1996 HIGHER SCHOOL CERTIFICATE EXAMINATION

COMPUTING STUDIES

Introduction

In this, the second year of examination of the new Computing Studies Syllabuses, there has been a continued level of interest in the subject with an increase of 758 students from 10987 in 1995 to 11745 this year. This increase has been in the 2 Unit (General) and 3 Unit (Additional) courses, accompanied by a transfer of 200 candidates from the 2/3 Unit (Common) Course to the 2 Unit (General) Course.

Candidates	1995	1996	Difference	Percentage
General	3062	3681	619	20%
Common	7925	8064	139	1.8%
2/3 Unit	6845	6636	-209	-3%
3 Unit	1080	1428	348	32%
Total	**10987**	**11745**	**758**	**6.9%**
Additional	1080	1428	348	32%

Table 1

The quality of answers was generally below that observed in 1995. This might be due in part to the wording of some questions where the better students might have tried to read more into the question than was warranted.

How is the paper marked?

The Supervisor of Marking (SoM), appointed by the Board on the advice of the Examination Committee, chooses a sufficient number of qualified markers from the pool of applicants to ensure that all papers can be marked within the time-span allocated by the Board. Each marker is (usually) appointed to mark one question.

Markers operate in teams of six, with a Senior Marker in charge of each team. The number of teams allocated to each question is sufficient to ensure that the estimated total number of answers to that question can be marked in the time allowed.

The Senior Markers attend briefing sessions at the marking centre prior to the commencement of the actual marking program. During this time they finalise administrative structures and prepare a first draft of the marking scheme for their specific question. Once they have decided what they expect from the students, they read a large number of scripts to see what the candidates are actually providing in answer to their specific question. If a number of teams are marking a particular question then all of the Senior Markers for that question discuss the possibilities and prepare one draft marking scheme.

Once the draft schemes have been prepared, the markers themselves attend the marking venue, are briefed on the procedures and introduced to the marking scheme. As a group, all markers and Senior Markers involved with each question debate the marking scheme, suggest modifications and develop a trial scheme.

Bundles of questions are then pilot-marked, the scheme being applied to a number of papers and marks awarded to the answers. Nothing whatsoever is written on the scripts nor on final marking documentation.

The purpose of this operation is three-fold:

(1) to see whether there are other variations to the proposed answers which should be accepted;

(2) to see whether the proposed marking scheme discriminates between students and ranks them according to their ability; and

(3) to see whether the scheme can be applied consistently by all markers.

In the case of (1), groups of markers discuss alternative answers as they are found, allocate appropriate marks to them and build them into the marking scheme.

In the case of (2), to determine whether or not the scheme discriminates adequately, pilot-marking statistics are collected to produce a frequency distribution of marks awarded by each individual marker, by the marker's group and by all groups marking the question. This is done over a number of marking sessions, producing statistics for the current session and for an accumulation of all sessions to date.

If the mean is not close to 50% of the available marks for the question or the standard deviation is not around 1/5 of the range, or the markers detect an unacceptable pattern of marks being awarded (eg one part of a question consistently scoring the same mark with no spread), then the marking scheme is readjusted.

Once the pilot-marking is completed, the scripts used for piloting are retained in a secure place and released into the marking process at a later date so that they can be marked afresh, using the final, accepted marking scheme, with little chance that a marker will remember what mark was awarded during piloting.

To monitor consistency, Senior Markers arrange for a number of scripts to be marked by the whole group individually and then compare the scores awarded. The group discusses any discrepancies and the scheme is refined or expanded so that the interpretation is common to all. This procedure is continued during the actual marking operation as part of the quality control operation.

Once there is agreement that the scheme is fair, that it discriminates appropriately, and that it can be consistently applied, the marking scheme is checked by the SoM to ensure that it meets the requirements set by the Examination Committee and it is signed off as the official scheme to be used in the marking operation.

The SoM and Chair of the Examination Committee have an opportunity to read the complete scripts for the *top, bottom* and some *average* students in order to determine what scaled mark is to be awarded to the top candidate. If the candidate's paper indicates that the marks lost did not really indicate a lack of understanding of the topic, it is likely that the top raw mark will be moved to 100.

The statistics for these *raw* and *final* examination marks are provided in the Board's General Report on each year's HSC Examination.

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2 UNIT (GENERAL)

3681 candidates (31% of the total candidature) presented for this paper which consisted of:

Section I - 20 multiple choice questions

Section II - 5 questions, each on one of the 5 topics.

Section I

The average mark on the multiple choice questions was 10.99, with a standard deviation of 3.738.

Given that any question which less than 30% of the candidates answer correctly is considered *hard* and any question which more than 70% answer correctly is *easy*, this paper had 3 *hard* questions (3, 8 and 19) and 4 *easy* ones (13. 14, 16 and 18).

The item analysis for Section I follows.

A very small percentage of candidates (not shown in Table 2) failed to mark a selection or marked multiple choices.

Item	Choice A		Choice B		Choice C		Choice D	
	%	**mean**	**%**	**mean**	**%**	**mean**	**%**	**mean**
1	21	9.1	17	8.8	**51***	**12.8**	12	9.7
2	13	8.8	16	9.8	49*	**12.4**	21	10.1
3	34	10.4	28	9.8	10	8.5	**28***	**13.8**
4	3	8.0	**52***	**12.3**	23	9.7	22	9.5
5	3	8.2	17	9.2	16	9.0	**65***	**12.0**
6	**36***	**13.0**	15	9.5	25	9.3	24	10.6
7	9	10.6	22	10.9	**42***	11.5	28	10.3
8	15	10.1	**19***	**13.5**	23	10.1	43	10.6
9	4	8.6	**58***	**12.6**	19	8.4	19	9.2
10	31	9.9	5	8.6	**43***	**12.7**	20	9.5

Item	Choice A		Choice B		Choice C		Choice D	
	%	mean	%	mean	%	mean	%	mean
11	**58***	**12.6**	22	8.9	5	8.3	14	8.9
12	**72***	**11.9**	16	7.7	1	7.9	11	10.1
13	10	7.6	4	8.8	12	7.7	**74***	**12.1**
14	5	6.5	**89***	**11.6**	3	6.8	3	6.1
15	8	8.2	5	7.5	17	9.8	**70***	**11.9**
16	14	8.3	7	7.3	5	8.3	**74***	12.0
17	2	6.1	**58***	**12.5**	36	9.2	5	7.7
18	5	9.1	**71***	**12.1**	16	7.9	9	8.3
19	**25***	**12.4**	33	10.4	19	10.9	23	10.3
20	**66***	**12.1**	13	9.5	7	7.5	15	8.8

Table 2

Note: Mean is the average mark on Section I of the students who selected that choice.

Bold figures marked with * indicate the correct choice.

The mean mark for those students who selected the correct answer was higher than the mean for any of the other choices IN ALL CASES.

Question 7 seems to indicate a random choice by the students and needs to be reworked.

Section II

Question 21 : Spreadsheets

(a) In this part most students were able to give a definition of the five concepts. To gain full marks, however, they had to go further and show that they knew how it related to spreadsheets as stipulated in the question. Rote learning of definitions is insufficient to gain all of the available marks in any question.

There were some common errors in which students confused:

- the *cell pointer* with the on-screen *mouse pointer*;
- the selection statement *IF* with the *what-if prediction*;
- the term *template* with *model*;
- *dynamic link* with concepts from communication networks, and
- *file conversion* with the concept of *data compression*.

