COMPUTER SCIENCE

Paper 0478/12
Computer Systems

Key messages

Candidates demonstrated a good understanding of packets and how packet switching is performed within a network.

Candidates need to link their answers to that context provided in the scenario for the question. For example, asking how machine learning is used in a search engine requires more than a generic description of machine learning.

General comments

Candidates often demonstrated a good understanding of a range of topics, making appropriate use of terminology in their responses. These included binary conversion, networks and protocols.

There were some common misconceptions such as the smallest denary number that can be represented in binary is 1 instead of 0 and that an actuator changes what is displayed on a monitor.

Some candidates need to consider the key words in the questions, for example the difference between a question that asks for purpose, characteristics or advantages, all of which require different responses.

Comments on specific questions

Question 1

(a) Candidates were often able to correctly identify several of the correct missing items. The most common correct answers included binary being base 2 and hexadecimal base 16. A common misconception was that the smallest denary number that can be represented as an 8-bit binary number is 1 instead of 0.

(b) Many candidates correctly added together the two binary numbers. Fewer candidates showed their full working. A small number of responses converted the two binary numbers into denary, added these and then converted the total back into binary. Candidates need to make sure they are clearly showing where the carries are located. If candidates perform the calculation multiple times by rewriting the addition it is important that they indicate which is their actual answer especially when they produce different results.

(c) Many candidates were able to identify the correct answer that it is too large to represent in the number of bits available.

Question 2

(a) Candidates gave a range of responses to define colour depth. The most common ones included the number of bits per colour or the number of bits per pixel. A common error was stating it was the number of pixels per bit, or the number of pixels in an image. Some responses stated that it was the number of colours that the image used, these responses lacked precision because it is the number of colours that can be used, they may not all be used in the image.

(b) Most candidates answered this question well. The most common responses identified that as the resolution increased, so did the file size of the image. Fewer candidates went further to describe

this relationship and how the resolution changes the file size. Some candidates gave detailed responses that clearly identified the increase in pixels and then the increase in bits.

(c) (i) Responses commonly identified that lossless did not lose or permanently delete any data from the image. Some responses included reference to lossless not impacting or changing the quality of the image. Fewer responses explained why this was required in this scenario; those candidates that did, often identified that lossy may results in pixelation or blurring of elements in the image.

(ii) Many candidates were able to identify run-length encoding as a lossless method of compression. Some candidates gave a file type or identified zip folders which are not a method of compression. Candidates who identified run-length encoding were often able to describe how this worked, by identifying the repeated patterns. Some of the stronger responses gave an example of how this would work in practice with an image.

(d) (i) Many candidates were able to demonstrate a stronger understanding of packets and how packet switching works. Common answers included the identification of the different parts of a packet: the header, payload and trailer. Some responses expanded this to identify data that was stored within these sections. Candidates were often able to identify that each packet travels along its own route to the destination and some candidates extended this to identify that the packets arrive out of order. Some responses did identify that the packets are rearranged when they arrived, but did not state that this only happens once all the packets have arrived as they cannot be put in order when some packets are still missing.

(ii) Candidates often annotated their diagrams to show the understanding of the difference between simplex and full-duplex. Some annotations lacked precision, for example identifying that full-duplex can go both ways, without clarifying that this can happen at the same time. Some annotations did not match the diagram candidates had drawn, for example arrows going both ways for simplex but the annotation stating only one way was allowed. Some diagrams showed multiple wires (lines) going between the two computers for serial, whilst contradicting this in the annotation by stating there was only one line of transmission.

Question 3

(a) Candidates were often able to identify at least one of the registers. A common erroneous response was a logical register and an arithmetic register.

(b) Many candidates were able to identify the purpose of the CPU as running the FDE cycle. Some responses lacked technical understanding, for example explaining that it does the processing, or that it is the brain of the computer.

(c) (i) Candidates were often able to identify computer A as being able to execute the most instructions simultaneously. Fewer candidates were able to explain why this was the correct answer. The most common point made was that it had more cores, or that it has four cores. Some responses did explain what the four cores meant and how four cycles could be executed at the same time. Some candidates stated that it can run more instructions per second, which did not explain why it executes more instructions simultaneously.

(ii) Responses often identified that it has a faster clock speed. Some responses explained what the difference in these two clock speeds meant by quantifying the difference in the number of instructions that could run each second. A common error was identifying that computer B could run 2.5 billion instructions each second without taking into consideration the dual cores. Some of the stronger responses identified that there would not be the latency in the single-core that would be present in the dual-core due to communication required between the cores.

