

Principal examiner reports for teachers

Principal examiner reports for teachers summarise what candidates did well and what candidates needed to improve for this examination series only.

This report is to be used in conjunction with the question paper and mark scheme.

For guidance on teaching and learning we provide resources for many of our syllabuses.

Resource	Where to find it
Grade descriptions – Grade descriptions describe the level of performance typically demonstrated by candidates achieving the different grades awarded for a qualification.	School support hub Select: Subject > Resource finder > Syllabus and specimen materials
Schemes of work – Schemes of work are designed to support you in your teaching and lesson planning.	School support hub Select: Subject > Resource finder > Teaching and learning
Lesson planning – Guidance on how to plan a lesson.	Lesson planning
Resource plus – There may be additional resources such as teaching packs containing lesson plans, resources and worksheets and videos for aspects of your syllabus.	School support hub Select: Subject > Resource finder > Teaching and learning
Teaching tools	Teaching Tools
Exemplar candidate responses	School support hub Select: Subject > Resource finder > Teaching and learning
Learner guide – A guide for students to help them understand what the course involves.	School support hub Select: Subject > Resource finder > Teaching and learning
Community forums – Do you have a question or something to share? Our online forums are great way to keep up to date with your subject and the global Cambridge community.	Community forum on the school support hub
Access to scripts for this series.	Access to scripts service
Results analysis is available for some syllabuses.	Results analysis
Test maker is available for some subjects.	Test maker

Other services from Cambridge International Education

- [Digital mocks service](#)
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 - [Focus on assessment](#)
 - [Online marking workshops](#)



COMPUTER SCIENCE

Paper 0478/12 Computer Systems

Key messages

What candidates did well

- Many candidates were able to convert numbers between the different bases, perform binary shifts and binary addition.
- Candidates often drew diagrams with annotations to explain what they were showing.
- Many candidates had an understanding of how URLs are converted to an IP.
- Most candidates could identify security solutions and describe these solutions.

What candidates needed to improve

- Candidates need to provide additional information or detail than is already given in the question.
- Candidates should consider which examples are given in a question and provide additional examples.
- Candidates need to understand the difference between describing what something is, describing its purpose, giving an example of how something can be used and giving a benefit or drawback.
- Candidates need to use technical language, for example is a computer executing instructions instead of understanding instructions.
- Candidates need to adapt their answers to the scenario given in the question, using their knowledge of similar scenarios to structure their response, including an application to the question in each statement.
- Diagrams should be fully annotated, for example with arrows pointing to specific areas with a description of what it is showing or what it represents.

Comments on specific questions

Question 1

(a) Comprehensive responses

- Many candidates correctly identified the solution.

Limited responses

- Some candidates ticked incorrect options, commonly the first and last answers.

(b) Comprehensive responses

- Many candidates gave an accurate stage of the working.
- Some candidates continued to calculate the final value.

Limited responses

- Some candidates divided by 1024 once instead of twice. Some candidates multiplied by 8 to calculate the bits for a colour depth of 1 byte instead of 2 bytes.

Question 2

(a) Comprehensive responses

- Most candidates were able to identify at least one function of a web browser.

Limited responses

- Some candidates repeated the functions in the question.
- Some candidates stated that it allows a user to access a website, which was also provided as part of the question.



(b)(i) Comprehensive responses

- Some candidates identified the purpose of the IP.

Limited responses

- Some candidates repeated that the IP provides an address to the device, with address being given in the question. These responses required more about the purpose of the IP address, the reason why a device needed an address.
- Some responses gave partial answers, for example to allow a device to be identified, without including where this identification was required.

(ii) Comprehensive responses

- Many candidates gave descriptions of some of the stages of the process, usually in a logical order.

Limited responses

- Some candidates stated that 'a request' was sent to the DNS from the web browser, without stating what was included in this request i.e. the URL or domain name.
- Some candidates formed their answer in the same manner of the question, stating that the DNS converts the URL into an IP address, without explaining how this happens.

(c)(i) Comprehensive responses

- Some candidates gave a suitable response.