(b) In this part most students successfully answered (i) and (iii). The concept of *circular reference* asked for in (ii), in which the calculated value in one cell is dependent upon the value in another, was frequently expressed as a *self-reference,* i.e. the value to be calculated in the cell depended upon itself. Whilst this may often give a similar error message, students are expected to differentiate clearly between the two.

In part (iv) the answer had to refer to any of the common functions which are specific to Spreadsheets such as SUM or COUNT. Those who used mathematical functions such as SIN, COS or TAN which are not specific to Spreadsheets scored fewer marks. Those who simply picked any action from a menu bar, such as NEW, SAVE or BOLD, scored nothing.

(c) The common errors which were made here were:

- entering data values where a formula had been requested;
- using the wrong column;
- omitting the '=' before the formula;
- confusing relative and absolute addresses; and
- not knowing the correct formula to use.

In this part-question, well prepared students who had had experience in constructing spreadsheets and in working with them scored much better than those who were only familiar with the terminology and had been *watchers* rather than *doers*. This same comment was made in last year's Examination Report. Students must make every effort to gain practice in building their own spreadsheets and manipulating the data to achieve some pre-set purpose. The Syllabus stresses that there is a need for practical, hands-on work in all sections of the course.

Question 22 : Databases

The question used a common context, the town library, to assess understanding and this meant that most students who attempted the question and referred often to the information given were able to score marks. Those who scored best seemed to have had experience with constructing, and then using, their own databases.

(a) (i) Here students who read and used the information in the question were able

to to score well. Too many, though, did not understand the term *integer* in part

(v) (i), *logical value* in part (iii) nor *single character code* in part (iv).

Poor answers to part (a) (vi) showed a lack of practical experience in developing and refining databases and hence students were unable to break

down a field logically into its smaller component fields. A large number of students missed the obvious answer *home address*. If another field were nominated, it was quite unusual for the candidate to give a correct breakdown of it into smaller fields, instead, he/she tended to list related fields.

(b) (i) In this part few students understood search specifications thoroughly but many were able to convey the idea that they could carry out a search to find the required information. There was a general poor use of logical operators AND and OR which would indicate that more attention needs to be given to the construction of search specifications.

(ii) Here poor answers referred to generalities and relied too heavily on their knowledge from Desk Top Publishing, whereas the better answers appeared to reflect practice in generating reports and experience with a wide range of database terms.

(iii) The answer to this part was either right or wrong. Those who provided a wrong answer demonstrated an unfamiliarity with multiple sorts and/or a lack of knowledge of ascending/descending order as applied to numeric and alphanumeric data.

(c) (i) Many students failed to grasp the intent or misunderstood this part. The question related to the data within the database and its preparation for transfer to the spreadsheet. Some students failed to realise that a search of the database was required in order to isolate the records in which

BORROWER_TYPE = CHILD,

and that further searches needed to be made to find those records which met each of the three criteria supplied. Poor answers talked primarily about creating the chart in the spreadsheet.

(ii) The good answers here showed knowledge of and experience with data integration. The Syllabus states that students must use a range of methods and know the advantages/disadvantages of each. Poor answers relied heavily on *copy and paste* or *clipboard* as a method. Generally, students were able to name a method of data transfer but were unable to suggest adequate reasons for their choices under the circumstances given. The wording of the question was intended to **eliminate** *cut-and-paste* and *the use of the clipboard* as an answer and to elicit **two different answers**, one for each part. This would have resulted, however, in a part question which did not discriminate very well between candidates. Normally marks would not be awarded for the same answer to two parts of the same question.

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Question 23 : Graphics

(a) (i) In this part many candidates did not realise that *vector-based* and *bit-mapped* were the storage formats required. Some marks were awarded for the terms *paint* and *draw*.

(ii) Here it was again apparent that many students can recall material of which they lack any understanding. A number of students were able to give *memory* as a factor but were unaware of the relationship between number of colours, number of pixels on the screen and the size of the memory allocated to the frame buffer. A similar situation arose in (iv) where students were unable to write down the two differences in a manner which clearly distinguished between them.

(iii) Few candidates scored full marks in this part, with far too many simply describing the physical process of placing the original on the scanner, pressing a button and watching the resultant image appear on the screen. Students are expected to understand the general scientific principles by which the equipment they use carries out its task.

(b) (i) and (ii) Many candidates were confused in differentiating between *path-based* and *cel-based* animation. Here some thought that a limitation of path-based animation was the difficulty of following the path ! Most noted the changing graphic in (ii) but still did not identify it as being cel-based.

There was a general lack of knowledge that 6 frames/second is too slow to show a smooth animation, and many were unable to suggest ways of improving it. Some suggested that adding extra frames would be a solution, without mentioning that they should be intermediate to the existing ones and should show a more gradual change in the dancer's position. Some thought the animation would flicker because of *interlacing*, while others recommended that the frame-speed should be slowed down since the dancer's position changed too drastically between frames.

(c) (i) Students and teachers need to be aware that the Syllabus requires social issues and social implications to be incorporated into each topic and hence may be examined in any or all of the questions in the paper. In this part most candidates were able to identify at least one issue but, again, few were able to **discuss** the issues as asked in the question. A common response was *a person's privacy may be invaded* without any explanation or tailoring of this generally true statement to graphics in general, or the question in particular. Often students rewrote the same issue in three different ways. This does not attract full marks. Far too many students made no attempt to answer the question asked but, instead, described *how* the graphics could be edited.

(ii) Here most candidates scored the available marks, although it was apparent that there are many students who do not know the correct terminology for basic transformations.

Question 24 : Desktop Publishing

In a general sense this question was well answered by the bulk of the candidates. As has been said previously, students must know the correct definition of terms, apply them correctly and be able to relate them to specific situations.

(a) (i) and (ii) Most students scored full marks for this part. Too many explained *bolding* in terms of a **size** change rather than an increase in the stroke weight. In (ii), in order to gain full marks, the answer should have described *kerning* as *adjusting the space between certain pairs of characters* rather than just *adjusting space within words*..

(iii) There may now be software packages in common use which use the terms *tall* and *wide* rather than *portrait* and *landscape.* Candidates should still be familiar with terms which are in the Glossary as asked for here.

(iv) and (v) Few students seemed to be aware of the term *footer* and hence were unable to explain the difference. Students should be given the opportunity in their practical work to use all of the features that they have studied. Similarly (v) was poorly answered, with too many students failing to recognise that the term *template* applies outside of Spreadsheets and refers to the setting up of a format for repeated use in new documents.

(b) In all of this part too many candidates talked about the publication **in general** without any reference to Desktop Publishing issues. The question was not about how to decide the **content** of a wedding invitation but rather about professional design and layout issues. Therefore, issues such as *choosing a graphic of the bride and groom that did not show them crying* were not acceptable!

(i) In this part concrete placement issues such as justification of body text, rotation of host's address details and size of page margins on the *inside* page were being sought. Too many students talked about issues which related to *grabbing the reader's attention*; this is not appropriate in a discussion about the design of a wedding invitation. Vague answers about placement such as using the optical centre of the page, placing text from left to right and spacing it from top to bottom, were not acceptable. Students, once again, appeared to have memorised issues but could not apply them to the situation provided by the

stimulus material. The issues they mentioned in response to this question were often much more appropriate and relevant to an advertising flyer than a wedding invitation.

(ii) and (iii) The better candidates were able to describe **specific** enhancement in these parts and relate them to particular parts of the stimulus material, whereas the poorer candidates continued to give generalities and failed once again to relate them to the specific wedding invitation. Some candidates could not differentiate between text features and graphic features and others repeated points already made.

