Research and Information Services

MONITORING STANDARDS REPORT

SCOTTISH QUALIFICATIONS AUTHORITY

Comparison of Computing Studies Standard Grade 2006 and 1998

Summary of findings

The 2006 syllabus is more demanding of candidates than the 1998 syllabus because of an increase in content across all three examination levels. However, contextualisation of questions, and grouping of topics within the questions, has made the examinations clearer and more accessible for candidates. The level of understanding required by candidates and the standard of sampled scripts are comparable between the two years studied.

Syllabus

There is extra content in the 2006 syllabus compared to 1998.

Question Papers

The 2006 papers are consequently more demanding in their knowledge base, which is wider than in 1998. This is posited as the reason for the lowering of grade boundary marks. There is no significant change in the structure of the examination papers at Foundation or General level, but the Credit level paper has become similar to them in structure and is now an answer booklet as well as a question paper. There is more contextualisation of questions, but some wording of questions should be made clearer. The level of understanding required is comparable across the two years investigated.

Marking Instructions

In 2006 all marks were noted on the question paper and the marks were then easier to process. This change in instruction has improved the marking process.

Candidate performance

There are no significant differences in quality and depth of understanding between the sampled scripts. However, the 2006 scripts contained more blank answers suggesting that the candidates concentrated on particular elements rather than the whole syllabus, perhaps acknowledging the increased knowledge base required across all levels. The grades awarded at all levels of performance appeared consistent.

1 Introduction

The task was to compare the 1998 and 2006 Standard Grade Computing arrangements and all three examination papers (Foundation/General/Credit). The 2006 examinations were the first papers of the new syllabus. It was difficult to compare the two sets of papers and results given the large amount of additional material studied by the candidates last year. The new syllabus is more up-to-date and the examination papers are more accessible in their language to students of lower abilities.

Some 16,508 students sat the examination in 2006 and the figure for 1998 was 18,266. In 2006 there was a 4% *increase* in students gaining a grade 1 to 4 over the 1998 results. In 2006 students performed better at Credit level by an *increase* of 6% compared with the 1998 figures. The associated increase in KU and PS for grades 1 and 2 is 5.1% and 9.1%. At Credit level the grade boundaries were *reduced* from the 1998 levels by up to 8% (KU, grade 1). The largest grade boundary *reduction* from the 1998 papers was 11% (Foundation, Grade 5, KU element).

2 Level of demand of arrangements/syllabus

2.1 Depth

The 2006 syllabus is more demanding of the candidates as so many new elements have been added. Obsolete technologies have been removed from all three levels of the Standard Grade syllabus, ensuring that the candidates are learning 21st Century systems and technologies. Appendix A lists the detailed comparison of the old and new syllabuses and demonstrates the large increase in breadth across the new syllabus, which mainly affects the Foundation candidates.

The arrangements have been altered between 1998 and 2006, with computer applications increasing from 60 hours to 70 hours, and programming and project work both losing five hours of allocation. The content of the syllabus is an issue because of the large increase in elements to be covered with no associated increase in examination time (or teaching time). Further, the teachers have less time to cover each of the added elements within the allotted teaching time. A consequence of this is the lower mark attainment in the examinations and hence the lowering of the grade boundaries.

2.2 Breadth

All levels have new breadth of knowledge added to the syllabus, but it is the Foundation students who have now more KU elements than in the 1998 syllabus. The Foundation/General pupils have a larger amount of new content to learn than the General/Credit. The main increase in the depth of knowledge and detail therefore appears in Foundation level. There is no significant difference in the integration of skills and content required across all three levels.

3 Level of demand of examination questions

The general approach to examination has not changed in the Foundation and General papers, but the Credit paper is now stylistically similar to the other papers in that it is used as an answer booklet as well. In the style or demand in the examinations there are no more marks available, and the depth of answer or knowledge required has not changed. However, because of the large increase in additional elements, the sampling of questions is wider.

The structure of the total assessment task is slightly different. The 1998 papers were 50% general purpose packages, 25% systems, and 25% industrial commercial applications for both KU and PS. In 2006 the percentage breakdowns for both elements were 55%, 25% and 20%. The KU elements were increased for general purpose packages and decreased in computer systems. This is setter-dependent, and may vary over the coming years.

