

## **IB COMPUTER SCIENCE: Extended Essay Assessment**

All extended essays are externally assessed by examiners appointed by the IBO. All extended essays are marked on a scale from 0 to 34. For each criterion, examiners are instructed to identify the level descriptor that is most appropriate (i.e. the best match) for the extended essay under consideration.

### **Criterion A: Focus and Method – 6 points possible**

The title should clearly indicate the area of research, with the underlying computer science forming the principle basis of the essay.

Students should avoid topics that deal primarily with social aspects of information technology that would lie more within the subject ITGS (eg “The value of friendships attained through social networking sites”).

The research question must be sharply focused in order to allow for significant research into the topic at an appropriate depth. At the same time the topic must be accessible to an IB student.

Broad topics (eg “To what extent is the variety of different computer languages in existence beneficial or problematic for programmers”) will only lead to superficial treatment within the 4,000-word limit.

Students should avoid choosing futuristic topics (eg “AI/robots in the next century”), which generally lead to opinion-based essays which are backed up with few facts. A journalistic approach should also be avoided as this will tend to lead to a superficial treatment of any computer science.

The research question must be in the form of a question and should be stated in the introduction to the essay, and the areas investigated must be clearly placed in context. For example, an essay such as “How useful are neural networks in the evolution of machine learning?” must provide for the reader sufficient background information into both neural networks and machine learning.

The student must further explain why the topic and research question are worthy choices for an EE.

The methodology they will use to answer this question should be clearly described.

The essay must be well planned, making use of a variety of authoritative sources. These can be taken from the internet, literature and interviews with experts in the relevant field.

Many essays will involve an experimental or programming element, with the resulting data providing a valuable source. Students should avoid relying on small-scale surveys taken from fellow students.

**If the topic or research question is deemed inappropriate for the subject in which the essay is registered, no more than four marks can be awarded for this criterion.**

\_\_\_\_\_ 0      **The work does not reach a standard outlined by the descriptors below.**

\_\_\_\_\_ 1-2:      **The topic is communicated unclearly and incompletely:**

- Identification and explanation of the topic is limited; the purpose and focus of the research is unclear, or does not lend itself to a systematic investigation in the subject for which it is registered.

**The research question is stated but not clearly expressed or too broad:**

- The research question is too broad in scope to be treated effectively within the word limit and requirements of the task, or does not lend itself to a systematic investigation in the subject for which it is registered.
- The intent of the research question is understood but has not been clearly expressed and/or the discussion of the essay is not focused on the research question.

**Methodology of the research is limited:**

- The source(s) and/or method(s) to be used are limited in range given the topic and research question.
- There is limited evidence that their selection was informed.

\_\_\_\_\_ 3-4

**The topic is communicated:**

- Identification and explanation of the research topic is communicated; the purpose and focus of the research is adequately clear, but only partially appropriate.

**The research question is clearly stated but only partially focused:**

- The research question is clear but the discussion in the essay is only partially focused and connected to the research question.

**Methodology of the research is mostly complete:**

- Source(s) and/or method(s) to be used are generally relevant and appropriate given the topic and research question.
- There is some evidence that their selection(s) was informed.

**If the topic or research question is deemed inappropriate for the subject in which the essay is registered no more than four marks can be awarded for this criterion.**

\_\_\_\_\_ 5-6      **The topic is communicated accurately and effectively:**

- Identification and explanation of the research topic is effectively communicated;

- the purpose and focus of the research is clear and appropriate.

**The research question is clearly stated and focused:**

- The research question is clear and addresses an issue of research that is appropriately connected to the discussion in the essay.

**Methodology of the research is complete:**

- An appropriate range of relevant source(s) and/or method(s) have been applied in relation to the topic and research question.
- There is evidence of effective and informed selection of sources and/or methods.

## Criterion B: Knowledge and Understanding – 6 points possible

The student must demonstrate their own understanding of the topic into which the essay falls.

An essay that is comprised primarily of reworded source material will not provide this evidence. Instead the student should provide clarifications or simpler explanations of any technical information that is taken from their sources, always linking this information to the original research question.

The source material should be selected and incorporated in a way that illustrates the knowledge gained by the student in relation to the chosen topic.

The language must be at a technical level that is appropriate to computer science, but used in such a way that clearly demonstrates the student's own understanding. Students should beware of making their essays over-technical and should remember that the reader will not necessarily be an expert in the specific topic that is being addressed.

**If the topic or research question is deemed inappropriate for the subject in which the essay is registered, no more than four marks can be awarded for this criterion.**

\_\_\_\_\_ 0                    **The work does not reach a standard outlined by the descriptors below.**

\_\_\_\_\_ 1-2                   **Knowledge and understanding is limited.**

- The selection of source material has limited relevance and is only partially appropriate to the research question.
- Knowledge of the topic/discipline(s)/issue is anecdotal, unstructured and mostly descriptive with sources not effectively being used.