(c) (i) Here most students saw this as a copyright issue and gave an answer which referred to obtaining clearance from the copyright owner. A more subtle, but acceptable, response recognised the copyright issue but questioned whether it was necessary to get formal clearance, as only one page was used; in addition, it was being used for a private function and no commercial gain would arise from its use.

(ii) In this part, which referred to production issues, too many students failed to focus on Desktop Publishing issues and attempted to gain all their marks from *Database* issues and/or *Graphics* issues. Whilst it was acceptable to include one database issue (such as checking the accuracy of the guest list before printing), the other issue needed to refer to issues such as the need for a double print run or the correct placement of the fields. In the second part, referring to incorporating the photograph, the better answers examined issues such as the number of colours, colour separation or the resolution of the graphics and the impact that these had on the printing process. Poor answers talked about attaching the original photograph to the invitation with sticky tape or glue and showed no understanding of the digital aspects of combining text and graphics in DTP software.

Question 25 : Computer Communication

Once again, in answers to this question students showed a reasonable knowledge of terminology but found it difficult to relate their knowledge to the specific question. Due to the brevity or vagueness of their response, a significant percentage failed to gain full marks for answers that required a description. Questions in part (c) were surprisingly poorly answered, given the emphasis placed on the topic in the Syllabus. This might have been because this was the last question on the paper and a time factor could have been involved.

(a) This was reasonably well answered, with many students scoring at least half marks.

(i) and (ii) Here most candidates correctly identified the start and stop bits as being essential for asynchronous communication but too many went on to include the parity bit in their explanation.

Many found it hard to draw a diagram for synchronous communication and simply redrew that provided in part (i) without the start and stop bits.

(iii) This part was poorly attempted. Most answers were vague and showed no understanding of the responsible factors. Many students talked about incorrect parity settings (which deals with the correctness of the data) rather than dealing with the difference in the number of characters (correct or not) sent and the number received.

(iv) The last part of (a) was often well answered, with students showing an appreciation of the features of the three media. The wording of the question, which required a three-way comparison, caused problems for a large number of students who were unable (or did not realise the need) to describe a distinguishing situation which made the chosen medium the best of the **three**.

(b) This part was generally well answered. Misreading or misinterpreting (b)(iv), viz. *minimise the cost of downloading* resulted, however, in some students' providing inappropriate alternatives such as *posting hard-copy* or *posting a disk* while others erred in their interpretation by suggesting that they *delete unimportant parts* or *download the file in small parts*.

(v) Many students seemed unaware of any security measure beyond password protection in this part and hence scored only half the available marks.

(c) (i) The wording of these parts is taken directly from the Syllabus and hence it is

(ii) of some concern that students found difficulty with the term *principles*.

and (iii) Many answers provided an *advantage* of the item examined rather than the underlying principles, as asked for.

(iii) Here some candidates risked mark penalties by providing more than the required number of advantages. Students are reminded that if they provide more answers than required to a question, they risk contradicting themselves or asking the marker to make a choice. In either case the candidate will lose marks.

(iv) The large number of good answers here indicated some practical experience as required by the Syllabus. As has been stated before, however, answers which include general advantages such as *quicker* and *cheaper* and which are not amplified in some way will attract few marks.

2/3 UNIT (COMMON)

The 8064 candidates who presented for this paper comprised 6636 2 Unit students and 1428 3 Unit students. The paper consisted of:

Section I : Core - made up of:

Part A	-	20 multiple choice questions
Part B	-	2 questions - one on each of the Core Topics
Section II : Options	-	7 questions, each on one of the Optional Topics from which each candidate had to answer three.

Section I : Core

Part A : Multiple choice questions

1428 (14%) of these students were also taking the 3 Unit (Additional) examination; the average mark on the multiple choice questions was 10.64, with a standard deviation of 3.514.

Given that any question which less than 30% of the candidates answer correctly is considered *hard* and any question which more than 70% answer correctly is *easy*, this paper had 2 *easy* questions (4 and 14) and 2 *hard* questions (7 and 13).

The item analysis for Part A follows.

A very small percentage of candidates (not shown in the following table) failed to mark a selection or marked multiple choices.

Item	Choice A		Choice B		Choice C		Choice D	
	%	mean	%	mean	%	mean	%	mean
1	**67***	**11.9**	16	8.1	8	8.5	9	7.7
2	5	8.7	**68***	**11.6**	13	8.8	14	8.5
3	11	7.9	25	11.2	4	6.5	**60***	**11.2**
4	5	8.6	**82***	**11.2**	7	8.0	6	7.7
5	17	8.8	**36***	**11.7**	7	8.8	39	10.9
6	8	8.5	6	7.6	20	9.2	**66***	**11.6**
7	50	11.0	8	8.9	17	9.2	**25***	**11.5**
8	**65***	**11.5**	12	9.5	17	8.9	6	8.4
9	**51***	**11.5**	21	10.1	8	9.0	19	9.7
10	12	9.4	**69***	**11.5**	9	8.4	9	8.1
11	39	10.3	16	7.9	**33***	**13.0**	13	8.9
12	**52***	**12.2**	7	7.6	23	9.2	18	9.2
13	39	9.9	14	8.5	18	10.1	**28***	**13.1**
14	3	7.4	13	8.1	**80***	**11.3**	3	8.3
15	27	8.8	**43***	**12.6**	18	9.0	12	10.3
16	10	9.4	**45***	**12.3**	29	9.7	17	8.6
17	6	7.9	12	9.6	**43***	**11.5**	40	10.4
18	17	8.9	21	9.8	**45***	**12.3**	16	9.1
19	**53***	**12.2**	13	8.0	29	9.4	4	7.6
20	**55***	**12.3**	7	8.6	27	9.0	11	7.5

Table 3

Note: Mean is the average mark on Part A of the students who selected that choice.

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Bold figures marked with * indicate the correct choice.

In most cases the mean mark for those students who selected the correct answer was higher than the mean for any of the other choices. Question 3 is an exception in which a number of the better students selected choice B.

Part B : Core Questions

Question 21 : Computer-based Systems

This question was straightforward and was generally well answered. As has been said before, students must read every question very carefully and answer the question that is asked. Regurgitation of rote-learnt part-answers with no attempt to relate the words to the specific question will attract no marks.

(a) (i) In answering this part students showed a reasonable understanding of the role of the systems analyst but were not sure of the depth of treatment required. Referring to the space provided and the marks available should give some indication of the examiners' expectations.

(ii) Answers to (ii) seemed to show that students stopped reading the question once some idea of what was expected had been formed. Too many gave a good description of the feasibility study but failed to explain *why it is important*.

(iii) Those who did poorly in this part either did not know what *parallel conversion* was or confused it with *parallel transmission* or *phased conversion.*

(b) Students who did not do well in this part appeared not to have read the question carefully.

(ii) Here many students stated a general social implication in terms of *privacy* or *security*, without making any reference to the specifics of the question. There were those, too, who responded from the viewpoint of the person making the insurance claim rather than the employee as required.

(iii) Although most students answered this part well, there were a large number of students who had no understanding of the difference between *actual data* (the real data used by the system) and the *test data* (data created specifically to test the software) and, hence, allocated their *advantage* randomly.

Question 22 : Algorithm Design

The standard of responses was generally not to the level expected, particularly as the question was simpler than that set last year. Once again, students must read the question carefully to extract all the information and to ensure that all parts are attempted.