Limited responses

- Some candidates gave examples of the use of cookies, for example storing login details, instead of stating what a cookie is.
- Some candidates identified that a cookie is a file, without identifying the type of file.

(ii) Comprehensive responses

- Many candidates gave an appropriate example of how a session cookie is used.
- Many candidates gave an appropriate example of how a persistent cookie is used.

Limited responses

- Some candidates provided a definition of a session cookie and a persistent cookie, identifying which are retained during the session and which are retained permanently instead of an example of how they are each used.

Question 3

(a) Comprehensive responses

- Many candidates provided at least one characteristic of a drone. Candidates often provided two or more characteristics.

Limited responses

- Some candidates described the features of an embedded system and justified why a drone is an embedded system instead of a robot.
- Some candidates described the actions of the drone and how it worked, instead of its characteristics related to it being a robot.

(b)(i) Comprehensive responses

- Many candidates gave an appropriate sensor for the drone.

Limited responses

- Some candidates gave motion or movement sensor. These terms require more precision as to that actual type of sensor within it, for example infra-red. The drone also does not only detect movement because the drone itself is moving and therefore this would not be appropriate.



(ii) Comprehensive responses

- Some candidates identified the key features of a microprocessor.

Limited responses

- Some candidates described the features of a CPU or other processor that was not a microprocessor, for example a device that performs the FDE cycle, without clarifying what makes it a microprocessor.
- Some candidates linked a microprocessor to an embedded system and defined an embedded system instead of a microprocessor.

(iii) Comprehensive responses

- Many candidates were able to describe elements of this process, giving answers that described the comparison of the data to the stored data and the use of an actuator to physically change the drone's current actions. These candidates often gave detailed descriptions of how the result of the comparison of the data gave different actions.

Limited responses

- Some candidates gave answers that repeated the content in the question, describing it detecting if it was close to an object using the sensor and then the microprocessor stopping the drone from crashing.
- Some candidates described the transmission of the data to the microprocessor without identifying that this is a continuous stream of data that is converted to digital.

(c) (i) Comprehensive responses

- Few candidates gave a complete description of the interface.

Limited responses

- Many candidates gave benefits of a USB interface, for example it being universal, that it can transmit data a long way.
- Some candidates described a USB memory stick, that the interface is the storage of data on a device that can be removed from the computer.

(ii) Comprehensive responses

- Some candidates gave a suitable description of how the data is transmitted.

Limited responses

- Some candidates described the connection of the wire to the port, or the use of wires to power a device.

Question 4

Comprehensive responses

- Many candidates identified the structure of a data packet and the content of these three sections.
- Some candidates drew an annotated diagram that included the sender and receiver, multiple routers and packets being transmitted between these devices. These responses had annotations to explain what they were drawing, for example to identify the packets, to show the packets travelling different routes or arriving out of order.
- Some candidates gave a diagram and a narrative below the diagram. They numbered these points to join them to the diagram to allow it to be followed.

Limited responses

- Some candidates drew a diagram that showed lines between devices without annotation, for example which elements were the packets and how these were moving through the network.
- Some candidates identified a router choosing the path for the packets without identifying it chose the most efficient route.

Question 5

(a) Comprehensive responses

- Many candidates identified one characteristic of secondary storage.



Limited responses

- Some candidates gave a comparison between primary and secondary storage or a benefit of secondary storage.
- Some candidates identified a larger storage capacity than primary, which is not always accurate depending on the devices.

(b) Comprehensive responses

- Most candidates identified the correct term for at least one space.

Limited responses

- Some candidates identified XOR gates instead of NOR gates.
- Some candidates identified pits and lands instead of electromagnetic field.

(c) (i) Comprehensive responses

- Some candidates gave a suitable definition.

Limited responses

- Some candidates described cloud storage as being remote servers, without differentiating between cloud storage and other servers that are not part of cloud storage.
- Some candidates identified it as being data storage on servers without identifying the location of these servers to differentiate them from a local server on the same network.

(ii) Comprehensive responses

- Many candidates were able to identify an advantage of storing data on the cloud, with candidates often giving several appropriate advantages.

