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COMPUTER SCIENCE

Paper 0478/12
Computer Systems

Key messages

Candidates demonstrated a good understanding of the steps in managing interrupts, the consideration of drawbacks of a self-driving tractor and terminology in networks.

When the question asks, 'how performance is affected', candidates need to make sure their answers clearly state the change being described. For example, 'the clock speed increases the performance' does not identify whether this is an increase or a decrease in clock speed.

General comments

Candidates were often able to demonstrate an understanding of key topics and made appropriate use of technical terminology.

Responses to in-context questions had improved in areas from the previous series, with some candidates applying their answers to the scenario appropriately. A good example of this was some of the ideas for the use of sensors in a self-driving tractor. Answers included a range of uses to monitor the ground water and check the distance between crops.

Some misconceptions have been repeated in responses, for example that hexadecimal takes less memory to store values on a computer.

Candidates need to make sure they carefully read the requirements for each question to make sure they are answering the question, for example an input device was required for interrupts, but many provided an output device.

Comments on specific questions

Question 1

(a) This question was answered well by many candidates who were able to select the correct answer. A common misconception was that computers only allow 1s and 0s to be entered (Answer A).

(b) (i) Many candidates were able to identify the correct ASCII denary number as 81 (Answer A).

(ii) Many candidates were able to convert the binary number accurately. Some candidates gave an answer in different quantities of bits (for example 7 bits) which was acceptable because the question did not require a set number of bits.

(iii) Some candidates were able to demonstrate an understanding of how each character has a unique binary value. A common misconception is that each character has a binary value, or has its own value, without clearly representing that each of these is different. For example, letters can each be given a binary value, but two letters could be given the same binary value. This clarification was given by some candidates.

Some responses were able to explain how the value for each of the letters R E and D are stored in the order for each letter. Some responses were not clear about the order, for example stating that the value for the letters is stored.

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(c) (i) Most candidates were able to demonstrate an understanding of sound is recorded. Fewer were able to explain how the higher sampling rate creates the accurate recording.

Some candidates inaccurately described sample rate instead of sampling resolution.

Candidates commonly identified that the sampling resolution is the number of bits per sample. Many candidates then repeated the question by stating that this made the recording more accurate without explaining how, that is, a higher sampling resolution means a wider range of amplitudes can be recorded.

(ii) Many candidates were able to identify increasing the sample rate as another method of improving the accuracy.

Question 2

(a) Most candidates were able to identify which of the statements were incorrect. Fewer candidates were able to correct that statement.

Statement B required the instruction changing to the address. Some candidates changed other elements, for example changing instruction to data, or giving a definition for RAM instead.

Statement C required the PC changing to an appropriate place where the data could come from. A common misconception is that it stores the data passed from the MAR and not the data from the address stored in the MAR.

(b) (i) This question required candidates to explain what was meant by a 3.5 GHz processor. Candidates had to explain 3.5 GHz, for example identify the equivalent number and then how this number relates to the processes. Candidates often identified that the 3.5 GHz is the number of FDE cycles each second, but fewer concluded that 3.5 GHz is 3.5 billion FDE cycles.

A common misconception was that 3.5 GHz is 3.5 million. Some responses stated that it was the number of 'cycles' per second without reference to what a ‘cycle’ was, or that it is 3.5 billion FDE cycles without reference to the timescale.

(ii) Candidates were often able to identify that the performance of the CPU would improve as the number of cores increased. Some candidates stated the improved performance but did not identify whether this was with more cores or fewer cores. Fewer candidates were able to expand on how this affected the performance, for example that there were more FDE cycles processed simultaneously.

(iii) Some candidates were able to explain the increase in cache and how this affected the performance. Most common response was that more cache improves performance. Fewer candidates could explain this in more depth, for example stating ‘because it is faster’ without explaining what it was faster than, that is, it is faster to access the data from cache than from RAM.

Some candidates did not identify whether an increase or decrease in cache improved performance. They only stated that cache improves performance.