A number of centres seem to be unfamiliar with the Board's Support Document, *Methods of Algorithm Development (2nd Ed)*, and the sorting and searching routines contained therein. Students should be exposed to a variety of styles of algorithm description and the use of common terms such as *increment* and *decrement* which (unless otherwise stated) imply adding or subtracting 1.

Another general comment which can be applied specifically to this question is that students must be discouraged from *hedging their bets* and offering a list of possible answers from which they expect a choice to be made by the marker.

(a) In this part most students were able to identify the lines and describe the errors but too many failed to change them correctly. In line 3 `Max` is set to -1 which, in general, will not guarantee correct operation of the algorithm. The preferred technique is to assign *Max* to the first value in the array. This **guarantees** correct operation under any set of test data. The alternative of setting `Max` to an arbitrarily *large* negative number is not advocated. The replacement of < by ≤ in the boolean expression controlling the loop in line 4 is the other change to be made. Without it, the last entry (87) is not compared with *Max* and is overlooked.

Students are reminded that under examination conditions it is most unlikely that they will be asked to identify errors other than errors of logic in an algorithm. Students should not offer answers concerned with either the placement of reserved words such as THEN, or whether indenting should be 2, 3 or 5 spaces.

(b) Here it was felt that the wording could have been improved to indicate more precisely what was required to gain full marks. The wording of point 4 implied a looping structure and point 2 was implied by the statement: *Your algorithm MUST include a sub-program that calculates the cost of the ticke*t. With that in mind, the following comments are made. The structure of the answers was not good, with inappropriate choice of multiple selection structures and/or nested simple selection statements.

When creating variables it is necessary to create only those which are relevant to the question and to initialise only those which will be used in the algorithm. Nevertheless, it is expected that more detail will be provided than the statement *Initialise all variables.*

Some students attempted to write their answers in a conglomerate of pseudocode and flowcharts. This is not recommended.

(c) In this part many students did not understand the term *pass* as applied to the sorting algorithms and, hence, either went too far or not far enough in their execution. There also appeared to be a lack of understanding of the terms *ascending* and *descending* as applied to alphanumeric data.

Section II : Options

This part of the paper contained the seven questions from which students had to answer three corresponding to the Option Topics studied. As in previous years, students are advised **against** attempting questions for which they are not formally prepared. They are also urged not to answer more than three questions since this only results in the time available per question being

reduced. Even if the *best* three marks are recorded, this usually means that the third mark included is a 2 rather than a 1.5 or 1 gained from the extra (unprepared) questions.

The number of candidates attempting each of the Option topics is as follows:

TOPIC	2 Unit		3 Unit		Total	
	n	%	n	%	n	%
Applied AI & Expert Systems	678	10 (14)	151	11 (12)	829	10 (14)
Computer Communications	5431	80 (88)	1153	81 (87)	6584	80 (88)
Computer-Controlled Systems	585	**9 (11)**	92	**6 (8)**	677	8 (11)
Computing Technologies	1781	**26 (26)**	431	**30 (28)**	2212	27 (26)
Database Design	4820	**71 (80)**	947	**66 (73)**	5767	70 (79)
Graphical Techniques	5284	78 (71)	1090	76 (75)	6374	78 (72)
Multimedia	1734	**26 (18)**	427	**30 (21)**	2161	26 (18)
TOTAL CANDIDATES	6781		1431		8212	

Table 4

Note: Cells marked in bold show topics where there is a 3 or 4% difference between the choices made by 2 Unit and 3 Unit candidates.
Percentages in parentheses are those for 1995.

Tables 5a, 5b and **5c** show the mean mark achieved on each of the Options (out of 20) together with the mean mark achieved by that group of students on the Core (out of 40). The correlation coefficient between the two mean scores is also given.

All 2/3 Unit (Common) Candidates	Correlation Coefficient	Core Mean	Topic Mean
Core	1.00	19.53	19.53
Applied AI & Expert Systems	.82	18.49	6.90
Computer Communications	.74	19.72	8.91
Computer-Controlled Systems	.68	18.61	6.55
Computing Technologies	.75	20.06	8.92
Database Design	.73	19.59	8.74
Graphical Techniques	.71	19.79	7.39
Multimedia	.76	18.34	8.11

Table 5a

Note: The mean scores on the Core are reasonably close, irrespective of the Option selected.

The Option means, though a little low, are generally consistent as are the correlations between each Option and the Core. The exception is Computer-Controlled Systems, as it was last year.

3 Unit (Additional) Candidates	Correlation Coefficient	Core Mean	Topic Mean
Core	1.00	24.71	24.71
Applied AI & Expert Systems	.70	25.76	10.73
Computer Communications	.68	24.77	11.40
Computer-Controlled Systems	.55	24.84	8.92
Computing Technologies	.68	24.93	11.53
Database Design	.63	24.85	11.24
Graphical Techniques	.58	24.78	9.88
Multimedia	.61	23.52	10.96

Table 5b

2 Unit (Common) Candidates	Correlation Coefficient	Core Mean	Topic Mean
Core	1.00	18.44	18.44
Applied AI & Expert Systems	.80	16.87	6.05
Computer Communications	.72	18.64	8.38
Computer-Controlled Systems	.67	17.63	6.18
Computing Technologies	.74	18.87	8.29
Database Design	.72	18.55	8.25
Graphical Techniques	.70	18.76	6.87
Multimedia	.75	17.06	7.41

Table 5c

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Question 23 : Applied Artificial Intelligence and Expert Systems

About 10% of the candidature (down from 14% last year) attempted this option with no obvious difference between the 2 Unit and 3 Unit candidature including it in their choice of options.

Once again it was reported that a large number of answers to this question were from candidates who were obviously not prepared for the Option. It could be that these candidates simply attempted the question because it was the first question in the booklet. As was stated last year, students need to be given practice in interpreting instructions under examination conditions and should be fully advised as to the expectations of the Options Section of the examination.

In general the question was not well answered, although some students had obviously been thoroughly prepared in all aspects of the topic and were able to score maximum marks.

(a) In this part those candidates who did well gave answers which went well beyond the succinct definitions, showing that they understood the concept rather than simply being able to recall a definition. The better candidates, for example, discussed *fuzzy logic* as being able to represent *shades of grey* or *degree* such as *very* and *fairly*, then going on to indicate that the degree could be represented in the system as a probability.

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(ii) Here a disappointing number of students provided trite answers such as *forward chaining works forward towards a conclusion and backward chaining goes the other way.* Better solutions included the idea that *forward chaining* goes from given data to establish a conclusion, whereas *backward chainin*g works from an hypothesis to establish facts which support the hypothesis. Similarly, as in previous years, a large number of candidates wrongly suggested that the possession of sensors differentiates between intelligent and non-intelligent robots. The real differentiator is the fact that intelligent robots are able to adapt to their environment in some way.

(b) Most candidates were able to give general answers to this part, but generally failed to relate their answers to the specifics of intelligent systems. As in previous years, candidates had problems in dealing with unique characteristics of intelligent systems.

(i) In this part many students stated problems related to the use of these technologies rather than *problems for which these technologies can provide solutions,* as asked by the question. Although a significant number of candidates were able to give good descriptions of a problem area, the majority were unable to explain, except in very general terms, what it was about the technology chosen that enabled the solution. Far too many shallow answers

were offered, such as suggesting that *voice recognition solves the problem by allowing a voice to be recognised.*

(ii) Here, as in previous years (and in other questions this year), a significant number of candidates gave very generic answers or failed to relate their answers to the specifics of the technology given in the question. Many treated the artificial vision system as though it were closed circuit TV and discussed problems such as power failure, cameras mounted in the wrong position or privacy issues. There was, however, a good proportion of candidates who **did** discuss problems related to face recognition and associated variability in images and how an artificial vision system could handle this.

