

November 2016 subject reports

ITGS

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 12	13 – 24	25 – 37	38 – 48	49 – 59	60 – 70	71 - 100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 10	11 – 22	23 – 33	34 – 45	46 – 57	58 – 69	70 - 100

General comments

Several crucial themes emerge from the comments on each of the exam papers:

- In order to earn the higher marks, candidates need to demonstrate higher order thinking skills by incorporating analysis, synthesis and subject specific terminology into the extended response questions. Bulleted lists cannot earn the highest marks because they do not allow for development of substantiated arguments required in Paper 1, part (c) and sometimes part (b) of the question, Paper 2 Criterion C and Criterion D, Paper 3 questions 3 and 4.
- Candidates should be able to incorporate examples and concepts they have learned in class into their answers. This means they need to keep a record of what is learned and discussed in class so they can study it before the exam.
- Candidates need to understand concepts rather than memorize facts. ITGS is a concept based course requiring the ability to transfer knowledge from known scenarios to the previously unseen ones in the examination papers.
- Candidates need continuous practice in writing skills, particularly with the ability to develop ideas rather than just list them.
- Teachers need to participate in the special events on the OCC and use ITGSopedia as part of their professional development. The nature of information technologies is constantly changing. These changes have effects on the relationship between individuals and societies and the information technologies and information systems they use. This is reflected by the changes in nature of the HL Paper 3 Case Study.

The ITGS course is designed to provide candidates with the ability to make informed decisions about the development, implementation and use of both information technologies and information systems across a range of scales ranging from the individual user to the global community. In order for candidates to do this effectively in the externally assessed components, the teaching of these higher order thinking/critical thinking skills should be a central theme throughout the ITGS course.

Internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 11	12 – 15	16 – 18	19 – 22	23 - 30

The range and suitability of the work submitted

ITGS Projects were submitted following the requirements in the Handbook of Procedures for 2015 Section B3.5. Updated requirements for 2016 were not available in the Handbook of Procedures for 2016. The zipped files were submitted as required using Forms.zip templates and were within the 750MB limit.

In most cases the zip file contained a *Teacher's Marks Justification* form. This was important in order for the moderator to understand the rationale of how the teacher awarded marks and to provide appropriate feedback if the teacher's interpretation of the criteria is awry.

In some school samples there was an appropriate diversity in the type of products developed including problems for clients in a school environment, business or organization. In other cases, it was clear that the starting point was not the client and problem as required. These samples consisted of very similar products such as websites developed with the same features or databases with similar structures.

There were some instances where the clients were under the age of 18 years old. In these cases, an adult co-client must be involved in the entire process from Criterion A through Criterion F.

The choice of the IT products was, in almost all instances, appropriate for the client's needs and the requirements for the ITGS Project. Websites made with online web development tools or online services tended to be more successful. There were also other IT solutions such as videos, desktop-published documents and databases.

The major shortcomings in the ITGS Projects were that a number of candidates:

- did not understand the specific requirements of the various assessment criteria as they relate to their product.
- did not conduct adequate research and investigations necessary for the design and development their product
- did not work closely with their client throughout all of the stages of development that is set out in Criterion A through Criterion F.

Specific concerns included:

- Even though projects used the forms.zip file, there were instances where candidates changed file names and the templates. This is not advisable as the template is setup to work with the original file names, changing the file names may lead to a loss of functionality of the links, which may affect one of the required elements in Criterion G.
- Documentation for some criteria was generic and lacked detail, especially Criterion B, Criterion C and Criterion D. Often references specific client, problem, IT solution, tools, techniques and resources were not indicated.
- Most projects were submitted in .zip or .rar format. .zip format is preferred because it is cross-platform and can be easily unzipped on both PC and Macintosh computers.
- Some screencasts were not submitted. Screencasts should be submitted in a cross-platform format (i.e. mp4 or mov). File formats such as avi and wmv are not cross-platform.
- Candidates lost marks from simple omissions and errors such as the links on the cover_page.htm did not work or a link on the cover page did not open the specific product.
- Some types of products (e.g. videos, DTP documents, products made with applications not commonly available to the moderator) must be submitted in the original file format and in a cross-platform format to ensure that the moderator can access the product.
- Where products are websites and are only fully functional online or cannot be downloaded from online services, sufficient evidence from the making of the product must be provided in the Product folder. An empty Product folder may not be submitted.
- Some diagrams and screenshots in Criterion D and Criterion E were not accompanied by sufficient explanation, not appropriately labelled or were too small and illegible.
- Some screencasts had considerable background noise, were illegible or did not fully demonstrate that the product was fully functional. The techniques in Criterion E must be highlighted and it must be clear that the product contains sufficient content material.
- In instances where the word count exceeded 2000 words, only the documentation up to 2000 words can be awarded marks. No marks were awarded for the documentation that was beyond the 2000th word.

Candidate performance against each criterion

Criterion A: Initial investigation

The clients and their problems were largely appropriate for the Project. However, in most cases the consultation between the candidate and the client was not well planned.

Any ITGS Product which involves either the setup of a commercial product e.g. a school management system or involves a particular device e.g. RFID reader are not appropriate.

Major problems in Criterion A included:

- Candidates did not explain what approaches are currently being used/ have been used in the past and why they are not successful.
- It was not clearly understood what a 'cited reference' means. The interviewee, their position, and date must be clearly stated in Criterion A in the Consultation and Investigation.
- The questions were not carefully considered in the consultation and therefore, the investigation in Criterion A was superficial and the lacked depth required.
- In some cases, it was not clear what the proposed IT solution should achieve.

Criterion B: Analysis

The information in the Requirement Specification section often lacked detail and was incomplete.

IT terminology used in the subtitles; system interaction, input, output, processing and security does not appear to be understood and lacked the necessary detail.

