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1998 HSC

**EXAMINATION
REPORT**

Applied Studies

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1998 HIGHER SCHOOL CERTIFICATE EXAMINATION

APPLIED STUDIES EXAMINATION REPORT

Question 1: Applications of Computer-controlled Systems.

- (a) (i) and (a) (ii) There is a need for students to learn to differentiate clearly between sensors and effectors (actuators). This is seen to be one of the fundamentals of this area of study.
- (iii) and (iv) Answers here were satisfactory.
- (v) In answering the question on the way in which people might be affected by the type of automated building shown, the better answers were those that concentrated on how the workers might feel in this type of building, e.g. secure, comfortable, confined, etc
- (vi) This part was generally poorly answered. Students should be encouraged to consider and discuss ethical considerations in all aspects of this subject.
- (b) There was clear evidence that candidates in some centres had not studied a computer-controlled system at all and were, therefore, disadvantaged through inability to respond to the question. It is a definite requirement of the Syllabus that 'Students will study applications of computer-controlled systems', and 'elements of computer-controlled systems'.
- (i) and (ii) Answers here were satisfactory.
- (iii) The block diagram should be specific to the system chosen, preferably showing how the different parts of the system are interconnected and how data flows back and forth.
- (iv) Algorithms can be in diagrammatic or written form. If in diagram form, the correct standardised symbols should be used to denote start, end, decisions, etc. If in written form, correct terminology must be used to gain full credit in an answer.
- (v) 'Limitations of the system' should be practical and relate to the specific system. They should not be confused with a disadvantage to society.

Question 2: Applied Mathematical Skills

Exemplary Answer

- (a) (i) line 3
- (ii) Let the number of barrels of aviation fuel = x
Let the number of barrels of diesel fuel = y
Let profit = P
 $P = 8x + 6y$
- (iii) Substituting vertices into profit equations,
- (11, 12): $P = 8(2000) + 6(10\ 000)$
 $= \$76\ 000$
- (12, 13): $P = 8(8000) + 6(4000)$
 $= \$88\ 000$
- (11, 13): $P = 8(2000) + 6(4000)$
 $= \$40\ 000$

From these values, the minimum daily profit the company could expect to earn is \$40,000.

(iv) $15x + 30y = 240\ 000$

(b) (i) The CPI is calculated by taking the prices of a basket of goods used by households. These goods are categorized into 8 groups (e.g. alcohol and tobacco), and are then 'weighted' into their importance in the household and averaged off. This is then calculated to an index (base year = 100) and an increase in the index means an increase in general price levels. A decrease in the index means a decrease in general price levels.

(ii) $(131.4 - 118.6)/118.6 \times 100 = 10.8\%$

(iii) $1.108 \times 3000 = \$3324$

(iv) Firstly the percentage change has been rounded up (10.79 to 10.8) and therefore there are some discrepancies in the calculations.

Secondly, the CPI is a general price level indicator and therefore the figures do not necessarily apply to all consumer goods. For example, the price of alcohol may have risen sharply in the time period and computers may have deflated slightly. However, the CPI may still show an increase.

(c) An example would be China. The growth has slowed down due to the one child policy and limited housing and resources.

In China, while over the past few years its population had been growing at one of the fastest rates in the world, today it has slowed considerably, with its growth rate being even lower than the United States. One of the factors which led to limit the growth of China was the introduction of the 'one child' policy by the Chinese government. This saw a dramatic decrease in the country's average birth rate.

Another factor was the education and empowerment of women in China which encouraged them to use contraceptives which also slowed down the birth rate and which led to a decrease in the population growth rate.

$$\begin{aligned} \text{(d)} \quad 72\,000 &= 36\,000(1 + 8/100)^n \\ 2 &= (1 + 8/100)^n \\ 2 &= (1.08)^n \\ n &= 9.01 \end{aligned}$$

$$\begin{aligned} \text{(e)} \quad \text{(i)} \quad 25 \times 60 &= 1500 \text{ produced in an hour} \\ \text{(ii)} \quad \text{Dispatch} &= 15 \times 60 = 900 \\ \text{Backlog} &= 1500 - 900 = 600 \\ \text{(iii)} \quad 3000 / 600 &= 5 \\ &\text{Therefore the time will be 2:00p.m.} \\ \text{(iv)} \quad 3000 / 15 &= 200 \text{ min} \\ 200 / 60 &= 3.333333 \\ &= 3 \text{ h } 20 \text{ minutes} \\ &5: 20 \text{ p.m.} \end{aligned}$$