(c) (i) Candidates often answered this question well, with many candidates giving a description of RAM. Most common responses were that it was volatile memory and that it stored the currently running data.

(ii) Most candidates provided a correct item of data. Most common answers included the BIOS or the firmware.

(iii) Many candidates answered this question well. The most common answer was that it is allows more data to be stored in RAM when RAM is full.

Question 3

(a) Some candidates were able to give an appropriate description of managing memory. Common correct answers included the allocation of memory, or the movement of data between memory. Many candidates repeated the function name, for example stating that the memory is managed.

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Some candidates identified the platform for running software, but many candidates were unable to identify this feature, with common inaccuracies such as 'system software' or 'managing software'.

Many candidates were able to give a description of managing peripherals, most commonly from a description of installing or running device drivers. Some candidates repeated the name of the function, for example stating that it manages the devices and peripherals without any expansion.

(b) (i) Some candidates were able to state that an interrupt identifies that the processor's attention is needed. Common misconceptions stated were that the interrupt signals to the user that there is a problem or that an interrupt produces an output message (the processing of an interrupt might generate an output message but not always and this is from the interrupt handler) or that an interrupt stops the current program (the purpose of an interrupt is not to stop the current process and not all interrupts will stop the current process).

(ii) This question was often answered well with many candidates giving an input device and an interrupt. The most common response was a keyboard with a key press, or a mouse and a click of movement. Candidates need to make sure they read the question carefully. Many incorrect answers were due to output devices being given, for example a printer.

(iii) Some candidates were able to demonstrate a good understanding of interrupts and how they are managed. These responses gave a step-by-step description of what happens in terms of priorities, interrupt queues and the pausing of the FDE cycle.

Some candidates were able to identify that there was a priority given or used, but not how this affected the current program being processed.

Some candidates identified that the current program is stopped and stored but did not refer to how or where it was stored.

Question 4

Many candidates were able to create a diagram that showed some stages of the process. Common diagrams included showing the user, the DNS and the web server. Some candidates clearly annotated their diagrams, for example drawing arrows to show how the data moved and writing the content of what was being transferred.

Some candidates drew an image of a web page and the different components within a web browser instead of how the web page is displayed.

Question 5

Many candidates had a good understanding of digital currencies and were able to identify the correct terms to complete the statements.

Question 6

(a) Most candidates answered this question well, giving another reason for why the tractor is a robot, the most common answers being that it is programmable or that it has electrical components.

(b) (i) This question required candidates to consider how the system will automatically stop the tractor. It needed an understanding of how the components work together and how the data is accessed.

Some of the weaker responses repeated information in the question without expansion, for example that the microprocessor checks if the data shows a person is within 3 metres and now how this data is actually compared.

The stronger responses gave a clear explanation of how the data is generated and processed, for example how the value is compared to the distance of 3 metres.

(ii) Many candidates answered this question well. They identified an appropriate sensor. Some were able to give a use for it in the tractor. Some candidates gave a generate use of the sensor, for example that a temperature sensor records the temperature, without applying it to the given scenario.

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(c) Candidates often answered this question well, identifying appropriate drawbacks for the use of a self-driving tractor. The most common responses included the replacement of jobs and the cost of purchasing and programming the tractor would be high.

Candidates need to be clear what the cost is when using cost as an answer, for example 'it is expensive' is not enough. They need to state that the cost of purchasing is high, or the cost of maintenance is high.

(d) Many candidates identified at least one of the components of an expert system, with many giving several correct answers. Candidates need to make sure they use the full correct term, for example 'rule data' is not precise enough for a rule base. Some candidates also wrote 'interface engine' instead of the correct term of inference engine.

(e) (i) Many candidates had a good understanding of an echo check and the stages involved. Some candidates had the data checks in the wrong place, that is, the farmer's computer was comparing the data.

(ii) This question was often answered well with many candidates giving most or all the correct bit values. Some candidates had the values reversed.

