APPLIED STUDIES

In 1996 1115 candidates presented for this examination, an increase of approximately 18% over the candidature for 1995.

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The responses showed an improvement in the understanding of the Syllabus, but some candidates still appeared not to possess the required knowledge. Schools are advised to keep abreast of the changing topic(s) in some areas by reading the Board documents such as the Board Bulletin.

Question 1 : Applications of Computer-Controlled Systems

(a) (i) A large proportion of students either failed to give an algorithm or gave an inappropriate response to this part. It appeared that a number of students did not know what an algorithm was or, at least, how it should be represented. In some cases students simply restated the question.

The logical flow of the question required that non-labelled boxes be removed from the conveyor in the first instance.

(ii) Generally students had little trouble in answering this question and were able to come up with some good suggestions.

(iii) 1. Even though students scored well in this part they seemed poorly equipped to handle questions about the social implications of computer-based systems. The majority concentrated on job redundancy, whereas they could have discussed new job opportunities, the need for retraining, and the need for counselling, etc.

2. Many students did not fully understand the word *industry* in the context of the question. They assumed it meant something like *factory.*

(b) (i) In this question students were asked to answer questions related to a computer-controlled system that they had assembled. The most common responses to this part, based on a significant sample of papers, included the following systems:

Fan systems	15% of the sample
Security alarm systems	4.5% of the sample
Greenhouse systems	3% of the sample
Robot systems	3% of the sample

There was a variety of other acceptable responses.

A number of candidates (20%) in the sample either did not respond to this part or their responses were inappropriate. A number of other responses (20%) related to systems that are not computer-controlled, e.g. thermostat - as in a frying pan.

This question was poorly answered. Students were **required** to assemble a computer-controlled system, yet many of them talked about large commercial systems in general (SCATS, etc). Through choosing such types of system, students had difficulty in answering part (iii)

Block diagrams were not well understood.

Knowledge of sensors and effectors was very superficial. The HSC Computing Studies Glossary of Terms (2nd edition) would be a good reference in this area.

(ii) This part was very poorly answered. Comments written here tended to follow on from the comments made in answer to (b)(i). Lack of knowledge about sensors and effectors and their underlying operating principles resulted in unsatisfactory answers.

(iii) Responses here were also extremely poor. Those who did describe a system they had constructed were often at a loss to discuss two ways in which the system might be expanded into a real world application and the consequent effects.

(c) (i) This was very well done.

(ii) Students tended to rely on their general knowledge here, rather than on their specific understanding of computer-controlled systems.

Question 2 : Applied Mathematical Skills

Students seemed comfortable with this topic and, as a result, the question was completed satisfactorily.

(a) (i) The majority of the students were able to substitute into the equation. The majority were able to solve the equation by using logarithms. Some used a trial and error method with varying degrees of success.

(ii) Many students recognised the ratio A/P or $1.05^n = 2$ and, hence, identified the fact that any amount invested would take 14.2 years to double. A number of candidates used the equation to achieve the same result.

(iii) Many students divided by 70 and, therefore, could not get an appropriate answer. The majority, however, had no problems with this question.

Sample response:

70/5 = 14
Yes, this rule agrees with the answer in parts (i) and (ii)

(b) Those who recognised the simple nature of the questions calculated the answer easily.

Students who attempted to draw a graph found the task impossible as the problem was a very difficult one to graph. A number of candidates drew up a table quite successfully, but made the mistake of beginning the backlog a minute too early in each case.

On the whole this part was completed extremely well.

Sample response:

3 cars per minute, machine processes one per minute
..... between 1.20 pm and 1.40 pm is 20 min
.....for 20 min, 20 car parts are backlogged
..... between 1.40 pm and 2 pm is 20 min
..... for 20 min, 2 machines are not working,
40 car parts are backlogged
For the whole 40 minutes that the machines were broken, 40 + 20 = 60 car parts are in the backlog.

(c) (i) The majority of students recognised the fact that the curve was an application of the Logistic Law. Most could also give two features, although many missed the point that final growth was limited. A number seemed to indicate that growth continued, but was just slower.

Sample response:

This law obeys the Logistic Law according to which, when population is small, the rate of increase (gradient) decreases. This decrease is attributed to overcrowding factors, e.g. lack of space, disease, food shortage.