The Credit paper was more contextualised than in the past, in line with current trends. The number of lines allocated to the answers may be a problem, as students may believe they have to fill all lines even if it is for a one or two mark question. There is also a perceived problem in questions such as 'What is meant by RTF?' rather than 'What do the letters RTF stand for?' There may also be issues in 'filling in the blank' type questions if the students do not write the correct or required word but write something similar.

It was noted that some of the General level content was pushed up into the Credit paper, and Foundation content was pushed into the General paper. Some 6% of the new content was at the Credit level, but the General paper had around 10% of new content over the 1998 syllabus. The 1998 papers therefore had a smaller amount of content, and yet the grade distribution was not as wide as in 2006.

The level of demand of the questions is considered to be the same but there is less coverage of the syllabus in the exam, presumably because there is more content to sample. If the demand were to be the same as in 1998, there would have to be roughly a 15% increase in the sampling ratio. It is therefore assumed that the probability of a candidate revising or remembering the correct content is considerably lower than before, so the grade boundaries are reduced to compensate. The candidate group which is most affected by this is the Foundation students, the weakest students. The grade boundary for a grade 5 in KU has dropped from 70% to 59% over the years reviewed, and it is posited that this is because of the greater breadth of question material, resulting in students attaining lower marks.

There is less expectation in 2006 of Foundation candidates under examination conditions in terms of what they have to answer for each individual question. There are more 'fill in a sequence or blank' type questions. The 1998 paper required more language and reading skills in

reading paragraphs of text prior to the actual question. The 2006 papers are more accessible to students of all reading abilities. The lowering of the boundary from 70% to 59% to attain a Grade 5 is perhaps explained by the question sampling problem mentioned above.

In the General papers the content appears the same, with the exception of students being required to know two functions in the spreadsheet questions. The 1998 paper is harder as more writing is required and there are no options to 'fill in the blanks'. There is more integration of questions in 2006, albeit resulting in 1/6 of the paper being on automated systems. It was more difficult for students to gain a 3 or 4 in 1998.

There was more reading and linguistic skills required of the Credit candidates in the 1998 paper. Candidate 5 of 2006 didn't answer any new topic questions but still attained a 2. The addition of new material has therefore not stopped candidates achieving a Credit award, and Candidate 5 demonstrates that candidates had to know both old and new material to have achieved a Grade 1 in 2006.

The weakness of the new syllabus and examination instrument is therefore perceived to be the amount of new material added, primarily at the Foundation level. Although the new material is required to achieve understanding of modern technological topics in an ever-changing field, the concern is that the weakest students are being disadvantaged in having to undertake a large amount of new material. However, the lowering of the grade boundaries has compensated for this extra load, and students are now achieving higher grades overall.

4 Level of demand of examination marking

The allocation of marks is more clearly set out in 2006; there is far less instruction, but more examples for the markers to follow. In 1998 there were procedural issues with marking the Credit paper and then transferring the results to a grid. In 2006 all marks were noted on the question paper and the marks were then easier to process. This change in instruction has greatly reduced the need for professional judgement when marking the examination papers.

5 Grading of candidates' performance

There is a 3.42% increase in the proportion of students gaining a grade 1 in 2006 compared to 1998. For grade 2, the increase is 3.04%. Interestingly the biggest increases come from KU for a grade 1 (6.3%) and in PS for a grade 2 (6.7%). The grade boundary for KU at grade 2 was the only one to increase between 1998 and 2006. The 2006 candidates were able to answer all questions in the examination paper, perhaps because the paper was more contextualised and the language more accessible.

There were fewer written requirements in 2006 for all the grade levels. However, it is considered that the quality and depth of understanding in the samples of answers given appears comparable between the years and between the two upper grades.

Only the KU grade boundary was lower in 2006 for the General level papers. Fewer students achieved a grade 3 (1.7%) and a grade 4 (0.22%) in 2006. The biggest difference was in PS for a grade 4, where 3.9% fewer students achieved the required grade in 2006. Therefore fewer candidates achieved a General in 2006 in comparison to 1998. The 2006 candidates attempted less of the question paper than the 1998 candidates, leaving sections or questions blank. However, the level of understanding and depth of knowledge and language demonstrated by the sampled candidates appears comparable.