(d) Many responses found it difficult to define the term without using the term instruction or the term set. The stronger responses described the list of all the different commands that could be used and some responses made appropriate use of the technical term opcodes.

Question 4

(a) (i) Candidates were often able to identify an appropriate sensor, most commonly the use of an infra-red sensor or a proximity sensor. Some candidates gave motion sensor which was not precise enough to indicate the actual sensor that would be used to detect the motion, which is most commonly an infra-red sensor.

(ii) Some responses recalled previous questions that referred to sensors and microprocessors and gave a generic response to the question instead of considering the context of the question. The stronger responses considered what the data collected by this sensor was detecting and how this was being measured. Some of the weaker responses repeated the question, for example stating if the data showed that a person was within 1 metre instead of how the microprocessor would identifying that a person was within 1 metre – through the comparison of the data against a stored value. A common misconception was that an actuator would be used to change the display on the screen. An actuator converts a digital signal into physical movement for example to move a motor to open a door, it does not display a message on a digital screen.

(b) Candidates were often able to identify that the ATM performed a limited number of functions. Some candidates were able to expand on this to identify that the functionality could not be changed or that the hardware was dedicated to its functions.

(c) The most common responses included the use of a braille keyboard or a microphone for the input device and a speaker for the output device. Some candidates repeated those that were in the question, identifying touchscreen for both the input and output.

Question 5

(a) (i) The most common responses identified the NIC as allowing the device to connect to a network, some candidates expanded on this by identifying it as being allocated the IP address.

(ii) This question was often answered well, with candidates often demonstrating a good understanding of the characteristics of a MAC address, most commonly identifying it as being represented in hexadecimal, pairs of values separated by colons. Some candidates described the purpose of a MAC address, which is to provide a unique address to a computer or being used to identify the computer in a network which are not characteristics of the address.

(b) (i) Candidates were often able to identify the valid IP address.

(ii) The most common response was a router. Some candidates identified the use of a DHCP device.

(c) (i) Candidates were often able to define the term accurately, describing it as the collection of web pages. Some candidates mixed up the term with that of the internet, describing it as the infrastructure that provided access to the website. Some candidates gave contradictory answers, stating that it was both the infrastructure and the web pages.

(ii) Many candidates were able to demonstrate a good understanding of HTTPS. The most common responses included the use of encryption to protect the data, with many also identifying the use of SSL or TLS. The stronger responses also included a description of digital certificates and how these were transmitted from the server to the browser. Some responses inaccurately described the browser as sending the certificate to the server instead of the other way around.

(iii) This question was often answered well with candidates often giving two other parts. Some candidates gave multiple names for the same part, for example the file name and the path as two separate parts.

Question 6

(a) Candidates were often able to identify some other characteristics of AI, most commonly that it is a collection of data and rules, or that it was reason and adapt. Some candidates repeated the characteristics given in the question, or gave this in another form, for example that it learns from its mistakes.

(b) There were a range of responses to this question with many candidates showing consideration of the different ways that a search engine could make use of machine learning. The most common response related to the use of personalisation, for example identifying common choices by the user such as websites that they visit often, then using this to recommend these web pages first. Some responses focused on the use of natural language processing, for example identifying the keywords that the user was entering and then using this to display different search options or suggestions to complete the search that the user was entered. Few candidates considered how the search engine found the results. Some of the weaker responses gave generic answers about machine learning with direct application or consideration of the search engine.

Question 7

(a) Candidates were often able to identify assembly language as a different type of low-level. Some candidates gave machine code which was provided in the question, or binary which equates to machine code. Candidates were often able to get the appropriate translator even if the language was incorrect.

(b) Responses often described how an interpreter and a compiler worked instead of considering the advantages of an interpreter during software development. The stronger responses identified the ability to perform real time debugging and to only run sections of the code without the need for it to all be complete and accurate. Some of the weaker responses lacked the technical precision required to give a clear advantage, for example stating that the interpreter displays the errors one at a time, which could mean that they are all displayed one after the other and not that the interpreter stops when the error is detected and displays that error and does not move on until it is corrected.

(c) This question was often answered well with candidates often able to give several common functions. The most common functions included auto-complete, pretty printing and the code editor.

COMPUTER SCIENCE

Paper 0478/22
Algorithms, Programming and Logic

Key messages

Candidates who read the questions carefully, answered the questions in an appropriate context achieved the best marks.