There were inconsistencies between the resources listed here and those listed in Criterion D.

The *Specific Performance Criteria* were often stated as phrases and/or were not appropriate nor well-considered. The *Specific Performance Criteria* are used in both Criterion D and specifically in Criterion F, they must be unambiguous, measurable and realistic.

The justification for the choice of the IT solution was often limited. Very few candidates considered how websites, desktop published products and videos would be publicized, distributed or accessed as part of their justification and how the product would address the requirements of the client. The feasibility of the development of the solution and its implementation must be considered.

Criterion C: Product schedule

Project Schedules tended to be a generic list of tasks that could have been written for any product of the same type (e.g. website, publication, video or database). The entries were often not specific to the client, the problem being addressed or applications and methods used.

All stages of development must be included for Criterion A through Criterion F: planning, designing, developing, testing and implementing.

It was obvious in some cases that the Project Schedule was not planned, but maintained as each criterion was completed

Criterion D: Product design

Candidates must not only research the tools that they will be using, but also research how to design products using those tools. Accepted ways of presenting both the overall structure and internal structure of the specific product were not always used. Databases, websites, DTP products and videos – all have accepted ways for showing the overall structure and internal structure.

Additional research may be helpful to determine how problems of a similar nature have been addressed by an IT solution in the past.

Appropriate methods for showing the design of the particular product must be included including diagrams and sketches. They must have good quality and be legible. Some scanned images were too faint and some photographed images contained shadows. Screenshots from the product are not acceptable in Criterion D because the design process is completed before development takes place.

The list of resources must include the source of all of the resources required to create the product both the content and online services. The list of techniques may include basic techniques and must include all of the appropriate techniques identified in Criterion E.

The depth of testing was quite variable. The tests carried out must directly relate to the *Specific Performance Criteria* in Criterion B and the overall functionality of the product. It may also include additional testing to effectively test techniques identified in Criterion E.

Often the signature of the client was missing to indicate agreement with the design of the product.

Criterion E Product Development

Few projects achieved the higher marks, i.e. accessing the 6-7 markband. This was primarily due to the choice of appropriate techniques and the overall structure of the actual product not being explained. Most projects described the techniques used in the development of the product (how), but did not explain why they were appropriate or the choice of the technique over other possibilities. This criterion is designed to assess the choices the candidate makes, and why they are appropriate for the product they are developing.

In many projects the sources were not cited in the explanation of the techniques.

Websites were the most common product. Where templates from online services are used as a starting point for the development of the website, they must be cited. Templated websites tend to include only basic techniques available through the provider. Candidates must give more consideration to the needs of the client and how to include appropriate techniques in their websites rather than opt for a quick and simplistic solution. (See *Guidance on the appropriateness of an information technology solution* on the OCC)

The use of text boxes on screenshots is a way to point out how the tools were used. However, text boxes are not counted by word counting features in software. If the text within the text boxes provides descriptions or explanations, it will be considered as part of the overall word count. Please see additional guidance in the ITGS Teacher Support Material regarding word count.

Where code has been used as a technique, two screenshots are needed:

- Screenshot of the code with an explanation of what it does and why it is appropriate.
- Screenshot that shows the outcome of the code.

Criterion F: Product evaluation and future product development

The feedback from the client should focus on questions about the process of developing the product as well as the *Specific Performance Criteria*. Feedback that consisted of responses to yes/no questions provides little useful information in Criterion F. In some instances, the candidate provided only the feedback from the client and did not include any evaluation from the candidate which is required. Criterion F received no marks in these instances.

Additional criteria that have emerged during the development process or from consultation with the client may also be considered as part of the evaluation.

Recommendations for the future development of the product may be included in the feedback from the client. More thought must be given to the future development of the product. Too often recommendations were made that should have been included in the current product or were superficial or unrealistic.

Similar to Criterion D, the signature from the client was missing in many cases.

Criterion G: Required elements

A few candidates did not submit screencasts. Although an audio commentary is not required, a silent screencast makes it difficult for the moderator to 'guess' what is actually being demonstrated. The size of the screencast must be limited to 5 minutes for maximum effectiveness. Moderators are not required to view more than 5 minutes.

The most common issue in this criterion was not having any evidence in the Product folder, except for a link to the product. An empty product folder should not be submitted as this implies that no techniques were used in developing the product.

Forms.zip must be used for the Project. File names, folder names and the actual templates may not be changed, instead the files need to be saved to doc (or docx) while the Project is being developed and to pdf for submission. If this is done the links on cover pages will work. Only the product needs to be linked to the cover page.

The links on the cover page must be tested before the product is submitted and that the product and all of the documentation is accessible and functions properly. It is advised that this be tested on several different computers.

Recommendations for the teaching of future candidates

Only refer to the most recent ITGS Guide and use the new assessment criteria. Also read *Guidance on the appropriateness of an information technology solution*.

Review the Project section in previous ITGS subject reports which are available on the Online Curriculum Center (OCC). Please note that there were changes from May 2015 onwards in Criterion E and Criterion G.

Guide candidates more closely throughout the process of development which would include the following these steps for each criterion:

- The teacher explains the particular assessment criterion and the command terms used within the level descriptors.
- The teacher demonstrates the criterion by using exemplars from the Teacher Support Material (TSM).
- The candidate conducts research and investigations as needed for the particular IT solution.
- The candidate develops the criterion and submits it for feedback from the ITGS teacher. The teacher can comment on only one draft of a criterion.
- The candidate makes the necessary edits/adjustments before proceeding to the next criterion.
- If changes are made in one criterion, they may have an impact on others. The candidate ensures that all of the necessary changes are made before progressing to the next criterion.

When the product is completed, the candidate proof-reads all the documentation, checks that the cover page and product function properly.