In 2006, 2.9% fewer candidates achieved a Foundation level grade in comparison to 1998.The largest decrease in achievement was at grade 5 where there was a drop of 3.18% in the KU and 2.65% in the PS boundary. This is interesting, given the previous statements about accessibility, and may be answered, in part, by the greater breadth of content available for inclusion in question papers. The 2006 candidates missed out many questions or parts of questions, more so than the 1998 candidates. This reinforces the notion of the greater content available for question setting and candidates choosing to concentrate on parts of the syllabus. As regards level and quality of understanding, there were no major differences and the candidates appeared comparable.

Appendix A: Content of Standard Grade Computing

N.B. **Emboldened** text demonstrates material that has been added in the 2006 syllabus. *Italic* text demonstrates material that has been removed completely or moved into another level.

GENERAL PURPOSE PACKAGES - DETAILED CONTENT			
MAIN ASPECT	F/G/C	G/C	C
NEED	storage, retrieval and communication of large quantities of information.	accurate, complete and up-to-date information.	flow of information between and within organisations.
Hardware & Software	*App packages; integrated package basic HW for general*	*Printer quality*	*Knowledge systems*
STORAGE	need for backup. *Manual, electronic types of data-numbers, text, graphics*		**Advantages of standard file formats (text, ASCII, RTF)**
HUMAN COMPUTER INTERFACE (HCI)	user friendliness; WIMP environment - Windows, Icons, Menu, Pointer. *menu driven* **template;** **wizard;**	on-line help, on-line tutorial; Graphical User Interface; **toolbar**. *command driven*	**keyboard shortcuts.** **Customising HCI**
SOFTWARE INTEGRATION	**integrated package;** links between tasks; common HCI	ease of transfer of data.	static/dynamic data linkage **integration between separate packages in a software suite**
SELECTION OF PACKAGES	main purpose of each package (eg word processing for production of text).	potential of packages to fulfil more than one function (eg drawing graphs using spreadsheets).	selection of most appropriate package or packages on the basis of hardware and software availability and the nature of the task.
DATA TYPES	**text;** **number;** **graphic.**	**audio;** **photographic.**	**animation;** **video.**
IMPLICATIONS - ***SOCIAL*** - ***SECURITY*** AND PRIVACY - ECONOMIC	job types and careers; retraining; mail shots right of access to personal data; need to check accuracy; precautions against data loss. initial costs.	effects on employment and working conditions; increased paper. exceptions to right of access; control of access (eg passwords); unauthorised access to data (eg hacking). replacement costs; running costs.	**Data Protection Act** data subject, data controller, data user Computer Misuse Act; **Copyright, Designs and Patents Act.** staff costs.
ADVANTAGES	speed and accuracy of processing; ease of amendment.	increased productivity layout flexibility.	availability of information.
COMMON FEATURES OF MOST GENERAL PURPOSE PACKAGES	run/open application; new; open/load file; package; save file; print file; insert/amend/delete; change text appearance. **copy/move,header, footer.**	print part of file/document;	*header, footer.*

GENERAL PURPOSE PACKAGES - DETAILED CONTENT (continued)			
MAIN ASPECT	F/G/C	G/C	C
WORD PROCESSING	enter text; word-wrap; **alter text alignment;** **alter text style.** **alter page size & layout** **set margins** *alter line length, centre text*	standard paragraph; search and replace; spelling check; **grammar check** tabulation; **table** **page breaks** *alter page length, justify text*	standard letter and **mail merge;** **create template;** **edit scanned text from OCR.**
SPREADSHEET	rows/columns/cells; values; text; simple formulae (eg. +-*/); function SUM(..); calculation - automatic and manual; **alter column width;** **insert row;** **insert column;** **simple** charting.	*insert row;* *insert column;* complex formulae; **functions AVERAGE(..), MINIMUM(..), MAXIMUM(..);** replicate; alter cell format and attributes (eg number of decimal places). **cell protection;** *alter column width*	formulae involving conditions (IF(..)); relative reference; absolute reference; **fully labelled charting.** *cell protection*
DATABASE	**Create record;** add record; **edit record;** create fields; search/**query/find** on one field; sort on one field; **simple search for information on CD-ROM.**	alter record format; **field types (numeric, text, graphic, date, time)** search on more than one field; **sort on more than one field.** **complex search for information on CD-ROM**	computed field; alter screen input format; alter output format; use of keywords; *sort on more than one field.*
GRAPHICS	draw graphic; enter text; common tools.	alter tool attributes (eg line width); scale graphic; rotate graphic.	**scan and edit graphic;** **crop graphic.**
DESK TOP PUBLISHING	**use wizard or template;** **enter text;** **add clip art.**	**import graphic;** **scale graphic.**	**change layout;** **import text;** **text wrap around graphic.**
PRESENTATION AND MULTIMEDIA	**use wizard or template;** **enter text;** **add graphic.** **linear linkage of slides or screens.** **Assemble elements of presentation including text & graphics**	**add audio;** **add video.**	**capture audio;** **capture image;** **hyperlinks**
WEB PAGE CREATION	**use wizard or template;** **enter text; add graphic;**	**add audio; add video;**	**add table; add hotspots.** **hyperlinks.**
EXPERT SYSTEMS		**Purpose of Expert Systems** **Applications of Expert Systems**	**Advantages of Expert Systems** **Social, legal and ethical issues**