Question 3: Mathematical Ideas

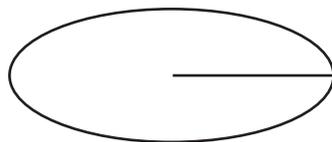
- (a) (i) This concept was examined previously in Mathematical Ideas and was well answered.
- (ii) Students always find 'explain' or 'discuss' questions difficult to answer, the majority rewrote the question and then repeated their answer to (i). Students were required to give a valid reason for religious and scientific conflict e.g. the Bible states that the Earth is the centre of the universe; religious leaders believed that God made man and the Earth unique and perfect and at the centre of all things.
- (b) (i) Students had a vague idea of what the semi-major axis was, but few defined it as the distance from the centre of an ellipse along its longest axis.
- (ii) Many were not able to cope with the substitution required here. The squares and cubes proved difficult for those who did a substitution as they were subsequently unable to solve the equation.
- (c) The sketches of the path of the planet Migid (ellipses) were generally poorly drawn and were not labelled.
- (d) (i) Many students had difficulty in calculating the sum of this series to the first four terms.
- (ii) Most candidates were able to give the next term in the series.
- (iii) Students generally did not recognise the series, and were unable to understand its historical relevance or its relationship to Archimedes' approximation.
- (e) (i) Candidates needed to be very precise in their definition of a fractal. Many were not able to give a definition and others tried to describe the process used to obtain the next stage of the example given in the question.
- (ii) 1. Candidates needed to give a clear description of the generation of the fractal. Many were unfamiliar with the fractal and gave vague descriptions.
2. Most students had difficulty in calculating the perimeter correctly.
3. The majority had difficulty in understanding the question, hence many of them simply repeated it as their response. By using their answers to (2) they should have seen the relationship between the perimeters of Stages 1 and 2. Students need to understand the concept of a limiting area.

Question 3: Mathematical Ideas

Exemplary Answer:

- (a) (i) Ptolemy's model of planetary motion placed the Earth at the centre of the universe with all things revolving around it (geocentric universe). Copernicus suggested in his model that the sun was actually at the centre and that the Earth and other planets revolved around it (heliocentric universe)
- (ii) The conflict was based on a few things.
- We had always believed the Earth to be the centre of the universe as all things fell towards it.
 - If the sun was the centre of the universe, then all things should fall towards it.
 - The Copernican Theory was still not precise in predicting future positions of planets.
 - There were statements in the Bible (Book of Kings) which suggested the Earth to be the centre of the universe therefore religious leaders caused conflicts also.

- (b) (i) The semi major axis is the mean distance of the planet to the sun.
If the path is drawn, then the semi major axis would be:



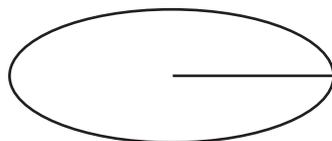
$$(ii) \frac{(0.61)^2}{P_B^2} = \frac{(0.72)^3}{(9.54)^2}$$

$$P_B^2 = 865.5801828$$

$$P_B = 29.42074409$$

It takes 29.4 years (1 decimal place)

- (c)



- (d) (i) $\pi = 4 \times (1 - \frac{2}{15} - \frac{2}{63} - \frac{2}{143})$
 $= 3.28$
- (ii) $\frac{2}{15 \times 17}$
- (iii) The series in the Leibnitz formula is a descending sequence as the denominator is an ascending sequence. This means that for each additional term the value of the brackets is decreasing and slowing getting to the value of Archimedes' estimate and therefore there are many terms required in the Leibnitz formula to fall within the limits of the Archimedes formula.
- (e) (i) A fractal is a self copying image where the image is changed by applying a consistent rule of generation. Each small part resembles that of the whole image.
- (ii) 1. Each side of the fractal is divided into thirds. The middle third is removed and an equilateral triangle is drawn in its place using the erased edge as its base (or a side).
2. Stage 1: $3 \times 4 = 12$
 12×3 sides
Perimeter of Stage 1 = 36 cm.
Stage 2 = 4×12
Perimeter of Stage 2 = 48 cm.
3. There is a limiting size on the plane of which a fractal can take up. It can still grow but will not overlap the area. In this finite area though, the fractal can continue to grow, increasing length indefinitely but only in a finite space.