Limited responses

- Some candidates gave advantages that were not unique to cloud storage, for example that the data could be accessed at any time. Data on a local secondary storage device can be accessed at any time.

(iii) Comprehensive responses

- Many candidates identified at least one advantage to the student of storing the data locally.

Limited responses

- Some candidates gave a response that the data could be accessed without Wi-Fi. The cloud does not require Wi-Fi access; a wired network connection will still provide access to the data.
- Some candidates identified that it would be cheaper, without explaining how this was applicable because cloud storage is often free of charge. This required an explanation of ongoing or long-term subscription fees to a cloud service provider.

Question 6

(a) Comprehensive responses

- Most candidates gave the correct 8-bit binary value.

(b) Comprehensive responses

- Most candidates gave the correct 12-bit binary value.

(c) Comprehensive responses

- Many candidates gave the correct result after the shift.

Limited responses

- Some candidates performed a right shift instead of a left shift.

(d) Comprehensive responses

- Some candidates gave the correct denary value.

Limited responses

- Some candidates gave a negative answer.

- Some candidates attempted to 'flip' the binary value and then converted this resulting value to denary.

(e) Comprehensive responses

- Many candidates added the two binary numbers accurately and showed their working of binary addition by showing the carries.

Limited responses

- Some candidates did not show their working or had incomplete working for example only 5 carries.

Question 7

(a) Comprehensive responses

- Many candidates were able to provide some justification for their choice.

Limited responses

- Some candidates described how the transmission method worked instead of justifying why their choice was appropriate. For example, for serial they stated it transmits one bit at a time down one wire, they needed to expand this to explain why this makes that method most appropriate.

(b) Comprehensive responses

- Many candidates selected half-duplex or full-duplex and were able to justify their choice.

Limited responses

- Some candidates selected serial and justified it that data only needed to go to the printer, without identifying the question stated data also went from the printer to the computer.
- Some candidates required additional context in their answer to show an understanding that data could travel in both directions.

(c) (i) Comprehensive responses

- Most candidates gave a way that an error could occur.

Limited responses

- Some candidates stated that data could be corrupted; this required more precision as to what the actual error is that the corruption causes because corruption is a general term for an error occurring.

(ii) Comprehensive responses

- Many candidates were able to describe several parts of the process, giving a logically ordered description of the stages.

Limited responses

- Some candidates described an echo check and that the sender resends the data after they have compared the two sets of data
- Some candidates described the process of positive acknowledge without mentioning negative acknowledgements.
- Some candidates were unclear as to the acknowledgment, for example stating an acknowledgement is sent if data is correct and an acknowledgement is sent when data is incorrect, without identifying which type in each occurrence.
- Some candidates described the user being involved in the process, that the user sends an acknowledgement or that the user resends the data. This is an automated process that happens between devices without interaction with the user.

Question 8

(a) Comprehensive responses

- Some candidates gave a suitable description of system software.
- Many candidates gave a suitable description of application software.

Limited responses

- Some candidates described system software as performing tasks for the computer which required additional detail as to what the system software provides for the computer because all software instructs the computer to perform actions.

(b) Comprehensive responses

- Some candidates were able to identify tasks performed.
- Some candidates described how the operating system managed the peripherals using device drivers.

Limited responses

- Many candidates listed, or described, other operating system tasks. For example, that it provides file management and memory management, instead of focusing only on the task of managing peripherals.
- Some candidates repeated the question, that the peripherals are managed, without additional descriptions.

(c) Comprehensive responses

- Many candidates identified one or two security solutions.
- Some candidates explained how their solution protects a computer, describing the function of the solution and what it protects the computer against.

Limited responses

- Some candidates required additional detail in their explanations, for example stating that a firewall blocks some incoming transmissions, requires more detail as to how it makes the decision on which transmission to block.
- Some candidates gave security threats, for example virus, instead of security solutions.

(d) Comprehensive responses

- Some candidates described firmware appropriately.
- Many candidates defined the operating system appropriately.

