

COMPUTER SCIENCE

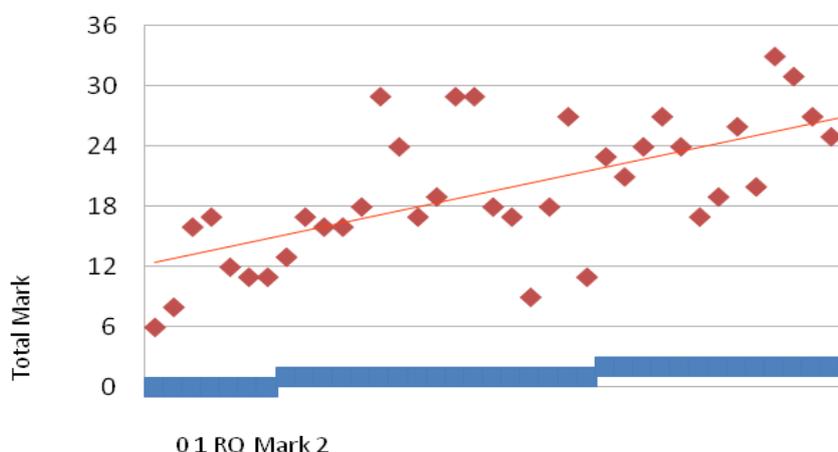
Overall grade boundaries

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

The choice of research question, as always, is the key to a good essay. A well chosen question, firmly in the realms of computer science, will not guarantee a top grade, but the chart and diagram below show the strong correlation that exists between the research question (RQ) mark (Criterion A) and the total mark awarded for each essay. The data is taken from an allocation of 44 essays from the May 2012 session.

Correlation between RQ Mark and Total Marks



Research Question Mark	Average Total Mark
0	12
1	19
2	26

Research questions awarded level 0 in Criterion A are often those that should have been entered in a different subject (e.g. ITGS). Two examples from the May session that fell into this group were:

- *How has the computer and network technology impacted on the behaviour and life of teenagers?*
- *The Issues of a Digital Age.*

Supervisors, especially those from schools who do not offer computer science as a subject must be particularly aware of the difference in focus between computer science and ITGS, with the former dealing primarily with the underlying science behind how technology (hardware, software, communications) works, whilst the latter looks more at how society is

affected by the use and advance of technology. Placing the essay in the wrong subject inevitably causes it to be penalised in different criteria.

Continuing the report from the perspective of the RQ, the essays that gained level one for Criterion A tended to attempt topics of research that were too big for the 3000 word limit. These essays may well uncover various sources of information leading to good investigation marks (Criterion C), but will inevitably tend to offer only a general look at the research theme and fail to achieve any significant analysis. They are quite often an accumulation of facts, at times more journalistic than research based. This will limit the total mark awarded particularly with respect to marks for computer science knowledge (Criterion D) and analysis (Criterion E).

Examples of research questions falling into this group were:

- *How secure are data encryption and message security?*
- *An investigation into the development of AI and its progressing influence in society.*
- *An analysis of the hindrances of Moore's Law.*

The top achieving group chose research questions that were clearly focussed, allowing the students ample opportunity to explore their topic in depth, and promoting a level of understanding beyond that required by the computer science IB programme. The best essays will show good research skills, but will also stop from time to time to expand on the argument with clear examples, further explanations in simpler terms or analysis that relates directly to the argument. This will have two consequences: it will improve the readability of the essay and its understanding on the part of the reader, and will also demonstrate to the examiner the candidate's own level of knowledge and ability to analyse. Diploma candidates would do well to look at respected publications (such as *The Economist* and *Scientific American*) to see how the authors inevitably stop to explain any technical terms that their readers might not understand.

Examples of sharply focussed research questions were:

- *An analysis of lattice-based post-quantum cryptographic primitives*
- *Investigation of the JIT compiler for the Dalvik Virtual Machine and its influence on the Android OS performance.*
- *A comparison of different algorithms for solving magic squares.*
- *Why are wireless mesh networks superior to other networking technologies in promoting smart grid driven energy and cost efficiency programs?*
- *To what extent does the Chinese Postman problem help to solve the website linkage check?*

Some of the more technical criteria provide opportunities for students irrespective of the chosen topic. The requirements for both the abstract and the introduction are quite clear, but ignored by many. The requirements for gaining full marks for formal presentation are also

clearly stated and within the capabilities of all students, but full marks are only gained by a few.

Candidate performance against each criterion

Criterion A: research question

See detailed comments above.

Criterion B: introduction

There are two specific requirements here that were ignored by many candidates. Both the context (history, explanation of terms, background information etc.) and an explicit reference to the importance of the research question must be present for full marks. For example, in an essay dealing with email security, the context might be some reference to past examples of encryption, and importance might include references to the consequences of insecure communication.

Criterion C: investigation

Most students are quite good at researching the theme, with the Internet not surprisingly being the source of most references. Care should be taken with evaluating the reliability of sources and the temptation to overly rely on Wikipedia should be resisted.

Criterion D: knowledge and understanding of the topic studied

The highest level in this criterion requires the student to show a level of computer science knowledge above that of the actual computer science course. However, it is not enough to fill the essay with technical information – they must also demonstrate that they understand what they are writing (see F below).

Criterion E: reasoned argument

Good essays develop an argument from the original research question up to the final conclusion and intersperse it with clarifications and examples throughout. Good planning (C) helps here, to avoid going off track. The reader basically needs to be able to read, even a very technical essay, from start to finish without having to continually pause at sections that have not been clearly explained.

Criterion F: application of analytical and evaluative skills

This is the criteria that most defines the overall quality of an essay. Most students are reasonably good at research, but are not so good at analysing or evaluating what they have written. Students need to demonstrate their understanding by pausing from time to time and expanding or clarifying on what they have written. They need to continually evaluate the information they are providing. This not only helps fulfil the higher levels of this criterion, but will also demonstrate their own knowledge (D) and provide a more convincing argument (E).

Criterion G: use of language appropriate to the subject:

Students tended to score good marks with a reasonable to good use of technical language. To attain full marks though, the student must make it clear that they understand what they are writing. Hence there is a need to expand on or clarify any technical terms.

Criterion H: conclusion

All students produced a conclusion, although many were restricted to a repetition of what had already been said. The best ones drew in the different threads to take any previous analysis one stage further in producing a final piece that both responded directly to the original research question, and looked forward to future research or new questions to be answered.

Criterion I: formal presentation

All levels are open to all students in this criterion, irrespective of the quality of the actual essay, but it is not many who gain a level 4. It is surprising how many students fail to proof-read their essays – they would do well to remember that a spell-checker does not proof-read. References are generally well used now and most bibliographies are arranged in an acceptable order e.g. alphabetical order of authors.

Criterion J: abstract

Students would do well to use the majority of the 300 available words, as many only briefly outline their methodology. The abstract should not only include a clear description of the 3 prescribed elements, but should also serve to provide the reader with a clear summary of what the essay is trying to achieve- therefore make use of the word limit.

Recommendations for the supervision of future candidates

- Ensure that the chosen topic is indeed computer science (and not, for example, ITGS). Remember that computer science deals with the underlying fundamentals of information technology.
- Ensure that the research question is focussed enough to force the student to explore the topic in depth.
- Beware of futuristic topics, especially those concerning AI. If there is a lack of serious sources, the the essays is likely to be speculative and journalistic.