Candidates need to be given much more experience with constructing sets of rules which follow a pattern as given by an example. The added dimension of using test data confused a large number of candidates who were unable to trace through the firing of rules to see where potential errors in the rule set might show up. Many students appeared to ignore the details given in the scenario and used the Table of Rules as criteria for testing the data, in other words they indicated which rules did not match the test data. It was apparent that the process of testing an expert system was foreign to most (but certainly not all) students. Quite a few confused Australian actors known to them with *Australian Actors* as defined by the list, and consequently provided incorrect test data. In re-writing Rule 7 students did not follow the structure of this rule-set by re-writing the rule in two parts, but used OR as a connective.

Question 24 : Computer Communications

There was a reduction in the percentage of students taking this Option from 88% in 1995 to 80% this year. In general, the question was well answered by many candidates but only a small number expressed their answers clearly and concisely and gained maximum marks. There was, again, a significant number of students who displayed a poor grasp of the terminology.

(a) This part was generally well answered.

(i) Here some candidates confused a *repeater* with looping structures in algorithm development!

(iii) In answering this part the better candidates provided a comparison between the chosen microwave transmission situation and one in which cable-based media would be preferred.

(b) This was generally well done; only a very small percentage, however, attempted (iii) and these, in the main, described the process as required.

(c) It was obvious from the answers to this part that the candidates had had differing experiences with networks. As in other questions, most were able to regurgitate text book definitions and descriptions in answer to the questions but were unable to relate them to the specifics of the question asked.

(i) and (ii) The two topologies in (i) and (ii) were recognised, but the choice of protocol often was inappropriate for the *LAN* topology. Similarly, the advantages given were often advantages of networks in general and not ones *associated with the use of this LAN topology* as asked for. Again it appeared that many of the answers were restatements of learnt material with little or no attempt being made to relate the material to the specifics of the question.

(iii) Here the first part was well answered since general benefits of connecting any two *LAN*s would remain benefits in this particular situation. The second part concerning protocols, however, was not well answered. Some gave the same answer twice, apparently hoping that it would be appropriate at least once!

Question 25 : Computer-Controlled Systems

9% of the 2 Unit students studied this Option as distinct from 11% last year. Only 6% of the 3 Unit students included it in their choice, which is similar to the numbers last year.

As in other questions, students were able to produce a description of the terms *batch*, *continuous* and *discrete* as appropriate in part (a), but, when asked to choose a suitable example and discuss the differences between them, they displayed a lack of real understanding.

(b) (i) Once again block diagrams were poorly done. This year more students than previously produced something which could be recognised as an attempt to draw a block diagram in this part.

The use of the suggested pressure and motion sensors to improve traffic flow and safety on the bridge seemed quite superficial to most students. Few positioned the sensors to detect very much at all. Many used both types of sensor to check cars going onto the bridge but used neither type to check or count the vehicles leaving the bridge. Students failed to concentrate on the computer-controlled system aspect of the problem and thus gave very general answers.

(ii) The majority managed to score at least some marks for the algorithm in this part, with more students attempting to use pseudocode (around 30%) than in previous years.

(c) Most students failed to come to grips with the food company example here. As in previous years, quite a few candidates ignored the information provided in the question and attempted to base their answers on general knowledge. Few managed to score even half marks in this part.

Candidates are expected to be familiar with a wide range of sensors and effectors commonly used in this field. Flow volume sensors, control valves and weight sensors were poorly described, if at all. Some paddlewheel and venturi tube examples were well done, with solenoids and scales being the common examples of the other two elements.

Algorithms have always been another weak area in this question, and this year few students attempted it. The algorithm required nested loops to operate correctly and, thus, many students produced long and involved flowcharts or a confusing pseudocode attempt. The improvement noted last year was not sustained.

Question 26 : Computing Technologies

26% of all candidates selected this option, with an almost even split between the alternative technologies. This was the same percentage as in 1995.

Students **must** be made aware that the current Syllabus offers a choice of two technologies, with content that is common to both. For this reason the question consists of a common part (a) to be answered by all candidates attempting this Option, followed by the parts (b) and (c). Each candidate is required to answer part (a) and **either** part (b) **or** part (c). The order of the parts dealing with *Optical Technologies* and *Theory and Construction of Integrated Circuits* was changed from that used last year. It is assumed that candidates are able to select which part to answer from the title and content rather than from its place in the order, though there were some candidates who should have answered the questions on Integrated Circuits who attempted the Optical Technologies questions.

(a) The majority of candidates appeared to have little knowledge of part (i) but handled the rest reasonably well, with most knowing the structure of binary numbers and successfully carrying out conversions. Hexadecimal and octal structures were also generally understood but conversions were not handled as well as decimal conversions. The binary subtraction here was well done and understood.

(i) In this part there was a poor understanding of the relationship between the number of bits and the effect of using two's complement for representing negative numbers. Few were able to give 01111111 as the largest positive integer which can be expressed in 8-bits, but they were able to convert their answer to decimal notation which, in the correct case, is +127.

Few students were able to explain that adding 1 to the largest positive integer caused arithmetic overflow, with a resultant bit-pattern of 10000000 which is -128 and is the *lowest* negative number that can be stored in this system.

(ii) Here many candidates knew the bases for hexadecimal and octal and were able to convert successfully from the decimal representation. Most converted directly into the required base rather than using an intermediate binary form (probably necessary for larger number conversions). Common errors were reporting the hex value as 1A, while some gave 1 11 instead of the correct 1B

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(b) Those who attempted this part on Optical technologies had a fair general understanding of the nature and uses of optical technologies in computing. Specific knowledge of the working of optical devices and optical fibre was often poor, however. Textbooks appear to give conflicting information in these areas and this was reflected in many candidates' answers which would have been better presented in point form to highlight the issue or feature required.

The laser printing process was moderately well known by the majority, who could restate at least some of the features. Many had no real understanding of the process and diagrams were poorly drawn, with features being omitted.

(ii) The recall of advantages required here was well done by most of the candidates.

(iii) In this part most students knew CD-ROMs contained *pits and lands* (or a variety of synonyms), but did not really understand that they were used to store binary data. Most had a rudimentary understanding of how they were read. Magneto-optical disks were better understood in terms of the storage process, but few students had any knowledge of the retrieval process and the involvement of polarised light.

Here many candidates gave a single answer for the second part, without referring to the stem of the question that said *For each of the following optical technologies.....*

(iv) The majority achieved only half the available marks for part (iv) through providing superficial answers such as *the data capacity is greater than* or *the medium is more secure*. When this is an optional topic which the candidate has chosen to study, it is expected that there will be some depth of knowledge displayed in the answers.

(c) Those who attempted this part on Integrated Circuits had a good knowledge of basic facts such as the operation of a single gate or simple circuit. Those questions which required a more detailed description were poorly done.

(i) This part was very well done by the majority of the candidates.

(ii) Here, in the first part, some candidates traced the values through, whereas others simply supplied the *known* sum and carry of a half-adder. The remaining parts were often answered with too little description to attract full marks. Stating that a half-adder *doesn't handle a carry* is not sufficient to gain all of the marks. For the final part, those who drew a diagram tended to supply more detail and to show more understanding of the design than those who described it in words.

(iii) This part was poorly answered, with few candidates showing any understanding of the photo-masking process whereby the design of the circuit is transferred to the physical layout of the chip.