Limited responses

- Some candidates identified firmware as being hardware or gave an example of what could be stored as part of the firmware for example that firmware is the BIOS.
- Some candidates gave a list of management functions for the operating system or repeated the earlier question that it manages peripherals.

Question 9

(a) Comprehensive responses

- Many candidates described how a check digit is calculated.
- Some candidates described how the check digit checks for an error.

Limited responses

- Some candidates required more clarity for what was being compared, that the read-in check digit, and the calculated check digit are compared. Some responses stated that the check digit was compared with the data, or the values which could not be directly read as being the two check digits.
- Some candidates described the process of a checksum, with data being sent from a sender to a receiver over a transmission media, instead of data being read in as input.

(b)(i) Comprehensive responses

- Many candidates identified the type of words used in a high-level language.
- Some candidates gave an additional feature of a high-level language.

Limited responses

- Many candidates stated that the code needs translating for the computer to 'understand' it. Candidates needed to demonstrate an understanding of the computer executing, processing, or running, the code because a computer cannot 'understand' code.

- Some candidates gave benefits of a high-level language instead of describing what it is. For example, that it is easier for people to read, write and debug.

(ii) Comprehensive responses

- Many candidates gave a description of how the resulting file after compilation can be used within the development process.
- Some candidates described how a compiler provides errors and the benefits of this during development.

Limited responses

- Some candidates described the error report as making it easier for the user to correct the errors, the compiler does not help the user to correct the error, the user is still required to debug the program.

COMPUTER SCIENCE

Paper 0478/22 Algorithms, Programming and Logic
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Key messages

What candidates did well

- Most candidates demonstrated good knowledge of the theoretical aspects of the subject, such as the analysis stage of the program life cycle.
- Most candidates were able to draw a correct logic circuit for a given logic expression.
- Most candidates were able to complete a truth table for a given logic expression.
- Many candidates were able to find errors in a given algorithm and suggest appropriate corrections.
- Many candidates successfully completed the extended programming question, mostly using pseudocode or Python.

What candidates needed to improve

- Some candidates did not answer the questions to match the command word, for example, by not providing sufficient detail for 'explain' questions.
- Some candidates used Python statements for questions that required a response written using pseudocode.

Comments on specific questions

Question 1

Comprehensive responses

- Most candidates correctly ticked option **C** to show their understanding of the meaning of verification checks during input.

Limited responses

- Option **B** was a common incorrect answer.

Question 2

(a) (i) Comprehensive responses

- Most candidates understood that a format check was the correct check in this case.

Limited responses

- Some candidates confused a format check with a type check.

(ii) Comprehensive responses

- Most candidates understood that a type check was the correct check.

Limited responses

- Some candidates mixed up the name of the check and used incorrect names such as integer check or number check instead.

(b) Comprehensive responses

- Most candidates were aware that validation checks are necessary to make sure input data is sensible and to try to prevent inaccuracies occurring during processing.



Limited responses

- Some candidates confused validation with verification and gave responses that would be reasons to verify data on input.
- Some candidates did not give a sufficiently detailed response to match the fact that this was an 'explain' question.

(c) Comprehensive responses

- Most candidates wrote a pseudocode algorithm containing the majority of the required elements.

Limited responses

- Some candidates incorrectly mixed Python code in with their pseudocode statements.
- Some candidates did not include all of the necessary elements to give a comprehensive response, such as not enabling the number to be re-input until a negative number is input.

Question 3

Comprehensive responses

- Most candidates clearly understood the various processes that take place during the analysis stage of the program development life cycle.
- Most candidates were aware of the use of structure diagrams, flowcharts and pseudocode during the design stage of the program development life cycle.

Limited responses

- Many responses needed to show greater understanding of the specific uses of structure diagrams, flowcharts and pseudocode during the design stage.

Question 4

Comprehensive responses

- Most candidates correctly ticked option **B** to show their understanding of the meaning of a maintainable program.

Limited responses

- Options **A**, **C** and **D** were common incorrect answers, where candidates had misread the question and missed the word **not**.

Question 5

(a) Comprehensive responses

- Some candidates spotted and corrected most of the errors in the given algorithm.
- Most candidates spotted and corrected some of the errors in the given algorithm.