Further comments

Consult relevant information regarding the ITGS project:

- *ITGS Subject Reports* from the May 2012 session onwards, especially the most recent reports from May 2015, November 2015 and May 2016.
- *ITGS Guide* including the updated Criterion E and Criterion G.
- *Teacher Support Material* which includes both information and 6 exemplars.
- *Forms.zip* templates which must be used for the Project (link included in TSM).
- *Guidance on the appropriateness of an information technology solution* for the project
- *OCC ITGS Project FAQs*.
- *IB Coordinator Notes* containing update notices for ITGS.

For professional development regarding the ITGS Project, please participate in:

- *OCC Discussion Forum* where questions and comments can be posted regarding the ITGS Project.
- *ITGS online workshops* (cat 1 & 2) or *ITGS face-to-face workshops* (cat 1 & 2, cat 3) where approaches to guiding the Project and specific Project samples are discussed.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 7	8 – 14	15 – 21	22 – 27	28 – 33	34 – 39	40 - 60

General comments

Higher level (HL) Paper 1 and Standard level (SL) Paper 1 are separate components. However, many of the comments that apply to one component apply to the other. Given the overlap between the HL and SL papers (three out of the four SL questions also appeared on the HL paper), comments offered for SL Paper 1 should be read in conjunction with those for HL Paper 1.

In this session the three questions common to both papers were as follows:

Question 1 - Choosing a search engine

Question 2 - Restaurant automation

Question 3 - Digital citizenship

The comments for these common questions are included within the HL Paper 1 comments on specific questions.

The areas of the programme and examination which appeared difficult for the candidates

A significant number of candidates did not read the question carefully, particularly parts (b) and (c). The most important skill in reading an exam question is understanding what is required to address the command term used in the question.

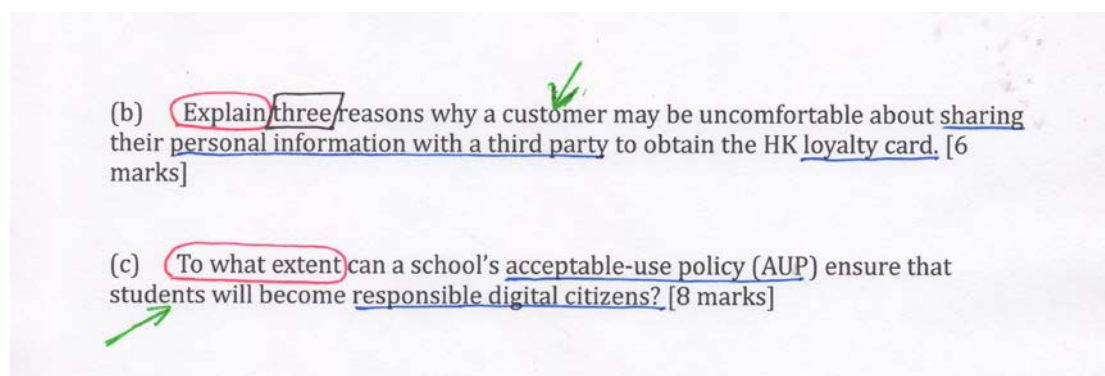
Candidates should identify the key terms in the question in order to be able to focus on a clear answer. One way to teach students to do this is to create a system of quickly marking these elements in the question. This is one example. It is not the only way to accomplish this goal.

Circle the command term. Please note that students need to be very familiar with the command terms and the kinds of responses they should elicit.

Draw a box around the number of responses required if applicable.

Use an arrow to indicate the stakeholder.

Underline key technical terms or key issues to address.



In part (a) questions, a few candidates are still writing fairly long answers for identify questions and therefore losing time that could be spent on extended response question. Candidates also struggle with writing clear definitions.

In part (b) of a question when the command term is “analyze” few candidates went beyond description to engage in analysis supported by reasoning and detail. Candidates had less trouble with explanations.

Part (c) of the questions posed the most significant problems. A number of candidates are still writing lists, usually of advantages and disadvantages, sometime with some minimal description, often in the form of bullet points. However, the command terms for a part (c) question should elicit developed arguments, not lists. To earn a 5 or above for these questions, candidates need to show evidence of critical thinking by providing arguments that are supported by reasoning, examples, and details. Almost no candidates showed evidence of the ability to apply what was learned in class to new situations. The following paragraph and analysis illustrate one approach developing an idea in a part (c) question. Note that this student is writing inductively, that is the main idea is the last sentence in the paragraph.

Student text	Comments
One of the issues that an Acceptable-use policy (AUP) may educate students about is cyberbullying, and it may be included in a school's AUP that students should not use the internet to threaten or bully other students, for example by sending offensive messages or images over social networking websites.	<i>The student shows understanding of the nature of an AUP by describing a specific example.</i>
By including this in their AUP, schools can hold students accountable for their actions, as students will often have to sign the AUP at the start of the year. If a student then engages in cyberbullying behaviour, they will have breached the AUP and the school may punish them accordingly.	<i>Explains in detail how this use of the AUP might work.</i>

Hence, the use of an AUP may discourage students from cyberbullying by holding them accountable for their actions and making them aware of the consequences of such actions.	<i>Analyzes the impact of this use of an AUP.</i>
However, an AUP may not be enough to eliminate cyberbullying at schools.	<i>Introduces the idea that the impact previously explained may well be limited.</i>
An example, of this was a recent case of a secondary school in Victoria, Australia, in which images of students at the school were shared in a private Facebook group without the knowledge or permission of the people in the images.	<i>Illustrates the point with a specific example which could have been discussed in class or could have come from the student's own reading.</i>
Even though an AUP was already in place, and students had been warned about the consequences of such behaviour, this ultimately did not deter them from behaving as irresponsible digital citizens.	<i>Draws the conclusion that impact of AUP can be limited.</i>

This example, taken from a previous exam, illustrates a deductive approach to responding to a part (c) question.