(ii) Very few candidates lost marks here.

Sample response:

For 0.5 year old acacias a good estimate is 0.3 metres in height.

(iii) Many could not read the full height off the graph correctly and, consequently, read 1.64 metres. A few did not follow through and failed to give an age after they had worked out 2/3 of the height.

Sample response:

Full height = 1.75 m
175/3 = 58.33
58.33 x 2 = 116.66
2/3 height = 116.6 cm
2/3 height age = 1 year

(d) (i) Many students confused the 30c/kg and 70c/kg and thought this should have been added to 100.

The majority of students recognised the fact that it was necessary for the two parts to add to 100%.

(ii) The majority of the students successfully completed this question. Marks were lost for confusing which ingredient was 30c/kg and which was 70c/kg. Some randomly chose a combination of percentages, calculated a cost and gave this as the answer.

Sample response:

Cost = 0.3x + 0.7y
(10,90) Cost = \$66/100 = \$0.66
(20,80) Cost = \$62/100 = \$0.62
..... the cheapest fruit mixture would consist of 20% orange peel and 80% raisin-currant mix.

Question 3 : Mathematical Ideas

(a) (i) The majority of the candidates could successfully draw diagrams of Ptolemy's and Copernicus' models of the Solar System and their correct orbits. A few students put the orbiting solar bodies on the same orbit.

A small number obviously knew the answers but could not successfully put them into diagrammatic form.

(ii) The majority of students answered this question successfully.

(b) (i) A number of students used the number of terms given in the example, instead of only the first five terms.

Most students could correctly round off to 3 decimal places.

(ii) This question was well done.

(iii) Many candidates guessed the answer, worked it out and thus achieved their result.

(c) (i) Using the given generator, the majority of students could construct first and second stage fractals correctly.

A number gave only part of the first and second stage and, as a result, could not generate a correct version of the second stage.

Many appeared to be confused by the wording of the question.

(ii) About half calculated the correct answer, some made up a new square and recalculated a new area.

(d) This section was poorly done, and a number of students did not make any attempt to answer the question.

(i) Many students mixed up non-Euclidean concepts with Euclid's axioms; a number quoted geometric proofs that they knew. Marks were awarded for both Euclid's axioms and his postulates.

(ii) Very few students had any idea of the role of Euclid in the development of geometry. The majority did not attempt to answer this part.

Question 4 : Science and Medicine

(a) (i) Students tended to present answers on asthma, diabetes and malaria.

(ii) This question was poorly answered. Candidates were confused about the way in which the disease affects the body and its symptoms.

(iii) The question asked how the *causes* of a specified disease have been identified. Students confused this with the *symptoms* of the disease.

The majority described the *cause* of a disease they had studied but missed the link with *identification.*

(iv) Answers to this part were good.

(v) Most students gave the initial treatment for the disease. Fewer, however, could explain why this treatment was effective.

(vi) This question was poorly answered, although most responses indicated that students had investigated one of the diseases named in the question. Some students gave a prepared answer to another question and did not answer the question asked.

Some students could give a range of side-effects associated with the treatment, others could give only ONE side-effect. The majority, however, were unable to give TWO side-effects.

Some gave a generic side-effect often based on their own experiences and not specifically related to the disease they had studied.

The terms *discuss, describe, detail*, even *how*, were poorly understood in terms of the breadth of answer required.

(b) This question was poorly answered.

Students had not studied the limitations of the images produced by the diagnostic techniques. Many confused the limitations of the technique they had studied with the limitations of the image produced by the technology.

Some produced prepared answers on the operating principles underlying the technology, which was not relevant to the question.

(c) (i) Students had difficulty in recognising the fact that, in the question, *investigate* means *describe scientific research undertaken to help solve the problem.*

Some students could not decide what the question was asking them to do.

(ii) Responses covered the full range, viz. *YES/NO/UNSURE*.

Most students gave a reason including discussion involving:

- improved education
- advertising campaigns
- clever product marketing for UV cream
- depletion of the Ozone layer, increasing UV radiation.

Generally scientific methodology needs to be reinforced. Students need to **DO** problem-solving involving scientific research.

Some gave the terms used in scientific research, but showed little or no knowledge of how to apply them in investigating a problem.