Limited responses

- Some candidates correctly identified lines of code that contained errors and did not offer an appropriate correction.
- Some candidates introduced new errors within their corrected responses by changing correct code for incorrect code.

(b) Comprehensive responses

- Many candidates demonstrated a good understanding of nested iteration by writing appropriate pseudocode.
- Some candidates demonstrated some knowledge of nested iteration by writing pseudocode with an appropriate loop structure.

Limited responses

- Some candidates incorrectly mixed Python code in with their pseudocode statements.
- Some candidates did not make full use of the nested iteration facility by writing a single output statement inside their loop structure. Instead, they wrote two output statements.
- Some candidates only used a single loop in their responses.

(c) Comprehensive responses

- Many candidates understood that only one of the columns in the array was being checked and sorted.

Limited responses

- Some candidates mixed up that last names were being sorted, and first names were not used, stating that the array was being sorted by first names only.

Question 6

(a) Comprehensive responses

- Many candidates traced the algorithm and completed the trace table.
- Some candidates completed the trace table with no errors.

Limited responses

- Some candidates need to follow the algorithm to be traced and complete the table as they go, until the algorithm completes.

(b) Comprehensive responses

- Most candidates demonstrating understanding of the purpose of the algorithm represented by the given flowchart.

Limited responses

- Some candidates did not give enough detail in their response to completely cover the purpose of the algorithm.
- Some candidates did not give a sufficiently detailed response to match the fact that this was an 'explain' question.

(c) Comprehensive responses

- Some candidates recognised that input prompts and output messages would make the program represented by the algorithm more user friendly.

Limited responses

- Many candidates confused the requirements of this question with a question about maintainable programs and gave inappropriate answers such as writing comments in the program.

Question 7

(a) Comprehensive responses

- Most candidates drew good diagrams of logic circuits to represent the given logic expression.

Limited responses

- Some candidates need to take more care when drawing logic gates to make sure each gate has its own distinctive shape, for example, NOR and XOR gates shouldn't have straight sides with curved backs, as this could confuse them with NOT gates.

(b) Comprehensive responses

- Most candidates completed their truth table to accurately match the given logic expression.

Limited responses

- A small number of candidates gave a response that was the exact opposite to the expected answer suggesting either an extra NOT had been applied or a NOT had been missed.

Question 8

(a) Comprehensive responses

- Most candidates stated the correct number of fields and records.

Limited responses

- Some candidates mixed up fields and records and gave their answers in reverse to what was expected.

- Some candidates included the table heading row as part of their amount of records response.

(b) Comprehensive responses

- Some candidates understood that primary keys were more manageable if they were of a fixed size or format.

Limited responses

- Many candidates missed that the question told them the `IDCode` and `Country` fields both gave unique data, by suggesting the `IDCode` would make a more suitable primary key because its data was unique.

(c) Comprehensive responses

- Most candidates wrote the correct output for the given structured query language (SQL) statement.

Limited responses

- Some candidates included unnecessary extra punctuation, such as commas, in their responses.

(d) Comprehensive responses

- Many candidates wrote a complete SQL statement with all the required features.

Limited responses

- Some candidates missed out the correct `ORDER BY` statement or used incorrect SQL code within that statement.

Question 9

Comprehensive responses

- Most candidates gave their response using either pseudocode or Python.
- Many candidates initialised their arrays at an appropriate place in their program.
- Most candidates allowed correct inputs to take place within their program and these inputs were validated.
- Most candidates wrote code to enable the options for the survey to be input and stored.
- Most candidates enabled the inputted options to be displayed and a validated choice to be made and stored.
- Some candidates wrote code to count the number of votes for each option and then could find the options that were the most and least popular.
- Some candidates gave an appropriate final output to show the results of the survey.

Limited responses

- Some candidates misunderstood that there were options and voters in position 1 of the relevant arrays and therefore began their iterations from index 2.
- Some candidates did not provide a response to all of the requirements of the program.
- Some candidates needed to include more comments within their program to explain what it was doing.