COMMUNICATIONS and NETWORKS - DETAILED CONTENT			
MAIN ASPECT	F/G/C	G/C	C
ELECTRONIC COMMUNICATION	**electronic communication; electronic mail; text messaging. LAN, WAN**	**advantages and disadvantages of electronic mail. Netiquette**	**File Transfer**
LOCAL AREA NETWORKS	**sharing data and peripherals; local area network;**	**benefits of networks (backup); transmission media LAN - cables, wireless WAN - telecommunications links security (passwords, encryption, physical)**	**Multi-access; Network interface card client and server network;**
INTERNET	**information available, services, browser; Internet ready computer; on-line, off-line. Modem**	**World Wide Web; web page, hyperlink; HTML search engine with simple search. dial-up connection, broadband connection**	**Internet Service Provider; search engine with complex search; download software - freeware, shareware, commercial; mobile Internet technologies; video conferencing.**

COMMERCIAL DATA PROCESSING - DETAILED CONTENT			
MAIN ASPECT	F/G/C	G/C	C
NEED	volume of documents; speed of processing; speed of access; repetitive tasks.		management information.
DATA PROCESSING CYCLE	data collection; data preparation, input, processing and storage; output.	difference between data and information.	
DATA COLLECTION, PREPARATION AND INPUT	bar codes; **mark sense cards;** magnetic stripes. *Kimball tags, character recognition*	magnetic ink character recognition (MICR); check digit; types of check (eg length, range). *Key to disc, direct data entry, turnaround document*	**smart cards.** Mark sense cards optical character recognition (OCR); validation; verification.
PROCESSING AND STORAGE	data, field, record, file; update; backup.	interactive processing. *Batch processing, master file, transaction file*	sequential access; random/direct access; **multi-user databases.** **File ancestry**
OUTPUT	paper, screen, *pre-printed stationery*	*microfiche*	file.
HARDWARE AND SOFTWARE	basic hardware: - mainframe computer system - terminals.		*Remote terminals*
IMPLICATIONS - ***SOCIAL*** - TECHNICAL - ECONOMIC - ***SECURITY*** AND PRIVACY	effects on business. **e-commerce;** **on-line banking;** **on-line shopping;** initial costs; mass market. accuracy of information; privacy.	job types and careers - programmer - systems analyst - engineer - **network manager** *data preparation operator.* *Computer operator* electronic funds transfer (EFT); point of sale (POS); running costs. physical and software security; sale of customer lists.	computer crime, fraud. **Data Protection Act;** **Computer Misuse Act;** **Copyright, Designs and Patents Act.**
ADVANTAGES	comparison with manual system.	maintaining contact with and information about a large number of customers.	single entry multiple use.

INDUSTRIAL APPLICATIONS - DETAILED CONTENT			
MAIN ASPECT	F/G/C	G/C	C
NEED	speed; hazardous environment; repetitive tasks.	efficiency; accuracy.	adaptability.
HARDWARE AND SOFTWARE	sensors; feedback; robots: - anatomy - motor - programmable - stationary/mobile; - **tools** CAD/CAM; *Simulation, CNC*	analogue I/O; **interface** guides - magnetic and light; *open & closed loops* high level instructions; **simulation;** **virtual reality** real-time processing.	A to D and D to A converters; *End effector, degrees of freedom, digitiser* control language; ROM software; **embedded systems** **Intelligent robots**
IMPLICATIONS - ***SOCIAL*** - TECHNICAL - ECONOMIC	retraining.	employment - changes in nature of job; - increased leisure time. industrial automation; safety precautions. high initial cost; long term savings; replacement costs	design of workplace; modern factory; need for systems analysis. *Capital, labour intensive; effects on productivity*