Most interpreted the packaging process as being somehow involved with packaging the finished product for transportation rather than the encapsulation of the chip so that it can be inserted into PCBs.

(iv) Here most students described the layout or design of a flip-flop but failed to *describe the behaviour* as asked by the question. Whilst the majority remembered that it was a *bistable device*, few understood the concept of *setting* and *resetting* the state of the device. Many drew a valid diagram, but then failed to use it in support of their answer. Very few attempted to draw the truth table and those who did so were not able to use it in their explanation.

Question 27 : Database Design

Some 71% of the 2 Unit students and 66% of the 3 Unit students attempted this question.

As has happened previously, there appeared to be some difficulty on the part of many students in reading and understanding the scenarios. Terminology once again was not widely known and many who obviously had a reasonable knowledge of the subject did not use the most appropriate terminology in formulating their answers. Candidates seemed to find that too much reading was required and, hence, neither took in all the information provided nor appreciated the full requirements of the question. **All words in a question serve some purpose and should not be ignored.**

There was the added problem of the question's extending over two double-page spreads which some students failed to realise, in spite of the notice placed at the foot of the half page and the fact that parts (a) and (b) accounted for only half the available marks.

Again, as in other questions, many students appeared to have rote-learnt definitions without any understanding of the term in question. This was the case in part (a) which attempted to assess the candidates' understanding of terms and their definition. All parts required an answer in each candidate's own words.

(a) (i) To score full marks here, simply giving an example - such as *locking the computer room door* - which is applicable to any discussion of *security,* did not show sufficient understanding of *data security* as it related to databases.

(ii) Good answers discussed procedures such as checking the data against the source documentation, whereas poorer (correct) answers suggested procedures such as maintaining log files of changes made to the database which, in itself, will not guarantee data integrity.

(iii) To gain full marks here two distinct examples had to be given.

(iv) Here the commonest error was to define a data dictionary without explaining what it is used for.

(b) (i)

Most candidates here were able to provide a generally acceptable advantage for

and

these parts.

(ii)

(iii) Unfortunately, the inclusion of the word *field* instead of *record* in the question for part (iii)(1) rather destroyed the purpose of the question, which was to get the candidates to interpret the results of a particular query.

In this case they were expected to realise that the result would be the retrieval of *the pay records for all employees who were paid $1000 in the pay-week of August 15th, 1996.* This would then have acted as the lead-in to the rest of this part.

In answering (2) the commonest error in otherwise correct answers was failing to show clearly the correct use of the conjunctions **OR** (ADDRESS CONTAINS PARRAMATTA **OR** ADDRESS CONTAINS BEGA) and (DEPT = SALES OR DEPT = ACCOUNTS) and **AND** to combine the address and the department.

Some students did not use the relation CONTAINS or failed to use wild cards around the suburb/town in *query-by-example*, having failed to realise that the address is more than just the suburb/town in spite of the presence of part 3. Most students realised that the address field could be broken up into a number of fields B one of which would be the town or suburb field.

(c) Here the majority of students were able to translate the manual, card, system into an electronic form. Some found it difficult to identify the *Caller* data in the manual system with the *Job* data in the electronic system.

(i) In the data dictionary required for this part the commonest error was to provide unrealistic lengths for the various fields. A ten digit numeric field is not considered appropriate for the age of a taxi, allowing for a range from 0 to 9,999,999,999 years (nor for its capacity). Obviously some leniency was given in the marking, but the better answers showed that some thought had gone into the choices made.

(ii) Most were able to name a suitable primary key for the *TAXI* table but were not sufficiently well prepared to express the fact that there was no really suitable single field for use as a primary key in the *JOB* table. A number merely named a field while many others left it blank.

(iii) As stated above, students should use the information provided to help them answer the question. This part suggested that there was no really suitable primary key for the *JOB* table and asked the student to explain what the deficiency was.

(iv) Some students misinterpreted the use of the word *relate* here and discussed the need for radio contact so that the taxi could be linked with the particular job!

(v) In this part the advantage being looked for in storing pick_up_ date as a field type *date* was either the fact that a system date could be automatically generated and entered in the field, or that its format is standard and can be used as a sorting key to place records in chronological order. Because of part (vi), it was not acceptable here to use the fact that date-fields have a fixed length as the *advantage* asked for in (v).

Too many students discussed the disadvantage of keeping the taxi=s age as an attribute in the database from a user=s point of view rather than from a database point of view. Answers such as *the client wouldn=t want to ride in an old taxi* showed no understanding of databases. The answer from a database point of view is that the value changes annually and hence puts the integrity of the data

at risk if, in any year, the field is not updated. If the updating were to be done automatically by the system then the taxi=s construction date would need to be maintained and the *age* field would have to be a calculated field.

(viii) Most students were able to obtain half the available marks here. Those who gained the extra marks did more than state and superficially *discuss* the issue.

Many students threw away marks by writing down generally applicable terms such as *invasion of privacy* without any explanation of how the keeping of the data might result in an invasion of privacy. Whilst showing some insight into the issues, answers which stated *people can find out when they are not home and rob them* show little understanding of the issue as it applies to the taxi company database; such an answer is just another *general* example.

Question 28 : Graphical Techniques

There was a marginal favouring of this topic by the 2 Unit students (78%) over the 3 Unit students (76%) which was the reverse of the 1995 situation

This question was not well answered by the majority of candidates. As with many other questions, students did not read the question carefully enough to answer the question asked. They failed to pick up clues given by key words such as *explain, describe,* and *discuss* and often gave general, remembered statements rather than applying their knowledge to the specific question. In brief, candidates wanted to tell what they remembered about the topic rather than answering the question asked.

It may well be appropriate, after the above comments, to emphasise the purpose of the marking scheme at the Higher School Certificate Examination. It is **to rank the candidates from those who display the most knowledge and understanding to those who display the least**.

Comments about many of the questions have stated that answers were too simple, too general or trite. Maximum marks will be given to those candidates who clearly display the most knowledge and understanding of a topic. Students should be reminded of this and encouraged to write answers which reflect their level of understanding. It is **not** being suggested that students should list everything they know about a topic. This usually results in exposing their lack of understanding.

(a) (i) In this part all of the definitions were reproduced word for word from the *Glossary of Terms*, yet few students were able to recognise the descriptions of *Bezier curve, aspect ratio* or *rendering.*

(ii) Here many, in answering, tried to explain how memory was *calculated* instead of simply *naming the components needed to do the calculation* as required by the question. Some students who did supply a list included many irrelevant components.

(iii) and (iv) These parts were generally well answered.

(v) This seemed an unknown quantity to many, even though it had been included in the *Glossary of Terms*. HLS is an acronym for Hue, Luminosity and Saturation.

(b) This part gave students an opportunity to relate their theoretical studies to the practical area studied.

(i) Here, however, students did not seem to be able to elaborate with examples when asked *to describe why the use of graphics in* [their chosen] *area has become so popular*. When students talked about graphics in simulations, they tended to talk about how the simulator operated rather than the graphics used within it.

(ii) In this part most students showed a good understanding of the use of optical storage in Graphics rather than of *this area*, i.e. the one chosen in part (b)(i).

(iii) Here students needed to use appropriate terms such as *copyright* and *plagiarism* in their answers. Many wrote about ethical considerations such as *privacy*, *pornography* and *violence* which did not answer the question which was about ethical considerations in using non-original images from other sources.

(c) (i) In answering this part students generally showed a low level of understanding about how various forms of compression worked. Many answers referred to general compression techniques rather than graphical compression and often the disadvantage provided was not appropriate to the compression techniques chosen.