(d) (i), (ii) and (iii) These questions were well answered since students understood them and could read a table well.

(iv) 1. Some candidates did not make the connection between grey hair and age, and more/higher/increased/greater exposure to UV radiation and skin cancer.

2. Most students saw the need to set up some type of group but they were not sure of how to proceed from there. A number appeared not to understand this question. The principles of scientific research and their application were again poorly understood by some candidates.

Throughout this question some students gave a response based on their personal opinion rather than one based on knowledge. Moreover, some students' inability to construct sentences meant that they could not adequately discuss the question.

Question 5 : Scientific Research

(a) (i) This part asked students to write down the name of two research programs based in Australia. One of these was to be used as the basis for an answer to parts (iii) to (vi) of this question. A sample of papers provided the following responses:

For the projects named and referred to in the remainder of the question:

(1)	COTS	30% of the sample
	Sirofloc	23%
	Synroc	15.5%
	Bush Fly Reduction	12%
(2)	Sirofloc	20% of the sample
	Einstein Rings	17.5%
	Synroc	16.5%
	Bush Fly Reduction	14.5%

Less common programs included Solar Cells, the Anglo-Australian Telescope, and Ice Core Drilling.

Although some candidates failed to outline clearly the aims of each program nominated, this part was generally well answered. Some nominated Research Programs which were not on the updated list of Australian Research Projects.

(iii) Many students did not understand the scientific principles that underlie the project they chose and, hence, this part was very poorly answered. A number described the program of activities rather than the underlying scientific content. It is emphasised that the subject is expected to have a scientific content.

(iv) The way(s) in which the project was being carried out was generally well known, but candidates had difficulty in identifying new developments for some projects

(v) Answers here were poor. At times *reported* was confused with *recorded.* Many referred to the *results* of the project, rather than the *way* in which it was being reported to the general public or to scientific organisations.

(vi) This was also poorly answered and many candidates were not able to suggest possible conclusions. Stating that nothing was unexpected was not an acceptable response. Students should be encouraged to consider a wide range of possible outcomes of a project.

(b) (i) This part, which was very well answered, asked students to answer questions relating to a research project of their own. A sample of papers provided the following list of popular research projects:

Removal of stains with solvents	14.5% of the sample
Testing the insulation effects of different materials	12%
Phototropism in plants	6.5%
Green-rot disease	5.5%

A significant number in the sample (10%) made no response, or made an inappropriate response to this part.

(ii) Although this was also generally well answered, in order to score full marks candidates needed to be specific about what they actually measured. Students should be encouraged to choose projects that contain well defined variables as well as controls and conclusions that can be clearly reported.

(iii) The conclusions were well stated, but candidates who obtained full marks were those who were able to demonstrate clearly how they reached their conclusion. Students are reminded that *conclusions can be broad statements* but *results are specific observations or measurements*.

(iv) Answers here were very poor. Many candidates suggested more of the same experiment, which was not accepted as it failed to provide greater understanding of the existing results. New information from a different or related study was required.

(c) (i) This was generally well answered. Some typical good answers included:

- *extra physical maturity over the extra year*
- *smaller groups providing more individual attention*
- *motivation to improve on last year's poor results.*

Simply assuming that this year's training was longer or more vigorous was not an acceptable answer.

(ii) and (iii) Both these parts were well answered.

(iv) Candidates found this section difficult. It was necessary to make a choice and justify it by clearly showing how the information provided in the question was interpreted, thus enabling them to reach their conclusion. They should be careful not simply to restate the question.

Question 6 : Significant Technological Achievements

Some concern has been expressed at the inclusion of the statement relating to students' carrying out experiments as part of their studies. It should be noted that the Objectives and Outcomes for this subject state that students will be able to *apply scientific knowledge to a variety of practical situations*, and to *use scientific and/.or technological models to deduce information* (Applied Studies Syllabus, p5). Many students had not conducted an experiment and therefore scored poorly in this question.

Parts (a) and (b) required students to select two different technological achievements.

