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1997 HIGHER SCHOOL CERTIFICATE EXAMINATION APPLIED STUDIES

EXAMINATION REPORT

In 1997 1212 candidates presented for this examination, an increase of approximately 32% over the candidature for 1996. The following is a breakdown of the percentage of students attempting each section.

1 UNIT

General Comments

This year's candidates continued the bias towards biological studies and away from the mathematically based topics. This course requires an understanding of the Syllabus and the technologies upon which it is based. There has been a great reduction in the number of incorrectly studied technologies but it must be emphasised that Board documents must be understood and that only the technologies prescribed can be taught. Another pattern appeared this year whereby some students had not completed some of the mandatory requirements of the Syllabus, such as studying two different technologies or carrying out 10 hours of laboratory work.

Question	Percentage (%)
1	14.7
2	12.0
3	8.1
4	64.2
5	23.1
6	4.8
8	52.2
9	28.8
10	61.2

Question 1 Application of Computer-Controlled Systems

(a) (i) This was reasonably well answered, with most candidates choosing the correct answer.

(ii) The correct answer, *B*, was not chosen by many students; the majority appeared to be guessing since they were obviously not confident in identifying a feedback loop.

(iii) Those who stated that counting cars was the task of the photo-detector/laser (*A*) were counted as being correct.

If, however, the coin box and the photo-detector/laser completed a counting loop, then *B* is correct.

(iv) This part was also not well answered, *A* being the correct answer.

(v) Students generally identified the following possible purposes of the photo-detector and laser at the gates:

- to count cars
- to close the boom gate
- to keep the boom open while the whole car passed through
- to assist in controlling the *car park full* sign.

Tests given were generally consistent with the purpose given.

(vi) This part was poorly answered — evidence of a cut-out switch or similar was required.

(vii) A number of students showed little evidence that they knew what an algorithm or flowchart was and appeared to have had insufficient experience in developing either.

Marks were awarded to those who identified appropriate control structures such as *loops* and *decisions* and showed an understanding of the dual inputs of cars entering and leaving. Students also gained marks for identifying a counter.

(viii) Social implications given concentrated on employment issues.

(b) (i) A significant number of students appeared **not** to have studied an **appropriate** *real world* computer-controlled system.

Systems that gained full marks were those that had readily identifiable sensors, actuators and feedback loops. Good examples of this were:

- SCATS
- Computer-controlled greenhouse
- Computer-controlled watering system.

Although the Sydney Harbour Tunnel is a good system, students often failed to gain full marks because of the system's complexity and hence the students' inability to identify the relevant parts.

(ii–iv) These parts were generally well done; many students identified an appropriate system.

(v) Social issues were generally discussed well, but many candidates had difficulty in identifying **ethical** issues.

Question 2 Applied Mathematical Skills

The question covered all aspects of the Syllabus. It was possible to achieve good marks if all aspects of the module had been studied.

No student gained full marks, several gained no marks and the distribution of marks was definitely bimodal.

(a) (i) *Profit = 2.5x + 3.25y*

(ii) *Profit = 2.5 x 250 + 3.25 x 250*
= $1437.50

(iii) *Currently 90 plums and 75 peaches*

Profit	=	*90* x *25 + 75* x *3.25*
	=	*$468.75*
Increase in profit	=	*$1437.50 – $468.75*
	=	*$968.75*

- Students must read the question carefully.
- Many were able to get full marks for this question.
- Those who lost marks did not use figures within the given constraints in (ii) or could not determine the initial profit in (iii).
- A few students could not answer (i) correctly, yet used the correct equation in (ii) and (iii).

(b) (i) Answer: *41 small cups served and 20 large cups.*

- Many students treated large and small drinks in the same way.
- A number of students looked at only one queue and not both.

(ii) Answers: *It takes seven minutes for the queue for regular sized soft drinks to be empty*.

- Those who attempted to work through this question methodically gained full marks.

(c) (i) Most students could recognise the fact that this equation represented a Malthusian population growth; such students were very successful in this question.

(ii) Answer: *70 155 kangaroos.*

- The majority of students gained full marks here, although many stated six years or 1997 years.
- A common mistake was not converting the answer to thousands.
- A number of students could not use the exponential key on their calculators.

(iii) *70155 ÷ 17 300 = 4, hence the population growth does not support the newspaper claims.*

- Many students DID NOT SHOW that their results did not support this claim.

(d) Answer: *$125 942.89.*

- In spite of the simplicity of this question, many students were not able to substitute the $150 000.00 correctly into the equation.
- When working with money, many students answered to one decimal place or four decimal places. This is not to be encouraged.