Question 4: Science and Medicine

- (a)
- (i) Most students answered this part correctly. A wide range of possible answers was acceptable.
 - (ii) The table required little interpretation, and consequently the majority of students were able to interpret it correctly .
 - (iii) Many students simply related answers to general structural differences e.g. ‘bigger males, males eat more’. Accepted answers used correct biological terms e.g. ‘metabolism’, ‘genetic make-up’, ‘hormonal differences’ etc rather than saying ‘a difference in size’.
 - (iv) This was a straightforward question and most students gained a mark here.
 - (v) Limited responses were given to this question. It was easy to earn a mark if the response were linked back to part (iv). Few students, however, described an experiment and most showed a poor understanding of the scientific method.
 - (vi) Good candidates understood that clinical trials involve the use of humans.
 - (vii) This question was easily answered by candidates, who favoured ‘obese’.
 - (viii) Here was an opportunity for candidates to demonstrate a knowledge of blind and double blind testing procedures. The term ‘placebo’ was used by those who had a good understanding of the scientific method.
- (b)
- (i) The two most common selections were Asthma and Diabetes.
 - (ii) There were numerous poor answers here. A mechanical device eg. puffer, ventilator, nebuliser etc was frequently chosen as a pharmaceutical used to treat or prevent the chosen condition.
 - (iii) Responses here were very basic. Many students did not know how the pharmaceutical worked and their answers were not specific enough.
 - (iv) Answers in this section were not specific in describing the side effects. Poorer answers stated ‘nausea and headaches’ as a limitation of the pharmaceutical in treatment or prevention of the condition. They were, in fact, in line with symptoms of the disease.

- (c) Students often restated what they saw in the stimulus pictures without showing much knowledge of the scientific principles on which the techniques were based. Very general language and insufficient technical terminology were used in many responses.

Most candidates elected X-rays and ultrasonography.

A number of candidates gave only limited and very basic responses. They needed to understand fully the scientific principles for the procedure. Good responses included use of specific terminology e.g. 'high frequency sound waves, electromagnetic radiation, photographic film, dense structures, reflection or rebounding of sound'.

Few candidates chose to discuss radioisotopes. Many restated what they saw in the stimulus pictures e.g. 'You can see bones'. This did not explain the advantages of using the specific technique to produce the image.

Many students confused part (iv) with part (v) or misinterpreted the question i.e. many gave an interpretation of the technique rather than the limitations of the image produced. Saying, for example: 'Ensuring that sufficient water was consumed for an ultrasound' is a precaution rather than a limitation for the image to be produced by the technique.

Question 5: Scientific Research

General Comments

Students must be able to present exact information about the specific Australian research program studied.

Students must be able to conduct a valid scientific project of their own, based on information gained from a review of relevant literature. They must also be familiar with the scientific method. Questionnaires are not experiments. Some valid experiments included:

- acid rain on plants
- materials that best separate oil from water
- certain treatments on the growth of plants
- the effects of chemicals on metals

Students should be able to discuss/analyse/interpret an experimental method from previously unseen information.

- (a)
- (i) This part was handled satisfactorily.
 - (ii) Many students described the project problem instead of the project implementation.
 - (iii) A number of candidates were not familiar with the results of the projects.
- (b)
- (i) The aims and hypothesis of a specific project were written well. Some students, however, could not distinguish between the two.
 - (ii) Students need to be drilled on the variables and controls (if any) that could be included in their specific research.
 - (iii) It was clear that many students did not read / could not discuss the relevance of their conclusions to other work in this field. It is suggested that students should review the relevant literature prior to conducting a research project.
- (c)
- (i) Answers here were satisfactory.
 - (ii) Most students successfully identified the control group for the hypothesis in part (i).
 - (iii) Candidates appeared to find it difficult to understand the format of these experiments. Many could not describe the relative effectiveness of the teaching methods.
 - (iv) Most answers included a discussion about the size of the preferred group.