(ii) Here students had some difficulty in explaining their understanding of the processes in a logical manner. Some used the same method twice with different names.

(iii) Answers to this part tended to be too general and students were unable to explain clearly the difference between the two systems.

(iv) Many answered this part by explaining how an animation is created rather than how *the effect of animation* is achieved. Some described the human perception of the illusion of motion rather than the graphical technique. This was an acceptable alternative.

(v) Here there were many long answers that said very little of worth. The same task was often used to explain both *paint* and *draw* programs and too many students described the difference between *paint* and *draw* instead of explaining why the particular task is more easily performed by the chosen type of program.

(vi) Most candidates were able to answer this well, although some needed to be more precise in their explanations of *interlacing* and a problem that it can cause.

Question 29 : Multimedia

26% of the 2 Unit candidates selected this Option and 30% of the 3 Unit candidates.

This question generally elicited better answers than last year=s question. Students, on the whole, showed a more in-depth technical and creative knowledge and understanding of the topic. As was the case last year, however, many failed to gain better marks because their answers to the *explain*, *describe* and *give reasons* type questions were far too brief to convey the actual extent of their knowledge and understanding.

Unfortunately, it appeared that many students who had not been prepared for the topic chose to answer it. The fact that they had not been prepared was gleaned from the very poor quality of their answers, combined with the fact that small numbers from large examination centres frequently attempted this Option. With the popularity of multimedia and the current marketing push of so-called *Multimedia Computers*, many students have picked up jargon without any theoretical underpinning. They should be discouraged from attempting this Option unless they have been well prepared for it in theory as well as in practice.

(a) The multiple choice questions in this part were generally poorly attempted, with few of even the better students getting all four correct. This indicates a lack of knowledge of the topic terminology and a lack of depth in candidates' understanding of the technical aspects of the topic. The most common error was in (ii) *Which of the following is determined by the size of the VRAM?*, where many chose *(A) - display speed* instead of *(B) - palette colours*. The second most common error for otherwise competent attempts was in (i) *In which file type is digital sound saved when stored to disk*? where *(B) - MIDI* was selected instead of *(D) - waveform*.

(b) (i) Once more, students showed a very poor grasp of the concept of hypermedia. Many defined it as *hypertext*, many as *fast media*(!) or defined it specifically in terms of the particular software that they had used. Too many failed to refer to *navigability* or *interactivity* or elements of multimedia other than hypertext.

(ii) As a simple recall question, this was well answered, with most students being able to pick up full marks.

(iii) The majority of the students showed some understanding of the concept of a storyboard here, but many failed to earn full marks because their answers were too brief. Most recognised it as something created in the planning stage, with average answers describing it as a map or plan, without describing how it is used. The better students discussed features such as linking, navigational paths, types of storyboards, as well as their use as documentation of the project. Some illustrated their answers with a sketch - these students generally scored well. Some of the poorest answers wrote the storyboard as an actual presentation or something used by the end-user.

(iv) Here the conversion process from analog to digital was fairly well handled. Many students earned full marks for this; these were mainly those who gave a detailed description of sampling of pitch, frequency or amplitude, including a detailed explanation of bit-size and/or megahertz. Shorter answers, however, obtained some marks for referring to sampling or saying that the sound is saved in a wave-table.

(c) (i) In this part many students did not know the difference between *design features* and *influences on design.* Answers describing hardware and software considerations did not attract any marks. Those who recognised *design features* as *suitability to audience, sound screen design features, consistency of interface, ease of navigation*, etc, obtained half-marks by merely listing three features. Those who went on to describe the feature and/or indicate why it should be a consideration scored well.

(ii) Here there was some misinterpretation of the question, which called for a hardware solution (with reference to the accompanying software, if appropriate). Most students recognised this and were able to earn better than half marks by listing three devices. *Keyboard, mouse* and *touch screen* were the most frequent answers but *virtual reality input devices* were also present in significant proportions (to obtain the mark for this they had to indicate that they understood that these required some sort of hardware device).

In answering the second part, many students wrote that their chosen input method was *voice activation.* This was acceptable, provided that the reason given in the next part was justifiable. Moderate types of justifiable answers in this part were those such as *it is an up-to-date and impressive technology and will make potential investors think well of the company.* To gain full marks if they made this choice, however, they really needed to indicate that they understood that voice activation technology is not sufficiently advanced to cope with unlimited voices and background noise as there would be in this situation. Many students also misinterpreted *voice activation* as being full-scale conversation between the person and the computer presentation. Such an answer did not attract any marks. As with (c) (iii) (below) no marks were awarded for answers such as *easier, quicker, cheap,* etc.

(iii) This was not answered as well as the other question in the section. Many students gave no indication that they understood what an *authoring package* was; they either did not attempt this part or they wrote of it as something similar to word processing or DTP package (i.e. authoring = writing). A few indicated that they had some idea that an authoring package was something designed to make multimedia easier to create. Some of these knew that it saved coding. Very few students, however, gave any evidence that they understood an authoring package to be a piece of software already coded to allow linking to various elements, file types and external devices in one presentation and to allow navigational paths to be built into that presentation.

(iv) This part was reasonably well attempted by most students. The majority could come up with at least one of a number of possible reasons. Obviously, the student who wrote *sample at 11 MHz instead of 22 MHz* obtained more marks than one who wrote *reduce the sampling rate*. Only a small number wrote that it would be possible to *store the speech on an analog audio tape and activate the tape from within the computer presentation when needed.* If well expressed, this was well rewarded.

3 UNIT (ADDITIONAL)

1428 or 12% of the candidature presented for this paper which consisted of:

Section I	-	20 multiple choice questions
Section II	-	2 questions, each on one of the compulsory topics.

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Section I

The average mark on the multiple choice questions was 12.92 with a standard deviation of 3.102.

Given that any question which less than 30% of the candidates answered correctly was considered *hard* and any question which more than 70% answered correctly was *easy*, this paper had one borderline *hard* question (19) and eight *easy* questions (2, 4, 6, 9, 13, 14, 15 and 16).

The item analysis for Section I follows.

A very small percentage of candidates (not shown) failed to mark a selection.

Item	Choice A		Choice B		Choice C		Choice D	
	%	mean	%	mean	%	mean	%	mean
1	16	11.9	17	11.3	15	11.7	**52***	**14.1**
2	3	9.6	13	11.0	4	10.1	**79***	**13.5**
3	**55***	**14.3**	21	11.3	9	11.6	14	11.0
4	**81***	**13.3**	5	11.4	3	9.1	11	11.6
5	12	11.8	21	12.6	**50***	**13.7**	16	11.9
6	10	11.5	8	10.4	**71***	**13.7**	11	11.0
7	17	12.1	5	11.2	21	11.2	**57***	**14.0**
8	12	10.7	3	9.3	**66***	**13.9**	19	11.5
9	8	10.8	**73***	**13.8**	13	10.9	6	10.2
10	21	11.8	5	10.5	**68***	**13.6**	5	11.5
11	14	11.1	14	11.3	**69***	**13.8**	3	10.1
12	4	11.8	**40***	**13.8**	43	12.5	12	12.0
13	4	10.2	**86***	**13.4**	4	9.6	6	10.2
14	2	9.7	7	11.9	**76***	**13.3**	15	12.0
15	**83***	**13.4**	2	10.6	7	11.5	8	10.6
16	3	10.7	3	10.6	8	11.2	**85***	**13.3**
17	7	11.0	28	13.3	**45***	**13.4**	19	12.1
18	16	11.6	**60***	**14.0**	11	11.3	12	11.3
19	22	12.4	19	12.2	30	12.2	**29***	**14.6**
20	**67***	**13.8**	11	11.2	11	11.3	10	11.0

Note: Mean is the average mark on Section I of the students who selected that choice.