Question 3 Mathematical Ideas

Students were not very successful in answering this question, although it was quite simple.

(a) (i) Ptolemy assumed that the Earth was the centre of the universe and that the planets and the sun move about the Earth in circular orbits.

Copernicus changed this model, stating that the planets orbited the sun.

Most students knew the difference between the two models.

(ii) Kepler suggested that the planets followed orbits that are elliptical, with the sun at one focus.

Again, most students answered this question satisfactorily.

(iii)
- Many students did not draw elliptical orbits or the sun at a focus.
- A number of students drew the orbit of Mars inside the orbit of the Earth.

(b) A rational number is a number which can be expressed as a fraction, p/q, where p and q are integers and q does not equal 0.
- The majority of students could not explain what a rational number was.
- Most students showed $3\frac{1}{7} > \pi$ by using their calculators.

(c) (i) For a network to be traversable it must have no odd vertices.
- Most students had no idea of Euler's network theory.
- Many who had studied network theory did not understand the simplicity of this question and tried to make it more complicated than it really was.

(ii) Most students gained marks in this section by supplying a simple explanation.

(d) Answers here were not wholly satisfactory.
- Some diagrams were incomprehensible.
- Students should be encouraged to practise using their geometrical instruments.

Question 4 Science and Medicine

Half the candidature chose to study asthma in detail but many did not have an understanding of the pharmaceuticals used in the monitoring and treatment of the disease.

(a) (i) Students need to have studied scientific principles carefully so that they can reiterate the basic scientific principles underpinning the development of the diagnostic technique they have studied. This question tested only knowledge/recall.

(ii) This was well answered.

(iii) This was poorly answered. Students need practice in working through examples of the application of scientific method.

(b) (i) Answers here showed that students need to research the factors contributing to the condition they have studied.

(ii) Answers here were non-discriminating and based on recall only.

(iii) Students need to research the link between factors contributing to the specific condition and effective treatment of it.

(iv) Students need to examine thoroughly the scientific processes involved in the testing of pharmaceuticals.

(v) Investigation of the development of treatment procedures is a very necessary element of the course.

(c) (i) Students were not sure what this question required. They *must* know what constitutes a valid test.

(ii) Although this was not a question that discriminated broadly between students, answers were generally good. Students were able to define *double blind* and give examples.

(iii) Students must be familiar with specified examples of scientific testing.

Question 5 Scientific Research

(a) It was evident that most students had studied two projects as required by the Syllabus and knew much about the topics; many, however, had considerable difficulty in answering the relevant sections of the question correctly. This year's question was soundly based on processes of scientific procedure and those who were able to differentiate between *problem, aim, procedure* and *design* were rewarded with good marks.

Care should be taken to ensure that the specific projects are examined as examples of scientific research and **not** as proven technological achievements, even though in some cases, the results have, in fact, been implemented. Care should also be taken by students to ensure that they are, in fact, answering what the question asks and not just writing all they know about the subject.

(i) 1 Here students should have emphasised the *problem* the research program was investigating.

2 Emphasis of any *scientific procedure* used in the program was expected here: examples could have included *monitoring of small areas, building of pilot plants, analysing of samples, carrying out breeding trials, etc,* introducing specific details of how this was done in the specific program. The question referred to **what** the researchers were doing in their program and **not** what the students did to gain understanding of the program.

(ii) 2 This part emphasised the ***reason for the design of the program*** and students were expected to explain why the specific approach being investigated by the researchers was chosen to deal with the problem. This section was not well answered.

(b) This part, as specified in the Syllabus, covered a research program of each student's own design. The chosen project should be carefully monitored, whether done as an individual or a group project and students should be encouraged to carry out a type of experiment. Projects which involve actual measurements, readings or observations have a better chance of success in all sections of this type of question, while, in general, literature reviews or student surveys tend to become too involved in one or more parts of this question.

(i) Answers here were generally good.

(ii) Students described the design detail of the equipment accurately but very few described how the results were to be obtained or even what measurements were to be taken or what information was to be recorded.

(iii) Answers here were not good: once again, the question asked for a description of the influence of the review of relevant literature on the student's investigation and marks were given only where specific details were provided.

(iv) Most students were able to give a conclusion from their investigation but found it difficult to relate this to a larger problem, if a relatively unimportant investigation had been chosen.

(c) This question was generally well attempted and most students gained good marks since they appeared to have a good understanding of the problems associated with backpacks.

(i) This was well answered.

(ii) As with part (b), students were able to describe ways of ensuring sample sizes and groupings, but rarely described what was actually measured, observed or recorded. References to *testing of backpacks* were not sufficiently detailed to gain marks.