COMPUTER SYSTEMS - DETAILED CONTENT			
MAIN ASPECT	F/G/C	G/C	C
SYSTEMS SOFTWARE	*purpose of high level languages; need for translation.*	common features of high level languages **purpose of high level languages;** **need for translation.**	*Special purpose languages* types of translator: - compiler - interpreter *assembler* portability of software.
OPERATING SYSTEMS	operating system as a program; directory/**folder**	*Standard functions of O.S.* batch system; interactive system; real-time systems; types of file: data program.	**O.S. provides a HCI for the user.** interactive systems with background job capability; hierarchical filing system; sequential and random/direct access to data. *Specialise functions of operating systems; multi-programming; multi-access; resource allocation.* *Flat filing system.*
LOW LEVEL MACHINE	stored program; bit, byte, kilobyte (Kb), megabyte (Mb**), gigabyte (Gb), terabyte (Tb)** main memory size; Input, Process, Output (IPO); **Processor; main memory**	concept of machine code; representation of positive whole number, text, b/w bit-mapped graphics;	binary representation of non-negative integers; floating point representation of large numbers. **Calculation of storage requirement of b/w bit-map** **Processor structure:** control unit; Arithmetic/Logic Unit (ALU); **Registers**. **Word; concept of addressability**
HARDWARE	microprocessor; chip; main memory; ROM and RAM; backing store; **mainframe, desktop, laptop / notebook, palmtop** **current input devices;** **current output devices;** **current backing storage devices.**	storage location. **Pocket PC, tablet PC** **current input devices;** **current output devices;** **current backing storage devices.**	capacity of backing store; sequential and random/direct access devices. Effects of changes in technology **current input devices;** **current output devices;** **current backing storage devices.**

COMPUTER SYSTEMS - DETAILED CONTENT OF CURRENT DEVICES			
MAIN ASPECT	F/G/C	G/C	C
input devices (Computer Systems)	mouse; trackball, trackpad; **touchpad**; graphics tablet; touch sensitive screen; keyboard; **joystick.** **Light pen**	scanner; **digital camera;** **digital video camera;** **webcam;** **microphone.** *voice recognition;* *handwriting recognition*	specialised input devices for: - disabled users - virtual reality; use of a variety of input devices for multimedia. **voice recognition;** **handwriting recognition;** **sound card.**
output devices (Computer Systems)	printer: - laser - inkjet; plotter; monitor. (VDU) **Dot matrix**	**Comparison of Printer in terms of:** **Speed(ppm)** **Cost** **Running costs** **Resolution(dpi)** Liquid Crystal Display (LCD/**TFT**); **Loudspeakers;** Voice output.	specialised output devices for: - disabled users - virtual reality; use of variety of output devices for multimedia; **sound card;** **graphics card.**
backing store (Computer Systems)	magnetic tape; floppy disc; hard disc; CD-ROM; **DVD-ROM**	**Comparison of Backing Store in terms of:** **Speed (data transfer)** **Cost** **Capacity** **CD-R** **CD-R/W** **DVD-R/W** **USB Flash Drive**	**backing storage requirements for different applications.**

GENERAL PROGRAMMING SPECIFICATION			
MAIN ASPECT	F/G/C	G/C	C
REPRESENTATION OF SOLUTION TO PROBLEM	*one simple representation (eg structure chart).*	**one simple representation (eg structure chart).**	use a variety of representations (eg pseudocode, structure chart).
SOFTWARE DEVELOPMENT PROCESS			**Analysis, design, implementation, testing, documentation, evaluation, maintenance**
PROGRAM ENTRY	**enter;** **edit;** **list/print out current version.**		
SEQUENCE	significance (if any) of the order of program instructions.		
MODULARITY	sensible arrangement of blocks of code.		Pre-defined functions
DATA TYPES	**to handle numbers, text**		**one-dimensional arrays.**
DATA INPUT AND OUTPUT	single item.	multiple items.	
STATEMENTS	assignment of constants; assignment of expressions.	assignment of incremental expressions.	
EXPRESSIONS	simple, commonly used keywords and operators (eg arithmetic operators).	comparison operators.	logical operators.
REPETITION	fixed loop.	control variable used in loop. *nested loops*	**nested loops;** conditional loops.
SELECTION		simple condition.	complex condition.
IDENTIFY AND RECTIFY ERRORS	syntax, system and logical errors.		
TESTING	**use supplied test data.**	**use own test data.**	**supply full set of test data. (normal, extreme, exceptional)**
READABILITY	use meaningful variable names; provide internal commentary.		
USER INTERFACE	screen layout.	prompts to user.	input validation.
DOCUMENTATION	**user documentation.**		**technical documentation.**