**Use of terminology and concepts is unclear and limited.**

- Subject-specific terminology and/or concepts are either missing or inaccurate, demonstrating limited knowledge and understanding.

\_\_\_\_\_ 3-4                   **Knowledge and understanding is good.**

- The selection of source material is mostly relevant and appropriate to the research question.
- Knowledge of the topic/discipline(s)/issue is clear; there is an understanding of the sources used but their application is only partially effective.

**Use of terminology and concepts is adequate.**

- The use of subject-specific terminology and concepts is mostly accurate, demonstrating an appropriate level of knowledge and understanding.

**If the topic or research question is deemed inappropriate for the subject in which the essay is registered no more than four marks can be awarded for this criterion.**

\_\_\_\_\_ 5-6                   **Knowledge and understanding is excellent.**

- The selection of source materials is clearly relevant and appropriate to the research question.
- Knowledge of the topic/discipline(s)/issue is clear and coherent and sources are used effectively and with understanding.

**Use of terminology and concepts is good.**

- The use of subject-specific terminology and concepts is accurate and consistent, demonstrating effective knowledge and understanding.

## Criterion C: Critical Thinking – 12 points possible

The development of an argument that flows logically from one section to the next throughout the essay is only arrived at through sound planning.

The student must carefully select information that is directly relevant to the research question and resist any temptation to make use of too many sources.

The student needs to evaluate the research material not just in terms of what is relevant and necessary to support the main argument, but also in terms of the validity of the sources. This particularly applies to sources taken from the internet.

The student should attempt to draw out conclusions wherever appropriate and not just in the concluding section of the essay.

Any analysis of tables of results or of graphs should go further than simply translating the results into words but should look to explain the underlying reasons for the obtained results.

Final conclusions should do more than summarize the essay but should draw the various threads together in presenting a justified answer to the original research question. The student should indicate where future research could be undertaken in order to explore unanswered questions or in expanding the original scope of the essay.

**If the topic or research question is deemed inappropriate for the subject in which the essay is registered, no more than three marks can be awarded for this criterion.**

\_\_\_\_\_ 0 **The work does not reach a standard outlined by the descriptors below.**

\_\_\_\_\_ 1-3 **The research is limited.**

- The research presented is limited and its application is not clearly relevant to the RQ.

**Analysis is limited.**

- There is limited analysis.
- Where there are conclusions to individual points of analysis these are limited and not consistent with the evidence.

**Discussion/evaluation is limited.**

- An argument is outlined **but** this is limited, incomplete, descriptive or narrative in nature.
- The construction of an argument is unclear and/or incoherent in structure hindering understanding.
- Where there is a final conclusion, it is limited and not consistent with the arguments/evidence presented.
- There is an attempt to evaluate the research, but this is superficial.

**If the topic or research question is deemed inappropriate for the subject in which the essay is registered no more than three marks can be awarded for this criterion.**

\_\_\_\_\_ 4-6 **The research is adequate.**

- Some research presented is appropriate and its application is partially relevant to the Research question.

**Analysis is adequate.**

- There is analysis **but** this is only partially relevant to the research question; the inclusion of irrelevant research detracts from the quality of the argument.
- Any conclusions to individual points of analysis are only partially supported by the evidence.

**Discussion/evaluation is adequate.**

- An argument explains the research **but** the reasoning contains inconsistencies.
- The argument may lack clarity and coherence but this does not significantly hinder understanding.
- Where there is a final or summative conclusion, this is only partially consistent with the arguments/evidence presented.
- The research has been evaluated but not critically.

\_\_\_\_\_ 7-9 **The research is good.**

- The majority of the research is appropriate and its application is clearly relevant to the research question.

**Analysis is good.**

- The research is analysed in a way that is clearly relevant to the research question; the inclusion of less relevant research rarely detracts from the quality of the overall analysis.
- Conclusions to individual points of analysis are supported by the evidence but there are some minor inconsistencies.

**Discussion/evaluation is good.**

- An effective reasoned argument is developed from the research, with a conclusion supported by the evidence presented.
- This reasoned argument is clearly structured and coherent and supported by a final or summative conclusion; minor inconsistencies may hinder the strength of the overall argument.
- The research has been evaluated, and this is partially critical.

\_\_\_\_\_ 10-12 **The research is excellent.**

- The research is appropriate to the research question and its application is consistently relevant.

**Analysis is excellent.**

- The research is analysed effectively and clearly focused on the research question; the inclusion of less relevant research does not significantly detract from the quality of the overall analysis.
- Conclusions to individual points of analysis are effectively supported by the evidence.