(iii) This was the poorest of the responses: the best framed questions around *what long-term damage was done to spines by bad designs or what techniques are used to test materials*. The majority of students responded with poor answers, indicating only what the testers had found out.

Question 6 Significant Technological Achievements

The words *describe* and *explain* require an answer of more than one line. Moreover, answers must contain some factual details or reasons which support comments made.

(a) (i) Although this was generally well answered, students need to be reminded not to use, in their definition, the terms given in the question.

(ii) Some students had obviously not carried out a practical experience. Moreover, some of those described did not relate to the technological achievement that had been studied. When choosing two achievements, practical experiments that can be conducted within the classroom should be considered.

(b) (i) Here students should have selected an achievement from the list provided.

(ii) Greater emphasis should have been placed on the *scientific* principles of operation of the technological achievement: students' knowledge of the technical workings of an achievement were generally poor or limited.

(iii) This question was interpreted in many different ways. Instead of describing *how* the achievement was implemented, they discussed *why* or *where* it was implemented. Most students' knowledge of historical facts leading to the achievements was either limited, incorrect or poor.

(iv) Answers here were fairly good.

(c) (i) Students are again reminded that an achievement must be selected from the list provided.

(ii) Some responses gave a detailed historical report of technology available in the area nominated or concentrated on very early technologies related to the achievement instead of focusing on that available immediately prior to the relevant one. Most responses stated the previous technology without providing any description. Since this part was worth only one mark, a single word response was accepted.

(iii) Most responses stated **why** the old technology was replaced without providing an explanation.

(iv) This part was answered very well.

(d) (i) Those who decided that the quotation failed to match the two specific achievements could generally not justify their opinions with factual or sensible reasons.

(ii) Some students related the impacts of the achievement on either themselves or other individuals rather than its effects on society as a whole.

(iii) This was answered in one of two ways – by describing either the impact of the achievement itself on the production, or the follow–on effects on production in other related areas because of it. Both were acceptable.

Question 7 Statistical Methods

The majority of students had difficulty in scoring well in this question. Those who find it very hard to explain mathematical concepts and changes, need to practise explaining hypothetical situations and expressing themselves clearly.

(a) (i)

z scores	**No of calls**
-1	108
0	120
1	132

- Students answered this question very well and seemed able to cope with simple z-scores.
- Diagrams were, on the whole, well drawn, although some students failed to draw a diagram.

(ii) Answer: 32 days

- Most students recognised that more than 132 calls was more than one standard deviation and used the percentages given to calculate the answer.
- Better marks were obtained when all working was shown.

(b) (i) A few candidates could not see that both claims could be true.

- Students were very confused with the term *explaining the concept of* and often simply restated the question.

(ii) 1 The median population would increase as there would be fewer countries

and higher populations.

2 The average would increase as the divisor is smaller.

3 There would be less spread, hence the range would decrease.

- Students found it difficult to explain logically their reasoning for the changes in measures of spread.
- Many were unable to use mathematical language.

(c) (i) The term *bias* means that one group is favoured more than others or does not represent a fair sampling.

- Many students talked of *personal bias* rather than *statistical bias.*

(ii) 70% is not a reliable measure, since a very small number was surveyed and it did not reflect the whole population.

(iii) This would not be a good method of increasing the reliability of the survey: although it does increase sample size, it still reflects the same bias as the small sample.

- Many students mentioned the restricted sampling in (ii) but failed to see that this bias was compounded by continuing to sample the same groups.

(iv) A random sample taken from a wide cross-section of the community would improve the design of the survey.

- This part of the question was well answered, as students recognised the restricted grouping and were able to discuss the different types of surveys they would use.

Question 8 Technology and the Consumer

Answers to this question were generally good.

(a) Students were able to identify a product or category from the list and answer all the parts of this question.

The poorest responses were for part (v) where many students had difficulty in identifying factors, other than cost, for best buys.

(b) Students were not as successful in answering this part. It appeared that candidates had not studied their second product in as much detail as their first. Many found it difficult to give TWO ways in which a consumer can influence the further development of the specific product.

A number of candidates were not able to describe a test to measure the appropriateness of their product. Students must be able to identify what they wish to measure as well as the test that will give them concrete results.

(c) Many students did not read the given passage carefully and, as a result, did not identify the clues given. Students should be encouraged to underline important information and use any given data in answering subsequent questions.

Answers:

(i) Powder C – *Cheapest per serve and the carbohydrate concentration is within the given limits.*

Powder D – *More convenient in liquid form and the carbohydrate concentration is within the given limits.*

Powder A – *Carbohydrate concentration within the given limits and it is an Australian-made product.*

(ii) Many students stated: *Easier to use, ready to drink, more convenient.*

(iii) Responses here included:

There are more brands on the market so there is more competition.