Question 6: Significant Technological Achievements

Students should practise answering the question asked, too many just repeat everything they have learnt on any specific topic. In this question students had difficulty in distinguishing between industry, society and production.

- (a)
 - (i) The majority of candidates had no difficulty in naming a technological achievement they had studied.
 - (ii) This part was handled well.
 - (iii) and (iv) Most candidates had little difficulty in answering both these parts.
 - (v) Answers should have stated where the item was to be marketed (TV, radio, newspaper, etc) and which specific group (e.g. farmers, etc) was targeted and not what the advertising campaign was going to say e.g. comparing different products, slogans, etc.
- (b)
 - (i) This part was well answered.
 - (ii) This question also was generally well answered. Students needed only to state alternative technology that existed ‘immediately’ before the achievement and not give a complete history dating back to B.C.
 - (iii) Students need practice in drawing relevant diagrams for all areas.
 - (iv) This part was generally not answered at all well.
- (c) Some students who had not been involved in a relevant practical activity on the technological achievement found this part difficult.

Question 7: Statistical Methods

- (a) (i) Students needed to read the question carefully; some did not know how an additional mistaken score affects the range, mode and median of a set of numbers. Emphasis should be placed on changes to the spread when erroneous data is added to the set.
- (ii) The purpose of the interquartile range should also be emphasised. This question was not answered well since some students could not give a clear definition of the interquartile range nor its purpose.
- (b) Some students did not know how to calculate the 'Z' score statistic. Those who did so were able to compare the two tests results in the question. The 'Z' score statistic and the 'Z' test should be emphasised as different measures of spread.
- (c) Students knew the 'Z' test, but some, although they knew the formula, made calculator errors. Students should be familiar with the process required on their calculators, i.e. entering the denominator into memory and then dividing the numerator by the denominator.
- (d) (i) This part was well answered.
- (ii) Some students lost sight of the fact that Group B stratified their sample. It is again emphasised that the question should be read carefully.

Most students understood both the process involved in stratifying a sample and the factors that influence the study.

The sample size of 200 might have been too small to be a good representation of the population. It might include only people from high or low socio-economic backgrounds who are not representative of the whole community, since it excludes people who shop at different shopping centres and people who work on a Wednesday morning.

The same number of people should be sampled from each group in the community i.e. the same number of both the high socio-economic group and the low socio-economic group, the same number of men and women, old and young. If this is not done perhaps one group will have greater influence in the decision-making process and this may give inaccurate results.

As many community groups as possible should be included to ensure both a fair spread and variety of opinions i.e. different socio-economic groups, different ages, sexes, areas in the community. This is vital in order to obtain accurate results from the sample. Without such varied groups, only one opinion will be heard and this increases error and inaccuracy.

- (iii) Answers here were good. People who feel strongly one way or the other will vote. Some, however, may not vote because they have forgotten or are overseas. Advertising may target a particular group and, as a result, only a certain section of the population will vote.

Question 8: Technology and the Consumer

In general, students tended to write all they knew about their chosen product without relating it to the question asked.

Students need to read each question carefully and to give only relevant information.

- (a) (ii) This part was not answered well, since students showed no real understanding of aesthetic qualities and guarantees/warranties. Some did not indicate how they evaluated each criteria.
- (iii) 1. Some students did not know the meaning of 'detrimental' or referred to individuals rather than society.
2. Students' answers indicated how to reduce the effect on society but not how consumers could be educated in order to do so.
- (b) (ii) Here students described the materials for the packaging not for the product.
- (iii) This part was well answered by the majority of candidates.
- (iv) Some of the possible tests students described were vague. Safety aspects of the product needed to be tested and compared. Many students failed to compare different brands.
- (v) Similarly, when asked to describe another test that could be used to compare different brands of a product, students did not clearly explain how the best buy could be determined.
- (c) (i), (ii) and (iii)
These parts were well answered. Most students were able to identify the better product and also successfully described a marketing strategy for their target group. Again, as in previous parts of the question, when asked to discuss tests, they were unable to give clear descriptions or to relate the results back to the question asked.