A sample of papers provided the following most common achievements referred to for part (a):

Milk Products	37%	of the sample
Superwash Wool	17.5%	of the sample
Air Traffic Control	5.5%	of the sample
Refrigeration	5.5%	of the sample
Grape Products	5.5%	of the sample
PET	5.5%	of the sample
Fibre Optics	5.5%	of the sample

The following achievements were most common for answers to part (b):

Milk Products	16.5%	of the sample
Superwash Wool	14%	of the sample
Genetic Engineering	13%	of the sample

(a) (ii) and (iii) A number of students had not carried out an experiment relating to significant technological achievements, which led to some poor responses for parts (ii) to (v). Even so, most of the responses that were presented scored well.

(iv) It appeared that the concept of variables was well understood, as a result responses to this part were good.

(v) Results were generally well reported, with relevant conclusions being drawn.

(b) (ii) This part asked students to describe the advances in **technology** that led to the development of the achievement named in (b)(i). Some students chose to name a pre-existing technology, rather than technological advances that led to the named achievement. For example, developments in electric traction motors, the growth in centralised power stations, and the development of power distribution grids all contributed to the development of the electric train. Advances in the understanding and make-up of genes led to the concept of genetic engineering.

(iii) This was possibly not well understood and, consequently, not well answered. The technological basis of an ice chest is a block of ice (at a temperature lower than the items in the chest) in a chamber adjacent to the food to be cooled. For its advancement, the refrigerator, the technological basis is the mechanical compression of gases and their subsequent expansion, allowing heat to be extracted from the food chamber.

(iv) This was well done.

(v) This part was poorly done. In many cases students made a comparison between the technological achievement named in part (a) and that in part (b) rather than the technological achievement named in (b)(i) and its relevant predecessor.

(vi) This part was generally well done with students successfully delineating a positive and a negative effect on society of the use of the specific technology.

(c) (i) and (ii) These parts were not well done, and often design features and marketing methods (part ii) were repeated as a response. The terms *design features* and *marketable products* were not well understood. Often *design features* given were not relevant to the technology, but rather to some extension or other application of the technology.

(iii) This part was well done. A number of students, however, repeated answers given in part (b)(vi).

Question 7 : Statistical Methods

(a) (i) Most students could place 87.5 marks at 2.5 standard deviations above the mean and shaded in the area above this. Many could not read the z-score table in order to convert the information into a percentage.

(ii) Students had more success in this part and could relate to the idea of the mark of 87.5 being only 2 standard deviations above the mean.

(b) This question was attempted reasonably well.

(c) (i) About half of the students could state a hypothesis, the remainder just gave a question that they wanted to answer.

(ii) Many students did not specify the considerations to be taken into account. Their answers tended to be very vague.

(iii) A number of candidates did not answer this question well. Their survey was weak and, consequently, their results were vague. Those who had completed the survey were able to answer this much more easily. It was obvious that many candidates made up a survey and, consequently, their answers were poor.

Question 8 : Technology and the Consumer

(a) (i) No marks were awarded for naming one consumer product critically evaluated in the course.

(ii) Many responses indicated that students had not read the question. They were required to discuss *how* they had researched and compared brands/models, referring to two specific criteria.

A number of students, however, simply listed features without any reference to the methods they used for testing, as in the following:

Sample response:

Cordless Drills

Safety: Cordless drills were found to be much safer than their power-driven counterparts especially if they are used up ladders or in damp areas where electrocution is possible. It was discovered, however, that some cordless drills contained more safety features than others, for example, some drills incorporated a keyless chuck so that you did not have a chuck dangling around near your drill. Other drills came with safety goggles that offered protection while drilling and most of the cordless drills came with a hard plastic outer shell that protected your hands from the moving components. This research came from examining various drills and reading test reports in magazines.

(iii) On the whole this was well answered. The only problems here were some confusion between target markets and marketing strategies - the latter not being required. Many students gave only one reason:

Sample response:

The target market group for a cordless drill would be tradesmen who require a drill to do things where power is not available or a handyman who works on cars or boats where it is more convenient to have a cordless battery-operated drill.

(b) (i) Answers here were generally good. Problems occurred mainly when students did not relate their answers to society, i.e. some responses related the impact on the individual rather than on society.

(ii) Many students did not say what the specific product actually did. There was considerable confusion over the words *scientific* and *technological*.

(c) (i) Responses seemed to indicate students' extreme negativity regarding the merchandise. Somementioned guarantees and the right to return goods. Few, however, mentioned the fact that the buyer needed to ensure that he/she knew all the features of the products.