In all cases the mean mark for those students who selected the correct answer was higher than the mean for any of the other choices.

Question 17 had a number of the better students choosing response B rather than the correct C. Desk checking of a program cannot find run-time errors but can find syntax errors. The practice of using the compiler to find syntax errors is not recommended as different implementations **may** report different syntax errors.

Section II

Question 21

In this question there was an improvement in the quality of answers over those in previous years. The length of some responses indicated that the time spent on individual parts of the question was disproportionate to the marks allocated. Many students spent a lot of time on part (a), worth 4 marks, thus leaving less time to spend on part (b), worth 7 marks, or part (c), also worth 4 marks.

Once again, students should understand that they need to relate their knowledge within the framework of the question that is asked, rather than regurgitate rote-learnt material. Candidates need to read the question paper carefully to ensure that they identify and answer **all** parts. In this paper, (b) part (ii) was missed or overlooked by many students.

(a) This part was not well answered by the majority of the candidates, although a number provided a good answer to part (ii).

(i) Here some students did not use any of the methods required by the question, with Data Flow Diagrams appearing quite often. The method chosen was not always clear, with many students mixing features and attributes from several methods.

A number of students did not include all aspects of the question in their diagram, with the majority overlooking the need to include administrative and file management tasks in their answer. Some students did not recognise reports as outputs of the system.

(ii) In answering here many students combined characteristics from different methods, while some were unable to describe in sufficient detail the characteristics of any one method. The question asked for *characteristics*, which implies more than one!

(b) (i) Here in (1), students confused the difference between *screen design* principles and *page layout* principles. Many gave one word answers rather than stating clearly the whole principle.

Students who, in answering (1), chose principles that would not be obvious in a diagram, e.g. *consistent placement of buttons between screens, use of colour to group or define areas*, etc, should have included labels in their sketch for (2) which clearly showed that their principles from (1) were being met. Nearly all students showed a good understanding of screen design, even if they could not explain the principles that they were using. Some spent time in drawing detailed icons or school crest drawings which did not add to the demonstration of the principle.

In answering (3) many students simply described what they had drawn in their diagram rather than describing how their screen satisfied their chosen principles.

(b) (ii) This part was well answered in that most candidates named a specific situation, although many did not explain **why** their example was appropriate. *Describe a situation where it is appropriate to use them* implies more than just naming a suitable situation and indicates a need to explain to the reader why it is appropriate. Many students gave examples in which check boxes were more appropriate than radio buttons.

(c) These parts were well answered by most students, especially part (ii).

(i) Here many students gave a *definition*, rather than *the characteristics of* a prototype. A number of students did not provide two different characteristics and some showed the consequences of using a prototype rather than the characteristics as required.

(ii) When it was answered this was the best answered section of the question, although in the poor answers, students made statements without explanation and some repeated the answers from (c) (i).

Question 22

(a) This part was generally answered well. Many students, however, while obviously recognising the use of a railroad diagram, experienced difficulty in producing a single diagram which was a general solution to the three possibilities indicated.

A number failed to recognise the repetitive structure demonstrated in the third example and, of these, only a minority included the A,@ in the loop. Some students attempted to cope with this by using a form of recursion and using the term *assign* or *assignment* as an item within the diagram itself.

A substantial number of candidates did not appreciate the hierarchical/modular nature of railroad diagrams and included fundamental items such as >**A**= or >**=**> without appreciating that they are just instances of the higher order elements Letter or Symbol.

Many candidates did not appreciate the need for an OR structure, allowing only one of either **Variable** or **Number** to be used. Some obviously felt that it was possible to construct a valid assignment statement without showing anything following the symbol. This would mean that a statement such as Assign A = END is possible. This is obviously meaningless and students should recognise that this would not be acceptable syntactically.

A number of students were not aware that the complete structure required both the inclusion of the first word Assign and the last word END as part of the diagram.

(b) (i) In answering this part, students were expected to include a complete deskcheck with their answer for each set of test data. Without such a check, the cause of error in the case of an incorrect answer could not be determined.

A number of students did not correctly understand the use of the WHILE construct. Particularly in the case of the second set of test data (25, 10), many students could not correctly complete a second loop and, instead, stopped after the first iteration, rather than completing a second loop and stopping where Y was detected as having the value zero.

(b) (ii) This part required students to make the original pseudocode shorter. This did not mean that lines were to be combined, or that symbols could be used to reduce the pseudocode, such as replacing X is divided by Y with the equivalent X/Y. Students were expected to refine the logic to make it more elegant and less unwieldy. The most obvious way of achieving this was by replacing lines of equivalent code with sub-routines, but students should note that they were asked for two SEPARATE ways and could not expect to attract full marks by doing this for two sets of equivalent code.

(iii) Here students were required to understand the use of the REPEAT..UNTIL construct and to be able to apply it. It was not sufficient simply to state that the use of the REPEAT..UNTIL structure meant that the module had to execute at least once. Students had to realise that if the value of either A or B were 0, then this would cause a run-time error when trying to divide by zero.

(c) (i) In this part students who used flowcharts had greater difficulty in producing a correct design for the read-all-data module than did those who used pseudocode. Students who decide to use flowcharts should realise that they must incorporate the standard control structures of REPEAT..UNTIL or DO..WHILE. Iterations

must clearly be either a pre-test or post-test iteration. It is not acceptable to place a test for the end condition somewhere in the middle of the loop.

Students were expected to be able to cope with the use of a sentinel value ZZZ and not allow this value to be stored into the array. If they assumed that the data was entered via the keyboard, then, once the ZZZ has been read, the algorithm should not ask for club and time details.

Many students had difficulty in using array elements. A significant number struggled with the correct use of an appropriate index, with many trying to use constructs such as READ NAME(NAME), CLUB(CLUB)... Those who recognised that a common index was appropriate often forgot to initialise or increment that index. It was surprising that there were so many who scored poorly on what is basically a 2 Unit exercise of loading a 1-dimensional array.

(ii) This part was generally not answered well, with a large number of students failing to realise that they had to allocate the correct heat and lane to the top 24 athletes. Of those who did attempt to allocate heats and lanes, there were a significant number who produced crude and inelegant solutions. These included multiple sections, with students manually allocating Heat 1 to athletes 1, 4, 7, 10,..., Heat 2 to athletes 2, 5, 8,...., and so on. Students should realise that solutions such as these may produce correct results, but will cause great difficulties for maintenance when the algorithm needs to be adjusted to allow for 5 Heats, or 6 lanes, or 30 athletes, for example. For this very purpose the Syllabus specifically states that students are to value elegant solutions.

When attempting to print the details, many students again experienced difficulties with what should have been a standard 1-dimensional array print routine. A number of students tried to print from athlete 24 to 1, even though the question specifically asked for ascending best time sequence. As in part (i), others could not use the array indices correctly, were unable to specify an index appropriately, or forgot to increment or initialise the index.

A surprising number of students attempted to sort the athletes= details, or somehow determine the best times, in spite of the very clear wording of this part of the question.

In general, students should be encouraged to start any new algorithm on a new page, to give themselves sufficient room to produce a clear algorithm. Unfortunately, many unnecessarily went over two pages and appeared to forget important details in the process.