209
D103 13	Data Communications	140	159
Information Systems Int 2			
D094 11	Computer Application Software	4,349	4,258
D299 11	Database Systems	4,033	4,093
Options			
D300 11	Applications of IT in Society	766	878
D301 11	Multimedia	2,563	2,292
D096 11	The Internet	2,673	2,478
Information Systems Higher			
D299 12	Database Systems	2,933	3,025
D303 12	Information Organisation	2,858	2,970
Options			
D094 12	Computer Application Software	962	994
D304 12	Expert Systems	696	677
D305 12	Hypermedia	1,224	1,439
Information Systems Advanced Higher			
D299 13	Database Systems	116	115
D306 13	Information Systems Project	112	119
Options			
D301 13	Multimedia	204	93
D307 13	Natural Language Processing	2	0
D308 13	Systems Analysis and Design	24	29