Note that the student has qualified the initial assertion by saying that the data must be protected and used properly. This sets up the disadvantages explained later in the essay.

However security of the data is a major concern. This data is very sensitive - biometric data for example once lost ~~can~~ cannot be retrieved. Other personal data might identify where people live whether reducing their anonymity - this is a particularly serious concern if the database holds unconnected citizens data too (as the UK criminal database does). The database should be encrypted with the highest standard encryption function (such as 256-bit AES encryption) otherwise it would not be acceptable for Finland to hold this data.

Concrete example with impact.

Evaluation (particularly serious concern) explained & applied to the scenario.

Concrete solution to problem.

Underlying all of these issues is a lack of conceptual understanding of the technology and its impacts. Memorizing definitions and other information is not enough. What is needed is understanding and knowledge that a candidate can apply to new situations.

Additionally, candidates often seemed best prepared on what was most recently taught i.e. Topic 3.10 and sometimes Topic 3.11 of the syllabus. This suggests that a systematic review of the entire course needs to be a significant part of exam preparation.

Most important, candidates did well when questions addressed technology they used in their own lives, but did poorly when understanding of concepts beyond their own experience was required. While quite reasonable, a major goal of education is to extend candidate's knowledge and understanding beyond their individual experience. This can be accomplished in a variety of ways both in and out of the classroom.

The areas of the programme and examination in which candidates appeared well prepared

Being able to answer three questions instead of four gave a number of candidates the opportunity to think carefully and develop their ideas more thoroughly. Candidates need to be taught how to take advantage of this opportunity.

Candidates who did very well had clearly done more than memorize definitions, lists of attributes and so on. Instead, they had a deep enough understanding of what they had learned so they could apply it to a new scenario very effectively.

The strengths and weaknesses of the candidates in the treatment of individual questions

Section A:

Question 1 (Choosing a search engine):

(a)(i) Most candidates did well on this question; however, many did not realize that more advanced search tools would allow a broadened search, so the Disney search engine does not really restrict sites users can go to. Although the Disney search engine may not *list* unethical sites, it can not prevent access to them.

(a)(ii) A significant number of candidates did not understand what is meant by "authenticity of a user." Those who did provided username and password, and some described two factor identification. Many did not realize that an IP address identifies a computer not a user.

(a)(iii) A dismaying number of candidates had no idea what was meant by Boolean operator.

(a)(iv) Few candidates incorporated "and" or "AND" into the search. Many wrote complete sentences.

(b)(i) Many candidates evidently had little idea of what a cookie was or what its functions were, and a few claimed capabilities of cookies that went well beyond reality. Those who did have a basic understanding of cookies were generally able to suggest plausible uses, although these were not always explained explicitly in the context of the Disney search engine.

(b)(ii) Many candidates were able to score at least one mark on this question although some responses tended to be rather circular, citing 'authenticity' as the reason why the Disney search engine would use authenticity as a key factor without attempting to explain *why*.

(c) This question elicited a wide range of responses in terms of their quality. Many candidates evaluated, or in many cases simply described, the search engine itself with little or no reference to the essence of the question asked: To evaluate the decision by Disney to *promote* their search engine. The wording of the question did not necessarily restrict the stakeholder(s) to Disney itself. The best of the responses explored the possible implications for Disney and/or other stakeholders of promoting the search engine and came to some reasonably substantiated conclusions.

Question 2 (Restaurant automation):

(a)(i) Most candidates were able to gain marks on this question part.

(a)(ii) Most candidates were able to identify advantages to the customers and a majority were able to add enough explanation to gain two marks.

(b) Most candidates spotted the hint in the stem that the HK Loyalty card may have implications for their privacy, security and anonymity, but far fewer were able to develop their response much beyond a re-statement of those three concerns. While a number of candidates were able to explain pertinent and well-focused reasons, far too many simply provided standard, boiler-plate responses that barely mentioned the context of the loyalty card.

(c) A number of candidates were unable to distinguish between the kiosk ordering system and the loyalty card program, which inevitably impacted the marks achieved. Those who focused on the loyalty card were generally able to provide at least some plausible advantages and disadvantages, although in many cases these were simply stated, or at best described. Some candidates assumed that a restaurant using the loyalty card would have the responsibility for maintaining the entire loyalty card system and technical infrastructure, or that the use of the loyalty card would necessitate the purchase of specialist card readers by the restaurant, neither of which is realistic.

Question 3 (Digital citizenship):

(a)(i) Although many candidates were able to gain at least one mark for this question part, a surprising number had little understanding of the nature of digital citizenship.

(a)(ii) Most candidates did well on this question.

(b) (i) Many candidates were able to explain one benefit. In some responses the benefit was so nebulous and vague that the candidate failed to gain marks.

(b) (ii) Candidates who understood what the question was asking were generally able to identify plausible indicators of reliable information and many were able to take the next step and explain why those indicators were significant. A number of candidates focussed on indicators that were more pertinent to the running of the website itself (e.g. the qualifications of the “webmaster”).

(c) Many candidates were able to describe aspects of being a good digital citizen but many had difficulty explaining how the school's Acceptable Use Policy (AUP) could help achieve that goal. A large number of responses tended to confuse an AUP with a course in digital citizenship, or even digital literacy. The better responses were able to explore both the ways in which an

AUP might promote good digital citizenship habits and some of the limitations of policy as an instrument to shape behaviour.

Section B: This year questions four and seven covered Topic 3.11 of the syllabus while questions five and six covered Topic 3.10 of the syllabus. In the 2017 exams, all section B questions will deal with both Topic 3.10 and Topic 3.11.