Candidates need to answer algorithm questions using pseudocode, as stated in the question. Candidates who followed the syntax of the pseudocode as defined in the syllabus, were more accurate with their responses.

Candidates who answered questions in an appropriate manner to the command word used, such as questions beginning with explain being answered with more detail than questions beginning with identify, provided the best response.

General comments

Candidates demonstrated a good overall understanding of the requirements of this paper.

Candidates are reminded that when a question asks for an explanation, it usually require an explanation of how something was done, rather than a simple description of what was done.

Candidates are also reminded that when answering the final programming question, they must ensure that they use only pseudocode, Python, Java or VB.NET, and carefully follow the details given in the scenario. In addition, candidates should read the scenario through to the end before beginning to write their solutions. If the scenario states that arrays and variables do not need to be declared, then candidates do not need to declare these variables and arrays. They should proceed straight to the writing of the program, ensuring that any variables and arrays given in the scenario are used in their solutions.

Comments on specific questions

Question 1

Most candidates were aware that a linear search is a standard method of solution to find a piece of data in an array.

Question 2

Most candidates were aware of the correct pseudocode statement used to store a piece of data held in a variable to a text file.

Question 3

Most candidates were able to match a range of development life cycle stages to their most appropriate description.

Question 4

(a) Most candidates were able to state the purpose of a presence check.

(b) (i) Most candidates were aware that a type check is used to test whether an input value is an integer.

(ii) A range of pseudocode algorithms were seen with the purpose of running a type check on input data to ensure that an integer was input.

Question 5

Candidates were required to complete a table with a range of data to include test data, type of test data and purpose of test data. Most candidates achieved some or most of the marks for the test data and types of test data. Candidates who gave specific answers, such as for the abnormal data, that it checks to see if inputs that are too short are rejected, achieved the best marks.

Question 6

(a) Most candidates were able to identify most of the errors in the given code.

(b) A common error seen was that some candidates did not include the OUTPUT command in their answer. This was essential as the question required the output of the rounded number.

(c) Many candidates successfully explained how they would alter the given algorithm to provide the extra specified functionality.

Question 7

(a) This trace table question was answered well by most candidates.

(b) The majority of candidates recognised that the flowchart represented a simple calculator.

(c) (i) There were many good responses on how the algorithm could be improved, in this case, in terms of a flowchart to reduce input errors.

(ii) Most candidates were able to identify another problem with inputs other than the one given in the previous question part.

Question 8

(a) Most candidates stated that the given database table contained 6 fields and 23 records. A common incorrect answer was where candidates stated that there were 23 fields and 6 records.

(b) The majority of candidates correctly identified the field `Code` as suitable for a primary key because it is a unique identifier.

(c) Most candidates achieved at least one mark. Common errors seen included the rows being sorted in the wrong order, for example, with Buenos Aires being in the first row rather than Valencia, unnecessary extra commas between the fields, or misspellings of some of the place names.

(d) Candidates were required to complete an SQL statement. A high proportion of candidates achieved full or near full marks.

Question 9

(a) Candidates who constructed a logic circuit directly from the given logic expression without attempting to simplify or otherwise alter any of the logic gates generally achieved the best marks.

(b) The majority of candidates achieved at least one mark for this question, with many achieving high marks. A common error seen was the final output column in the response was the exact opposite of the correct answer.

Question 10

Candidates were required to complete an extended program to meet a set of requirements given in a scenario based on adding and outputting membership details of a sports club. The program was to display a menu to allow three options:

- add a new member by entering a new membership code, chosen by the new member, with the program checking to make sure it had a length of six characters and that it had not already been used before.
- display a list of all members showing their names and membership codes.
- end the program.

There was a wide range of quality of responses, with most responses using either pseudocode or Python, but a small number of Java and VB.NET solutions were provided.

The full range of marks was awarded, with a high proportion of candidates achieving marks from the middle or higher mark bands. Stronger responses had closely matched the requirements stated in the scenario, ensuring that all points were fully covered.

Stronger responses had followed the remaining additional guidance at the end of the scenario. This included the comprehensive use of comments to explain the purpose of each part or sub-part of their solution and the use of appropriate messages to accompany all inputs and outputs.

The best responses correctly used all the data structures given in the scenario; in the way they were expected to be used as stated in their descriptions. These were the one-dimensional array `MemberID[]` to store unique membership codes, the two-dimensional array `Name[]` to store members first and last names and the variable `NewID` to allow a new membership code to be input.