EXEMPLAR PROGRAMMING SPECIFICATION - COMAL			
MAIN ASPECT	F/G/C	G/C	C
REPRESENTATION OF SOLUTION TO PROBLEM	**one simple representation (eg structure chart).**		**use a variety of representations (eg pseudocode, structure charts).**
SOFTWARE DEVELOPMENT PROCESS			**Analysis, design, implementation, testing, documentation, evaluation, maintenance**
PROGRAM ENTRY	**enter; edit; list/print out program.**		
SEQUENCE	**simple instructions.**		
MODULARITY	**sensible arrangement of blocks of code**		**Pre-defined functions (RND, INT, …)**
DATA TYPES	**Numeric; string.**		**integer; real; reserve space (DIM); one-dimensional arrays.**
DATA INPUT AND OUTPUT	**keyboard input of numeric and text data (INPUT); output of numbers and text (PRINT).**	**formatting of output (, ; TAB).**	**Pre-supplied data (READ … DATA);**
STATEMENTS	**assignment of constants (eg boxes := 6); assignment of expressions (eg total := price + vat).**	**assignment of increments (eg counter := counter + 1).**	
EXPRESSIONS	**simple, common keywords and arithmetic operators.**	**comparison operators (<, >, =)**	**logical operators (AND, OR, NOT).**
REPETITION	**fixed loop (FOR … ENDFOR).**	**control variable used in loop.**	**nested loops; conditional loop (WHILE … ENDWHILE, REPEAT … UNTIL).**
SELECTION		**simple selection (IF … THEN … ENDIF).**	**two-way selection (IF … THEN … ELSE … ENDIF);**
IDENTIFY AND RECTIFY ERRORS	**syntax, execution and logical errors.**		
TESTING	**use supplied test data.**	**use own test data.**	**supply full set of test data. (normal, extreme, exceptional)**
READABILITY	**use meaningful variable names; include comments.**		
USER INTERFACE	**screen layout;**	**prompts to user.**	**input validation.**
DOCUMENTATION	**user documentation.**		**technical documentation.**

EXEMPLAR PROGRAMMING SPECIFICATION - VISUAL BASIC			
MAIN ASPECT	F/G/C	G/C	C
REPRESENTATION OF SOLUTION TO PROBLEM	**labelled diagram of HCI specifying objects.**	**identification of variables and their types.**	**pseudocode for subprograms.**
SOFTWARE DEVELOPMENT PROCESS			**Analysis, design, implementation, testing, documentation, evaluation, maintenance**
PROGRAM ENTRY	**enter; edit; list / print code.**		
MODULARITY	**subprograms linked to command events.**		**common pre-defined functions;**
DATA TYPES	**integer; single, string.**		**one dimensional arrays.**
DATA INPUT AND OUTPUT	**command button; text box; label.**	**input box; option button; message box.**	**list box; combo box: check box.**
STATEMENTS	**assignment of constants (eg boxes := 6); assignment of expressions (eg total := price + vat).**	**assignment of increments (eg counter := counter + 1).**	
EXPRESSIONS	**simple, common keywords and arithmetic operators.**	**comparison operators.**	**logical operators (And, Or, Not).**
REPETITION	**fixed loop (For … Next).**	**control variable used in loop.**	**nested loops; conditional loop (Do … Loop While …, Do … Loop Until …).**
SELECTION		**simple selection (If … Then … End If)**	**two-way selection (If … Then … Else … End If);**
IDENTIFY AND RECTIFY ERRORS	**syntax, execution and logic errors.**		
TESTING	**use supplied test data.**	**use own test data.**	**supply full set of test data. (normal, extreme, exceptional)**
READABILITY	**use standard notation for objects (eg txtName); use meaningful object variable names; include comments.**		
USER INTERFACE	**design HCI; create / edit / position objects; set initial object properties.**	**prompts to user.**	**input validation.**
DOCUMENTATION	**user documentation.**		**technical documentation.**