A very limited number of candidates answered question six. Almost no candidates answered question seven. The vast majority of candidates chose questions 4 or 5. The comments below reflect this pattern of choices. All comments should be read with reference to the exam questions and markscheme.

Question 4 (Swarm technology):

(a) Many candidates assumed that all robots are autonomous perhaps because the stem describes the boats as autonomous. Candidates found it easier to identify some characteristics of a robot rather than attempting to define robot. A definition requires a conceptual understanding of the term while a list of attributes does not. This distinction is worth discussing with candidates.

(a)(ii) Because swarm technology is so new, this was a very difficult question. Most candidates could earn at least 2 marks but thinking carefully about this situation might require the robots to do. Some candidates didn't think in terms of actions but listed attributes that the robots would need to perform needed actions. The question, however, calls for actions not attributes.

(b) Some candidates did not address concerns that were caused by the fact that the boats were autonomous, but discussed very general concerns that would be true of any boat.

(c) This question invited a discussion of the ethics of using autonomous boats in conflict situations. A number of candidates were able to identify and describe critical issues but most found it difficult to go beyond description into an analysis of ethical issues raised by this situation. There were, however, some very fine answers to this question and some that suggested this problem had been discussed in class.

Question 5 (Electronic health records (EHR) in hospitals):

(a)(i) Most candidates had little difficulty with this question.

(a) (ii) Some candidates did not have a clear idea of the duties of the support staff.

(a) (iii and iv) Many candidates did not focus specifically on the advantages/disadvantages of questionnaires as a method of gaining information from the medical staff.

(b) Nearly all candidates knew the difference between a direct changeover and a phased changeover and could state some advantages or disadvantages of each. Few, however, could go beyond description and provide an analysis of the project manager's decision, so it was difficult for candidates to reach the top markband.

(c) Many candidates produced a very generic response without analytical development. Most realized that both were crucial, and some were able to develop a very well substantiated and analyzed argument supporting that stance.

Question 6 (Lowell High School learning management system (LMS)):

A limited number of candidates answered this question.

(a)(i) Nearly all candidates did well on this question.

(a)(ii) Most candidates provided answers that referred to basic hardware/software decisions rather than the design of the videos.

(b) As in question 5(b) nearly all candidates knew the difference between the agile and waterfall methodologies and could state some advantages or disadvantages of each. Few, however, could go beyond description and provide an analysis of the project manager's decision, so it was difficult for candidates to reach the top markband.

(c) Candidates did understand some of the issues related to this choice and were able to set it in the school context. Some candidates produced a thoughtful and detailed evaluation of the choice.

Question 7 (Facial recognition technology):

Almost no candidates answered this question.

(a)(i) Most candidates were able to identify one or two characteristics of machine learning but the wording often lacked clarity suggesting an underlying lack of conceptual understanding.

(a)(ii) candidates were able to identify ways to protect privacy, but some had difficulty adding description.

(b)(i) For this question, candidates either knew the difference or they didn't. Again, those who had a conceptual understanding of both ideas did very well.

(b)(ii) candidates were often able to give a reason but had difficulty explaining it.

(c) A few candidates did not read the question carefully and did not deal with advertising campaigns. Some provided analysis but struggled with the extent to which the technology can be effective.

Recommendations and guidance for the teaching of future candidates

- Concepts should be taught in specific contexts so candidates can see how the concepts relate to real world conditions. Then, candidates should be presented with a new scenario (context) and asked to apply what they have learned to that new situation. This can be done by using current news articles from reliable sources and creating activities that require candidates to provide supported arguments and to evaluate the impacts of information technology on specific stakeholders.
- Candidates should keep a record of what is learned in class including copies/links to news articles discussed, notes on concepts which have been taught, copies of formative assessments and so. The format does not matter as long as the candidates have an organized body of material to review before the exam.
- Teachers should participate in any Special Events on the OCC in order to deepen their knowledge about assessment.
- Teach candidates how to read questions carefully so that they do not miss key elements or misinterpret the question entirely. Strategies that may help candidates include underlining or circling key words, looking at the stem of the question carefully to identify key stakeholders and IT concepts and to be sure they understand how the technology is functioning in this particular scenario.
- Candidates need to be thoroughly familiar with the markbands and the command terms. This can be done by using them for formative assessments by having candidates use them to evaluate their own work and/or the work of other candidates, and by applying them to samples such as those available on the OCC.
- Often textbooks, news articles, and websites do not provide clear substantive explanations of topics related to artificial intelligence and robotics. For teachers, the best sources for understanding the basic concepts are often, take a deep breath, books. MIT and Oxford Press each have a series of books that are very short (100-200 pages), low cost, basic introductions to a number of technological topics. Occasionally they can become a bit obtuse but overall, they offer clear systematic explanations that are hard to extract from websites and article and develop concepts beyond the kind of comprehensive texts sometimes used in ITGS classes. They can be a good resource for teachers.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 13	14 – 17	18 – 22	23 – 26	27 - 40

The areas of the programme and examination which appeared difficult for the candidates

Given the overlap between the HL and SL papers (three out of the four SL questions are common with the HL paper), these comments should be read in conjunction with those offered for the HL paper. However certain aspects mentioned in the HL comments are worth reiterating and reinforcing here as they are such commonly recurring issues that frequently have a serious impact on the marks gained by candidates:

- Read the question carefully! Candidates must be taught to take particular notice of the part of the question that includes the command term and ensure that their answer addresses and satisfies that instruction. Responses should answer the specific question that is asked (rather than write their pre-rehearsed response).
- For question parts (b) and (c), some candidates are still tending to reduce any question down to lists or tables of advantages and disadvantages. Merely listing points in this way is unlikely to score more than half the available marks for a question at best. Although positive and negative aspects need to be addressed in order to produce a balanced response this does not imply that any question can be adequately answered in a list or table form. Candidates should be made aware that a list of descriptive points is still a list even when it has been presented as continuous prose.
- Where stakeholders are specified in the question, focus the response on them. Although it may be relevant or even necessary to bring other stakeholders into the response, this should be done in order to supply information or perspectives related clearly to the specified stakeholder(s)
- Set the answer in the context of the given scenario. Too many candidates are either ignoring the scenario altogether or overly generalising their responses. Explicit reference must be made to the given scenario throughout the response. Furthermore, the development of arguments must also be consistent with the scenario.
- Candidates must be taught that simply re-stating information given in the question stem will not attract marks. Although the candidate should use the information given in the scenario to shape and steer their response, this information must be developed beyond what is already given in the stem.