Question 9: Technology of Communication Systems

General Comments

Candidates supplied answers related to more than one communication system. Students are reminded to read all parts of the question carefully so that if the question relates to 'ways' more than one should be discussed.

- (a) (i) Candidates provided a limitation relating to only one system. Many discussed limitations of the act rather than the communication system.
- (ii) Candidates provided only ONE improvement, many correctly suggested adding sound/hand signals to improve the system.
- (b) (i) Answers here were satisfactory.
- (ii) Candidates easily identified an inventor/s but failed to indicate a reasonable time-frame. Candidates did not show the complete development of a system, i.e. before invention - developments of system - present day use.
- (iii) Candidates confused the term 'communication medium' with specialised equipment used in the system or stated 'encoding and decoding devices' without acknowledging the technical processes involved.
- (iv) This was a well answered question.
- (v) Candidates defined 'noise' but did not explain how it could be minimised. Any improvement must be to the actual system or the specialised equipment within the system. Turning down the volume is not an improvement.
- (c) (i) Some candidates incorrectly named an accessory of the specialised equipment e.g. VCR instead of television, answering machine instead of a telephone, floppy disk instead of computer.
- (ii) Drawings included the piece of equipment but did not show how it integrates with the whole system.
- (iii) Many candidates gave only one solution to correct the limitation.

Question 10: The Environment

(a) All candidates were able to identify a local issue that had been investigated. A wide range of answers were possible and were accepted. The majority gained a mark by simply relating a general change and linking it back to the local investigation studied.

(iii) A number of students answered this question by describing a variety of information-gathering processes that they had undertaken e.g. going to the library, phoning the local council, using the Internet etc.

Although the better answers included a variety of research techniques, these answers were rarely specific. An example would simply state, 'we tested for pH'. This was not elaborated, however, to include what was being tested e.g. soil, water, how it was tested e.g. Universal Indicator or pH meter. Candidates also failed to state why the test was being conducted, e.g. to test for acidity? alkalinity?

(iv) Most students were able to state a finding from their research and gained a mark in the question. Many, however, failed to give more than one, suggesting that they had not correctly interpreted the question which asked for findings of their research.

(v) This question was very poorly answered. Most students were able to relate the issue they had investigated to a global issue only in very general terms. They simply made sweeping anecdotal references to other countries without giving evidence of any clear understanding of the issues involved or how they related.

(vi) The majority of candidates were able to gain a mark in this question for naming any reasonable step that could be related to the issue chosen in part (i). The greater number, however, were unable to relate their response to a global problem in any meaningful way.

(b) The majority of candidates selected either ozone depletion or the greenhouse effect. Their answers, however, reflected a great deal of confusion in regard to the scientific basis which distinguished the two issues, particularly in regard to the type of gases involved and what steps could be used to solve either problem. On the whole this question was very poorly answered.

Although they answered this question by stating several environmental factors which were related to the issue selected, the majority of students were unable to differentiate between environmental and associated health effects.

Most students answered this question by stating their personal response to the issue selected saying for example, 'recycle more'. In general they were unable to differentiate between a long term and short term strategy. Furthermore the notion of time was itself ambiguous as what some students saw as a short term strategy others noted as being long term.

- (c) A large number of candidates answered this question in terms of soil salination as being the cause rather than a possible effect of soil degradation.

Answers to this question were, on the whole, too general e.g. 'use of fertilisers' or 'use of pesticides' without any explanation of why these may cause a problem. Full marks for this question were gained by those who related the answer with an effect e.g. 'use of pesticides may accumulate in soil causing soil toxicity'.

The majority of candidates gained marks for this question. Their answers, however, were limited primarily to the need to plant more trees or to stop deforestation. The better answers discussed other alternatives such as crop rotation, using sustainable agriculture and irrigation control, etc.

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