Computer Science

Overall grade boundaries

Grade:	E	D	C	B	A
Mark range:	0-7	8-15	16-22	23-28	29-36

The range and suitability of the work submitted

A wide range of topics were encountered, the vast majority of which fell correctly into the computer science category. Schools that do not offer computer science in the Diploma Programme should be particularly careful when allowing students to enter essays in this subject, as the use of computers in a particular essay topic does not necessarily mean that computer science is the correct category. The focus for a computer science essay must be on the underlying technology with regard to software, hardware or communications.

A popular topic which should be treated with caution is quantum computers. Although the topic is valid, the complexity of the theory often renders an essay written in this area as purely descriptive with little extra added from the student him/herself.

Candidate performance against each criterion

Criterion A: research question

Probably no more than half of the students gained the full 2 marks as the research questions were often too broad, which inevitably led to a descriptive essay. See the recommendations at the end of this report.

Criterion B: introduction

The introduction needs to put the different elements of the research question into context, to give the reader an adequate starting point. This could include brief descriptions or details of the present state of research. The actual research question itself should appear here with a discussion of its importance (this could provide the final paragraph). Often the introductions were too short, with material that should have been in the introductions provided later on in the essay.

Criterion C: investigation

Generally the students are quite good at the research element, but care need to be taken with regard to the quality of resources. Weaker candidates repeatedly used the same source (which should be avoided), and ones that can be edited by the general public should be treated with caution. A well-planned essay will help to provide a convincing argument. Essays that are not well-planned will not flow and will include material that is not directly relevant to the research question. Many candidates included data from their own programmed experiments which is, of course, perfectly acceptable.

Criterion D: knowledge and understanding of the topic studied

The EE gives the opportunity for the student to demonstrate his/her own knowledge and understanding of the chosen area of study. An essay can be well-researched and contain information that is completely correct without convincingly demonstrating this. Wherever appropriate the student must amplify or explain with examples the researched material or data from experiments to clearly show his/her own understanding. Many essays that fall into the 16-22 range (Grade C) fail to show this. The knowledge shown must be greater than that of the general public or that included in the commuter science DP syllabus. The research must be put in an academic context; in other words the material in the essay should be linked to actual applications or research in the wider world.

Criterion E: reasoned argument

The essay needs to be convincing to deliver a reasoned argument. Often statements or claims are made which are not substantiated. Diagrams and charts are often included without further commentary. This links in with the planning stage. A well-argued essay will consistently follow the path dictated by the original research question.

Criterion F: application of analytical and evaluative skills

This links in with criteria D and E. All research material included should be commented on and evaluated - similarly with data from experiments. A common fault is to represent data in graphs and then provide as an evaluation a simple description of what we can easily see from the graph itself, instead of providing the underlying computer science in explaining the behaviour of these graphs.

Criterion G: use of language appropriate to the subject:

The awarding of marks in this criterion depends both upon the technical quality and tone of the language used, and also on a demonstration of understanding of this language. This latter requirement was not always shown where there was a failure to clarify terminology that was clearly not part of the students' normal vocabulary.

Criterion H: conclusion

Many conclusions simply restated what had already been shown in the previous part of the essays. Candidates need to go further and tie together the various strands and also look to further lines of investigation leading from their own research.

Criterion I: formal presentation

Few candidates were awarded the full 4 marks. Reasons included poorly reproduced diagrams, poor formatting of title / sub-titles, incorrect positioning of elements such as the abstract and the bibliography and inconsistent referencing.

Criterion J: abstract

Many candidates self-penalised here by presenting abstracts well under the 300 word limit. Short abstracts often led to the methodology being too weak or vague resulting to a failure to gain both marks. Others concluded simply be saying that various conclusions were made without actually stating them.

Criterion K: holistic judgement

This holistic mark is awarded for the demonstration of various qualities but was often negatively affected by the failure to proof-read the essay, a fault shown by a surprisingly high number of students.

Recommendations for the supervision of future candidates

Pre-planning is an essential requirement for a successful outcome to the extended essay process. This will almost certainly be the first time that a student has had to undertake this kind of exercise and the required skills should be introduced to the students in the year(s) prior to the start of the extended essay process. This implies planning on the part of the school.

As regards the process itself, the selection of a suitable research question is crucial. There may be students who already have a special interest in one narrow area of computer science, but the majority will inevitably start with an idea that is initially too broad. Initial research will be needed to focus their original ideas leading to a research question that is sufficiently narrow to force the student into research that goes deeply into the computer science of the subject and at a level well beyond his/her initial understanding. For example, the student's initial idea of "Advances in Artificial Intelligence" may pass through various stages (e.g. "Neural Networks", "Machine Learning") before finally ending up as a well-focused question – "To what extent and degree of effectiveness can an artificial neural network imitate a biological neural network". The formation of a suitable research question is a cyclical process which should not be unduly rushed.

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