The areas of the programme and examination in which candidates appeared well prepared

There was a better understanding than in many previous sessions of the need to include the specific context of the scenario in responses. However, candidates must be aware that simply including terms from the scenario is a good starting point rather than an end point. They should ensure that they go on to suggest points that are consistent with the specifics of the scenario.

The strengths and weaknesses of the candidates in the treatment of individual questions

In this session there were three questions that were common to both papers. They were as follows:

Q1 - Choosing a search engine

Q2 - Restaurant automation

Q3 - Digital citizenship

The comments for these common questions are included within Section A of the HL Paper 1 comments on specific questions.

Question 4 (Virtual dressing rooms):

(a)(i) Most candidates evidently had some idea of what virtual reality is, although in some cases the definition was overly broad to the extent that it could have been applied to any depiction of 'reality' by a computer system, including viewing holiday photographs and watching movies.

(a)(ii) Most candidates answered this question well. A few missed the requirement for steps that "the shopper would take" and included steps taken by the system or other stakeholders (e.g. debit the order amount from the shoppers' credit card, deliver the parcel to the shoppers' home). As an identify question, any irrelevant steps were simply ignored by examiners and did not prevent the candidate gaining marks for valid steps identified subsequently.

(b) Many candidates were able to suggest generic implications of making the virtual dressing room software compatible with other platforms (e.g. attracting a wider customer base) far fewer candidates included a treatment of the implications for the developers themselves or demonstrated much awareness of the broad issues surrounding the production of cross-platform compatible software.

(c) This question was interpreted in two ways by candidates. Some assumed that the virtual dressing room was in direct competition with local clothing shops. Others assumed that the local shops could become members of the virtual dressing room 'scheme' and have a digital presence through the software. Either interpretation was acceptable. The better responses were set clearly in the context of the scenario and discussed impacts that were consistent with that context. Some answers were clearly standard, boilerplate points with vocabulary from the scenario inserted in various places. This at times led to some surprising assertions, such as the

suggestion that once the virtual dressing room arrived, nobody would go to the shops any more, resulting in widespread obesity, mass unemployment in the retail sector and ultimately a breakdown in the social fabric of society.

Recommendations and guidance for the teaching of future candidates

These recommendations should be read in conjunction with the HL recommendations as many are applicable to both levels.

- Although the inclusion in responses of examples studied in class or explored through independent research can provide useful information and insight, candidates should be taught that merely describing an example will add little to the response. Where examples are used that are not drawn directly from the given scenario, the reasons for including them must be made clear and explicit. Any conclusions drawn from an example should be fed-back into the scenario of the question and actively used to help answer the question that has been asked. There are similarities between the use of examples in ITGS and the use of examples in TOK. In both situations the purpose of an example is to facilitate the analysis of the claim (or counterclaim) being made and suggest implications for the developing arguments.
- As has been stated in previous reports, the links between the strands are as important as the content of each strand. Candidates must be taught that the inclusion of vocabulary and concepts from each strand must go beyond a simple “naming of parts” in order to access the upper markbands. For example, where a social/ethical issue and a related IT system are explained, candidates must also make it clear how and why that IT system causes, mitigates or has other implications for the issue. The ITGS triangle remains the key focus point and this should be highlighted throughout the ITGS course.
- Again, as stated in previous examiners’ reports, teachers and candidates must be aware that while markschemes from past exams are a useful resource for teachers, they are not model answers and should not be treated as such, especially with respect to part (b) “analyse” questions and part (c) “discuss” questions.

Paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 2	3 – 5	6 – 8	9 – 11	12 – 15	16 – 18	19 - 26

General comments

The article for this session was longer than in previous ones as it used an integrated IT system. The system used a central database, run by a third party which some candidates raised concerns about. Data could be entered using a variety of devices and by different types of people, police and citizens. The data could be processed, analysed and accessed in a variety of ways as well by different people. The processing and analysis could be performed using database tools and also visually. This meant that candidates needed to absorb a significant amount of information before answering the questions, and also had the problem of deciding how to use it for the various questions. There was no significant evidence from the responses that candidates ran out of time due to the length and complexity of the scenario. The general emphasis of the article was on the benefits of the integrated IT system which meant the candidates needed to think about the negative impacts which were hinted at in various places; and to use them in Criterion C and Criterion D.

Integrated IT systems are becoming more prevalent in the modern world and candidates are encouraged to study a number of them in detail. Examples of such systems are the current article, Uber, AirBNB, eBay, etc. that are characterised by the use of a centralised database with a variety of ways and people who can provide data for the system, and a variety of ways of processing and accessing the data. The input, output and processing are usually separate sub-systems, often in the form of apps for smartphones and personal computers, or back-end big-data type tools.

Overall, candidates did not have too many problems with the variety and complexity of the IT system. One notable exception was candidates who misread the article and incorrectly decided the system had a major role as a ‘surveillance’ tool. These candidates, and others who focused on narrow areas of the article, were not the strongest candidates. The mark boundaries remained the same as for the November 2015 session.