**Discussion/evaluation is excellent.**

- An effective and focused reasoned argument is developed from the research with a conclusion reflective of the evidence presented.
- This reasoned argument is well structured and coherent; any minor inconsistencies do not hinder the strength of the overall argument or the final or summative conclusion.
- The research has been critically evaluated.

## Criterion D: Presentation – 4 points possible

This criterion relates to the extent to which the essay conforms to accepted academic standards in relation to how research papers should be presented. It also relates to how well these elements support the reading, understanding and evaluation of the essay.

Students may provide a section and subsection structure to their essays, with appropriate informative headings.

### *Use of charts, images and tables*

Any charts, images or tables from literature sources included in the essay must be carefully selected and labelled. They should only be used if they are directly relevant to the research question, contribute towards the understanding of the argument and are of a good graphic quality.

Large tables of raw data collected by the student are best included in an appendix, where they should be carefully labelled. Tables of processed data should be designed to clearly display the information in the most appropriate form. Graphs or charts drawn from the analysed data should be selected to highlight only the most pertinent aspects related to the argument. Too many graphs, charts and tables will distract from the overall quality of the communication.

Only processed data that is central to the argument of the essay should be included in the body of the essay, as close as possible to its first reference. Tables should enhance a written explanation, but not themselves include significant bodies of text. If they do, then these words must be included in the word count.

If an experimental method is long and complex, students may place the raw data in an appendix and include a summary of the methods in the body of the essay. Students who choose this option must be careful to ensure that the summary contains all elements that contribute to the quality of the investigation, since appendices are not an essential section of the EE and examiners are not required to read them. In other words, any important information that contributes to the evaluation of the method must be in the body of the essay and not the appendix. For experiments where numerical results are calculated from data obtained by changing one of the variables, it is generally good practice to show one example of the calculation in the main body of the essay. The remainder can be displayed in tabular or graphical form.

Any material that is not original must be carefully acknowledged, with specific attention paid to the acknowledgment and referencing of quotes and ideas. This acknowledgment and referencing is applicable to audiovisual material, text, graphs and data published in print and electronic sources. If the referencing does not meet the minimum standard as indicated in the guide (name of author, date of publication, title of source and page numbers as applicable), and is not consistently applied, work will be considered as a case of possible academic misconduct.

A bibliography is essential and has to be presented in a standard format. Title page, table of contents, page numbers, etc must contribute to the quality of presentation.

The essay must not exceed 4,000 words of narrative. Graphs, figures, calculations, diagrams, formulas and equations are not included in the word count. Students must be aware that examiners will not read beyond the 4,000-word limit, nor assess any material presented thereafter.

\_\_\_\_\_ 0

**The work does not reach a standard outlined by the descriptors below.**

\_\_\_\_\_ 1-2

**Presentation is acceptable.**

- The structure of the essay is generally appropriate in terms of the expected conventions for the topic, argument and subject in which the essay is registered.
- Some layout considerations may be missing or applied incorrectly.
- Weaknesses in the structure and/or layout do not significantly impact the reading, understanding or evaluation of the extended essay.

\_\_\_\_\_ 3-4

**Presentation is good.**

- The structure of the essay clearly is appropriate in terms of the expected conventions for the topic, the argument and subject in which the essay is registered.
- Layout considerations are present and applied correctly.
- The structure and layout support the reading, understanding and evaluation of the extended essay.

## Criterion E: Engagement – 6 points possible

This criterion assesses the student's engagement with their research focus and the research process. It will be applied by the examiner at the end of the assessment of the essay, and is based solely on the candidate's reflections as detailed on the [RPPF](#), with the supervisory comments and extended essay itself as context.

Students are expected to provide reflections on the decision-making and planning process undertaken in completing the essay. Students must demonstrate how they arrived at a topic as well as the methods and approach used. This criterion assesses the extent to which a student has evidenced the rationale for decisions made throughout the planning process and the skills and understandings developed.

For example, students may reflect on:

- the approach and strategies chosen, and their relative success
- the [Approaches to learning](#) skills they have acquired and how they have developed as a learner
- how their conceptual understandings have developed or changed as a result of their research
- challenges faced in their research and how they overcame these
- questions that emerged as a result of their research
- what they would do differently if they were to undertake the research again.

Effective reflection highlights the journey the student has engaged in through the EE process. In order to demonstrate that engagement, students must show evidence of critical and reflective thinking that goes beyond simply describing the procedures that have been followed. Reflections must provide the examiner with an insight into **student** thinking, creativity and originality within the research process. The **student** voice must be clearly present and demonstrate the learning that has taken place.