They wish to broaden their target market.

(iv) Reasons for:
- *less sugar than soft drinks*
- *replace lost energy.*

Reasons against:
- *not all have the right concentration of carbohydrates*
- *manufacturers influencing what our children drink*
- *excessive consumption may cause health problems.*

Question 9 Technology of Communication Systems

(a) (i) It was obvious that students were unable to apply a general model of communication out of the normal context. In particular they failed to discuss the concept of sending and receiving a message without changing its meaning, or, alternatively, the role that interference might play in distorting a message. A large number of responses simply identified the send/receive aspects of a message but failed to answer in sufficient depth.

(ii) This was generally well answered, with a variety of responses including:

- relatively simply, appropriate to task
- cost effective, inexpensive to set up and run
- provides some degree of privacy.

The more abstract responses relating to participant disabilities were considered inappropriate for the design and were disregarded. There were some very far-fetched ideas.

(iii) 1 This was also relatively well answered, with responses including:

- inefficiency of coding longer messages
- possibility of message being sent when no receiver is available
- possibility of message being mis-sent or only partially heard
- potential for noise in the system.

It is worth noting that students were penalised for contradictory statements giving both advantages and disadvantages.

2 This response should have related to part 1: it was, on the whole, however, relatively well answered.

(b) The systems most frequently referred to as having been studied, were, in order:

Telephone
Computer Networks
Radio
Television

It was clear that students had studied the systems at varying degrees, the better responses came from students who had a clear understanding of the historical, social and technical aspects of the specific system.

Most students had a reasonable understanding of the functioning of the individual components of the system. They tended to have, however, only a superficial understanding of the system. This was shown by the inability of many to synthesise their knowledge in both diagrammatic and written forms.

(ii) Students had a good knowledge of the historical contexts of specific systems (except in computer networks). It was apparent that some were unable to link the societal needs of the times to the continued development of the system.

(iii) Those who had a clear appreciation of the system handled this part well.

(iv) An understanding of the system, input device/process, medium/transfer state, and output device/process was required here. This question was handled with various degrees of success. The better answers were comprehensively labelled and showed an appreciation of the full system.

(v) Responses in the options of Radio, Computer Networks and Telephone were relatively good. Students attempting to explain how coding and decoding works in television displayed a lack of appreciation of the processes involved in the transmission of sound and video.

(vi) This part was relatively well answered by those with an appreciation of a specific system.

(vii) Many students confused the generic concept of *noise* with the communication context of
(viii) *interference.*

(ix) Answers here were generally poor, with many students referring to a noise problem in responses, or looking at the social aspects of costs. Technical limitations of the systems should have been mentioned here.

Question 10 The Environment

Basic knowledge appeared to be all that was required in answering here and few questions were very demanding. Questions were so phrased as to require a specific answer and, if students did not know the facts or could not draw upon general knowledge, their answers gained no marks.

(a) The multiple choice questions provided an interesting change in format.

(iii) This part was poorly answered since students did not have adequate understanding of a chlorinated hydrocarbon.

(b) The local issue described was not particularly scientific. This topic has become a geographical analysis – omitting the chemical and biological changes implied in the Syllabus; in fact, literature searches are beginning to dominate the answers, implying that any form of scientific testing is unnecessary. Scientific testing is obviously being avoided and it would appear that independent work by students is not being done.

(i) Most students gave a concise account of their investigation. This year for the first time more students used the Internet to gather data, talk to experts etc about the issue they were investigating.

(ii) The majority of students clearly showed how they became aware of the problem. Few, however, were sure about the level of community awareness. The question proved a good discriminator.

(iii) The greater number of candidates could describe clearly the methodology that they had employed in their own investigation. Nevertheless, they found it difficult to give an alternative methodology. This question was another good discriminator.

(iv) Answers here were generally good.

(v) Most students did not generally make the link between an ecological solution and an economic advantage.

(vi) Here students did not generally make the link between an ecological solution and an economic advantage.

(vii) Candidates produced excellent examples of public education campaigns to increase local awareness. They had trouble, however, in coming to grips with increasing responsibility. Generally they described the campaign in such detail that they overlooked the second part of the question.

(c) This was a good discriminator.

(i) Students found it difficult to suspend judgement about any connection between fluoridation and cancer.

(ii) 1 Students presented a range of answers here.

2 Many candidates were unsure of the requirements of the question. Few realised that they should employ scientific method and research the causes.

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