The areas of the programme and examination which appeared difficult for the candidates

As usual the higher mark bands for Criterion C and Criterion D were rarely reached as there were very few conclusions, and even fewer substantiated conclusions. For the next session, teachers need to concentrate on strategies that enable their students to develop higher order

thinking skills. The conclusions that were provided were often a merely a summary of the analyses.

A second area of weakness, that has continually been a problem, is the tendency of candidates to not fully describe concerns and impacts in Criterion A, Criterion C and Criterion D. Too often candidates will simply state/identify a concern/impact and leave out the details. A useful way to avoid this problem is for teachers to direct the candidates to explain why there is a concern, or why there are positive or negative impacts. In the process of explaining why, candidates will need to provide the relevant details and hence demonstrate their understanding.

The areas of the programme and examination in which candidates appeared well prepared

Again it was pleasing to see structured responses in Criterion C and Criterion D. However, the use of a standard structure (or templated approach) does not automatically lead to an increase in the display of higher order thinking skills needed to achieve the higher marks these criteria.

The strengths and weaknesses of the candidates in the treatment of individual questions

Criterion A

This question is meant to be an opportunity for the candidates to become engaged with the details of the article and the major themes of the articles. The material required in the responses usually comes directly from the article and candidates who did not take advantage of the information provided in the article lost marks.

Part A

Generally, this question was done well but there was a tendency for candidates to identify pairs of concerns, e.g. privacy and security, integrity and reliability. The question asks for 'ONE social/ethical concern' and teachers need to direct the candidates to focus on only one of the concerns in the pairs. A similar tendency was to identify a topic such as 'machines and people' rather than focusing on the concerns directly related to the article. Also the advice above about how to solve the problem of the lack of detail in the description applies here.

Part B

As usual most candidates answered this question well. Candidates who did not do well did not refer to the details in the article but provided general descriptions.

Criterion BPart A

Since the article described the use of a complex integrated system and considering the limited space in the answer booklet many candidates used pages from an extra answer booklet. However, there was still a significant number of candidates who seem not to realise that the repetition of the material in the article does not demonstrate their knowledge and understanding of the IT system. In order to obtain the higher marks candidates are meant to describe the technical IT relationships between the various components of the integrated system – connection, data transfer, storage, processing, input and output. The description needs to replace the general terms in the article with technical IT terminology about the underlying hardware and software. Examiners are looking to award marks for responses that include technical IT terminology NOT in the article.

Part B

The connection between the IT system and the concern needs to be explained but many candidates did not include specific reference to parts of the IT system that enabled the negative aspects of the concern to happen. The response needs to focus on the deficiencies of the hardware, software, processes, etc. in the system, and to explain WHY these deficiencies enable the negative impact/effects to happen. The classic case is the ‘database can be hacked’ but this does not explain the specific weakness in the security of the database system such as lack of a firewall to intercept hackers, lack of levels of access to the database, lack of policies to monitor and control the use of the data and the system.

Criterion C

As was mentioned above a concern was the number of candidates who identified impacts but did not provide details describing the impact. Also lists of impacts were common ranging from only identifications of issues and concerns to detailed descriptions. This limited the marks to the lower end of the mark range.

Candidates are expected to show evidence of consistent critical thinking by making analytical connections between impacts, and making evaluative comments, about the impacts in terms of size, the future, links to other effects, impacts on other stakeholder, duration, extent, etc. For example, a candidate could have made an explicit connection between the benefits the system has for the public/police and, at the same time, explain that the same feature of the system could benefit criminals, or hinder the work of the police.

A minimal level of analysis is a structuring of the impacts. The most successful responses were those structured on the stakeholders as it enabled them to provide a balanced set. A suggested approach would be to include two positive and two negative impacts for each of two main stakeholders. A conclusion about the overall impact (positive or negative) cannot be argued unless there is a balanced comparison of impacts that can be used to justify the conclusion. For this IT system the conclusion could argue, for example, that the overall benefit of the system outweighed the negatives as these impacts were limited, would not happen often, and checks could be put into the system. Also the argument could be that the impact was different, larger,

etc. on one stakeholder than the other. The main word here is 'argue' not state and the details would need to justify the conclusion. (This then leads to the discussion in Criterion D of a detailed solution to the negative impacts.)

Criterion D

Candidates are always asked to identify the problem before providing a solution. All candidates filled in this section which was meant to help provide a focus, but a number included more than one problem and then went on to include more than one solution and penalised themselves. Remember: only the FIRST solution will be marked. Also a few candidates provided a problem that was NOT mentioned in Criterion C and self-penalised.

Candidates needed to identify a solution to one of the problems found in Criterion C but often the problem was not specified in sufficient detail to be of help when providing a conclusion about the overall effectiveness of the solution. The problem needs to be framed with reference to specific stakeholders as various aspects of the ICT system and its use. The first section of Criterion D needs to expand on the problem beyond those provided in Criterion C.

A significant number of candidates did not provide a detailed description of the solution, especially technical details (who, where, when, what, how) or details of policies that need to be implemented.

A minimal level of evaluation of the solution must be to explain how it solves the specific problem. Then candidates need to provide a balanced set of further positive and negative evaluations of the effectiveness. These could include consequential impacts of the solution on other problems, stakeholders, long and short term benefits, costs, etc. These must be used in the conclusion that argues that the solution overall was effective or limited in solving the problem considering the negative impacts, or vice versa.

Recommendations and guidance for the teaching of future candidates

Again there was little evidence of candidates going back to Criterion A and Criterion B and, if necessary, revising their responses. Considering the significant number of inadequate responses for these criteria that could easily have been remedied candidates need to review their responses.