- \_\_\_\_\_ 0     **The work does not reach a standard outlined by the descriptors below.**
- \_\_\_\_\_ 1-2   **Engagement is limited.**
- Reflections on decision-making and planning are mostly descriptive.
  - These reflections communicate a limited degree of personal engagement with the research focus and/or research process.
- \_\_\_\_\_ 3-4   **Engagement is good.**
- Reflections on decision-making and planning are analytical and include reference to conceptual understanding and skill development.
  - These reflections communicate a moderate degree of personal engagement with the research focus and process of research, demonstrating some intellectual initiative.
- \_\_\_\_\_ 5-6   **Engagement is excellent.**
- Reflections on decision-making and planning are evaluative and include reference to the student's capacity to consider actions and ideas in response to challenges experienced in the research process.
  - These reflections communicate a high degree of intellectual and personal engagement with the research focus and process of research, demonstrating authenticity, intellectual initiative and/or creative approach in the student voice.

**Predicted Total:** \_\_\_\_\_

## Grade descriptors

The extended essay is externally assessed, and as such, supervisors are not expected to mark the essays or arrive at a number to translate into a grade. Predicted grades for all subjects should be based on the **qualitative** grade descriptors for the subject in question. These descriptors are what will be used by senior examiners to set the boundaries for the extended essay in May 2018, and so schools are advised to use them in the same way.

### Grade A

Demonstrates effective research skills resulting in a well-focused and appropriate research question that can be explored within the scope of the chosen topic; effective engagement with relevant research areas, methods and sources; excellent knowledge and understanding of the topic in the wider context of the relevant discipline; the effective application of source material and correct use of subject-specific terminology and/or concepts further supporting this; consistent and relevant conclusions that are proficiently analysed; sustained reasoned argumentation supported effectively by evidence; critically evaluated research; excellent presentation of the essay, whereby coherence and consistency further supports the reading of the essay; and present and correctly applied structural and layout elements.

**Engagement with the process is conceptual and personal, key decision-making during the research process is documented, and personal reflections are evidenced, including those that are forward-thinking.**

### Grade B

Demonstrates appropriate research skills resulting in a research question that can be explored within the scope of the chosen topic; reasonably effective engagement with relevant research areas, methods and sources; good knowledge and understanding of the topic in the wider context of the relevant discipline; a reasonably effective application of source material and use of subject-specific terminology and/or concepts; consistent conclusions that are accurately analysed; reasoned argumentation often supported by evidence; research that at times evidences critical evaluation; and a clear presentation of all structural and layout elements, which further supports the reading of the essay.

**Engagement with the process is generally evidenced by the reflections and key decision-making during the research process is documented.**

### Grade C

Demonstrates evidence of research undertaken, which has led to a research question that is not necessarily expressed in a way that can be explored within the scope of the chosen topic; partially effective engagement with mostly appropriate research areas, methods and sources—however, there are some discrepancies in those processes, although these do not interfere with the planning and approach; some knowledge and understanding of the topic in the wider context of the discipline, which is mostly relevant; the attempted application of source material and appropriate terminology and/or concepts; an attempted synthesis of research results with partially relevant analysis; conclusions partly supported by the evidence; discussion that is descriptive rather than analytical; attempted evaluation; satisfactory presentation of the essay, with weaknesses that do not hinder the reading of the essay; and some structural and layout elements that are missing or are incorrectly applied.

**Engagement with the process is evidenced but shows mostly factual information, with personal reflection mostly limited to procedural issues.**

### Grade D

Demonstrates a lack of research, resulting in unsatisfactory focus and a research question that is not answerable within the scope of the chosen topic; at times engagement with appropriate research, methods and sources, but discrepancies in those processes that occasionally interfere with the planning and approach; some relevant knowledge and understanding of the topic in the wider context of the discipline, which are at times irrelevant; the attempted application of source material, but with inaccuracies in the use of, or underuse of, terminology and/or concepts; irrelevant analysis and inconsistent conclusions as a result of a descriptive discussion; a lack of evaluation; presentation of the essay that at times is illogical and hinders the reading; and structural and layout elements that are missing.

**Engagement with the process is evidenced but is superficial, with personal reflections that are solely narrative and concerned with procedural elements.**

### Grade E (failing condition)

Demonstrates an unclear nature of the essay; a generally unsystematic approach and resulting unfocused research question; limited engagement with limited research and sources; generally limited and only partially accurate knowledge and understanding of the topic in the wider context of the relevant discipline; ineffective connections in the application of source material and inaccuracies in the terminology and/or concepts used; a summarizing of results of research with inconsistent analysis; an attempted outline of an argument, but one that is generally descriptive in nature; and a layout that generally lacks or incorrectly applies several layout and structural elements.

**Engagement with the process is limited, with limited factual or decision-making information and no personal reflection on the process.**