(ii) Roles of advertising were generally well known.

(d) Answers here needed to be very specific to gain marks.

Sample response:

(i) The best product would be the Pocketphone. Firstly it is a digital phone which opens up more options for the consumer than owning an analogue phone. The phone is relatively light weight and has the largest talk-time capacity. It is small in dimension and offers many features to the consumer including a mobile charger. Finally it is priced very well for a digital phone, since the other digital phone is much more expensive.

(ii) The model which would offer the least benefit to the consumer would be the Superphone. It is an analogue phone that will be phased out by the Year 2000 and does not offer a range of services like the digital network. The features included on the phone are limited and the talk-time for the battery is the smallest of the three phones.

Question 9 : Technology of Communication Systems

In part (a) students were asked to select one of the four systems given. A significant sample of papers provided the following response rate:

Telephone	49%	of the sample
Computer networks	21%	of the sample
Radio	19%	of the sample
Television	7%	of the sample
Nil response	4%	of the sample

(a) (i) Many diagrams were incomplete, showing only one end of the specific system. This was particularly so in the case of those relating to the telephone system. More than half of the candidates submitted poor diagrams. Attention to detail, and clear labelling of specialised equipment were poor in the majority of cases. The complete system should be studied and not simply the *device*, i.e. television set. Often the modem was described as being a device that increased the voltage of the system rather than the analogue/digital conversion function it actually has.

In dealing with computer networks there was some confusion over the application of LANs and WANs. Some students drew a LAN configuration for (i) but would then answer the remainder of the part by referring to a WAN.

(ii) Description of the specific encoding and decoding device varied according to the system covered. Telephones, on the whole, were described well, although some students failed to describe them! Radio was not at all well understood. There was some overlap in responses to (ii) and (iv), neither part being well answered.

(iii) This part was generally well answered, although discussing *cost* alone was unacceptable. Those who referred to cost as a limitation had to state *why* it was a limitation, i.e. *initial capital cost may be a limitation in the short term, but an advantage in the long term.*

(iv) This part was poorly answered. Concern was expressed that few students had a good understanding of the scientific principles and technological functioning of the specific systems.

(v) Stating that a student would not be inconvenienced by the collapse of a specific communication system because he/she did not use the system was not acceptable. The question asked students to *imagine* that the system studied had failed and, therefore, they needed to answer accordingly. The lack of a time-frame relating to the collapse led to a variety of responses, some even assuming that the system no longer existed. Nevertheless, the part was well answered.

(b) (i) Many students resorted to repeating the information given in the leader to the question without really thinking about the consequences of the situation. Simply saying that the system was devised to *help in an emergency* was not acceptable.

(ii) Responses were many and varied, and generally this part was very well done.

(iii) A number of students were unable to relate to the connection between *noise* and interference and its effect on transmission of a message, consequently it was not uncommon to see responses that suggested that if there were a lot of noise it would not affect the communication.

(iv) and (v) These parts were not well answered.

Question 10 : The Environment

(a) (i) This part was well answered.

(ii) Students confused the *Greenhouse effect* with *Ozone Depletion*, and *UV radiation* with *infra-red radiation*.

Students did not understand the role of the CO molecule in terms of the upward trend in temperature.

(iii) and (iv) Both parts were well answered.

(b) (i) About half of the candidature gave TWO benefits that the suggested research could have on Australian agriculture. Some did not link the stem of the question and the specific question.

(ii) This question was generally poorly answered. Students could not explain the meaning of *sustainable* agriculture and thus could not relate it to either soil erosion or soil salination.

Some gave exemplary answers in discussing sustainability and related it well to soil erosion and soil salination, nevertheless, it was felt that these students might have studied the information in another area of the curriculum.

(iii) ONE possible positive outcome was discussed well, unlike ONE negative outcome.

(c) (i) This question was generally well answered.

(ii) Most students had a good understanding of what and how they had studied. They communicated their problem, methods, data, results and conclusions well. Some, however, had difficulty in describing what they had actually done, e.g. water testing was often cited as a method but without adequate explanation of what types of tests were used.

(iv) Some students had difficulty in analysing the social and, more specifically, the political impact of their research on the political and/or economic life of their community.