For Criterion C and Criterion D teachers need to move beyond providing impacts and solutions to emphasizing the critical thinking skills required. The previous subject reports, the comments above and examples above indicate what is required to achieve these marks; and the markscheme shows how the marks are awarded when a candidate demonstrates the appropriate critical thinking skills.

A major recommendation above was how to overcome the lack of detail in descriptions. This dovetails into the need for teachers to discuss and provide examples of the command terms and their uses, especially using the present and previous markschemes. Candidates need to be able to practice producing perfect responses to previous Paper 2s, either individually or in groups, or with the whole class.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 – 4	5 – 8	9 – 14	15 – 17	18 – 19	20 – 22	23 - 30

General comments

It was good to see that the candidates were able to write clearly and articulately, although the responses tended to be shorter than previous years. For the most part, candidates managed to stay on topic and also craft responses that focussed on what they should be answering, (except for Question 4 - see below).

The areas of the programme and examination which appeared difficult for the candidates

As with previous years, the higher order thinking questions (Question 3, Question 4) was difficult for candidates to demonstrate analysis and research. It is vitally important that teachers provide opportunities to candidates to practice this and to get relevant and appropriate feedback. Many candidates were answering Question 3 and Question 4 with short responses that were highly descriptive and lacked any formal depth to the analysis. Similarly, candidates did not link any real or relevant independent research into the response for Question 4. This means that candidates were not able to access the top levels of the markband.

Some candidates were not able to answer questions from the Case Study on specific terminology that was included in the “additional terminology” section. It is important that teachers carefully go through the Case Study and look at areas that have specific terminology, in particular the list of words and topics in the “additional terminology” section that will definitely be used to formulate questions. It was evident that many candidates had not done this.

The areas of the programme and examination in which candidates appeared well prepared

Some candidates were able to mention visiting a smart home or Skype calling into a company that develops smart homes. Candidates have approximately a year to carry out the additional research and are expected to incorporate this into their responses.

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1(a)

- Many candidates were able to identify suitable ways in which smart devices could be used to make the smart home more environmentally.
- Some candidates provided two answers that were too similar, e.g. the use of sensors for light and the use of sensor for movement, and so could only score 1 out of the 2 marks.
- Some candidates who identified alternative sources of energy did not score as this was not answering the question on how the devices were to be used.
- Some candidates gave generic answers that were not specific to smart homes and hence did not score as highly; some other answers were not clearly linked to environmental sustainability.

Question 1(b)

- Most candidates were able to identify at least one requirement, identifying apps and wireless connections as being the most popular features identified.

Question 2(a)

- Many candidates knew that protocols were rules, but some confused the rules of protocols with the rules set by the IFTTT server being a set of tasks to carry out, rather than the rules that the tasks had to abide by.
- Although the command term was “explain”, some candidates only defined ITFTTT protocol, adding an example, which was not enough to score 2 marks: an illustration is not the same as an explanation.

Question 2(b)

- Many candidates were able to give valid reasons for not using IFTTT for emergency services, but some did not read the question and did not address the ‘suitability’ of IFTTT but instead commented about it not being set up.

Question 3

- This question was on the whole approached well, with many candidates being able to present two or more arguments, both positive and negative. candidates were able to consider the positive arguments of a range of devices and the negative arguments around compatibility. More able candidates were able to discuss further implications of these points.
- Candidates who did not perform well in this question, sometimes developed their answers in a list type format, with general comments, rather than specifically answering the question. Question 3 uses an Assessment Objective 3 command term “discuss”, so just superficial descriptions and outlines of advantages and disadvantages were not sufficient to access the higher marks.
- Some candidates discussed smart devices in general without reference to the question or the specifics of different manufacturers.
- Many candidates did not write a conclusion.

Question 4

- A range of responses were given by the candidates, some clearly did not read the stem of the question and focused purely on the Case Study. The question stem made specific references to the particular use of cloud based data services being used to check the quality of service of devices. Many candidates focused on cloud storage in general and the ability to use these remotely from the home.
- There was limited evidence of good quality research, with some candidates referring to particular brands of smart home devices with tenuous links to the question, while others made general remarks about surveys and guest speakers at the school. Surveying your own class is not considered as independent research in this scenario.
- Not all candidates used the three pages available to develop their answers, with many lacking in depth or using supporting examples.
- Candidates were able to use the Case Study to identify security concerns and privacy concerns but not all gave the details of these and who and how the stakeholders would be affected.
- Candidates writing answers in bullet point lists did not score as well in this section, due to the descriptive nature of their answers, which was not appropriate for an Assessment Objective 3 question that uses the “discuss” command term.
- Candidates who gave evaluative comments throughout tended to score higher in this question.

Recommendations and guidance for the teaching of future candidates

For the Case Study, candidates as well as teachers, should use sites that will assist candidates' preparations for the paper. There is the OCC, the ITGSopedia site as well as the new and annual Facebook Case Study group.

There was evidence of some independent research, however some of it was not relevant or no more than common sense. Teachers should be exposing candidates to real life situations that link in with the core issues of the Case Study. Teachers should also take opportunities throughout the year to have candidates writing practice responses that particularly look at how to incorporate independent research. There has been an improvement on this from past years, however there is more work to be done.

As mentioned earlier, candidates should develop a case study list of appropriate terminology that could be incorporated into their responses so that they are able to demonstrate some higher order thinking. There is a list of specific case study terminology that are used as a basis for the questions and some candidates were not able to answer these questions. These key terminologies listed on the Case Study are a stimulus for class discussion and independent research.

Candidates should also be practicing analysing situations. Many candidates stopped at the descriptive phase of responses and therefore did not and could not reach the high mark bands. With the lead up to the exams, candidates should practice writing Paper 3 style responses and get feedback from teachers as to the level of analysis they are showing on the extended response questions.