Question 7

(a) (i) Many candidates identified the purpose of encryption; most commonly to stop the data being understood. A common inaccuracy is that the data cannot be read or that the data cannot be intercepted. Encryption does not stop data being intercepted or stolen, but the data does not make sense.

(ii) Many candidates demonstrated an understanding of the use of keys within symmetric and asymmetric encryption. Some descriptions of symmetric were not clear in that there was only one key for both encryption and decryption. Answers for asymmetric often identified the use of two keys and described how these were used to encrypt and decrypt the data.

(b) (i) Many candidates identified two appropriate items of data. Some answers needed precision, for example 'IP address' on its own is not enough to differentiate between the sender's IP address and the receiver's IP address.

(ii) Most candidates identified that the router controls the path that the packet takes. A common answer was that it sends the packet towards its destination. Some responses did not give the purpose of a router in the packet-switching process, instead giving its role in a network, for example to connect devices together.

Question 8

(a) (i) Some candidates were able to calculate the correct hexadecimal number. Some candidates gave the correct values but in the incorrect order, that is, CE instead of EC. Some candidates gave a binary number instead of a hexadecimal number.

(ii) The most common responses to this question included it being easier to read or understand. A common misconception was that hexadecimal can store more data or that it takes less memory or storage space.

(b) (i) Candidates used a range of different methods to convert the integer into denary. Some candidates were able to calculate the correct final value. Some candidates had appropriate working, but then did not add the values correctly, or did not include the negative sign in the answer.

(ii) Some candidates were able to identify that this was a positive number and the two's complement value does not require the manipulation or calculation to convert it and that the most significant bit has to be a 0.

(c) This question was often answered well, with many candidates identifying the division by 16 or describing the division number for example dividing by 2, four times.

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Some of the weaker responses stated that the value changed and was decreased, without identifying the mathematical effect of the shift.

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Paper 0478/22
Algorithms, Programming and Logic

Key messages

Candidates who read the questions carefully before answering, and make sure that they fully answered the question asked in an appropriate context, achieved better marks than candidates who gave generic responses.

Candidates need to answer algorithm questions using pseudocode, as stated in the question. Candidates who had made themselves fully aware of the syntax of the pseudocode defined within the syllabus for this course answered pseudocode questions accurately.

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 responses.

General comments

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

Candidates are reminded that explain type questions usually require an explanation of how something was done, rather than a simple description of what was done, which would be the expected answer in a describe question.

Candidates are also reminded that when answering the final programming question, they must ensure that they use only pseudocode, Python, Java or VB.NET in their response, and that the solution accurately follows the details given in the scenario.

In addition, candidates should read the scenario through to the end before beginning their solution. 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 the variables and arrays defined in the scenario are used as stated in the scenario.

Comments on specific questions

Question 1

Most candidates demonstrated awareness that decomposition is a part of the analysis stage of the program life cycle.

Question 2

(a) The majority of candidates were able to match each test data type with its most appropriate description.

(b) Candidates in general gave a good variety of test data covering each of the required types: abnormal, boundary, extreme and normal. The best responses gave comprehensive answers for boundary data, which showed data testing either side of the boundaries and for extreme data, gave both the highest and lowest acceptable values.

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Question 3

(a) Most candidates achieved some marks for writing a pseudocode algorithm to perform a specific linear search. Some candidates achieved full marks, with the best marks being awarded for candidates who produced accurate pseudocode.

(b) Most candidates achieved some marks for writing a pseudocode algorithm to perform a bubble sort, though candidates did seem to find this part to be more difficult than part **(a)**. Candidates who wrote their algorithms making use of two nested loops, with correct comparison between adjacent array elements and swapping of elements if required, achieved the best marks.

Question 4

This question was generally well answered, requiring three data types used in programming to be listed.

Question 5

(a) The majority of candidates correctly identified and corrected at least one error in the given algorithm, with many candidates achieving more than one mark.

(b) (i) Candidates in general managed to write pseudocode to check for the input of values of less than zero and/or applying a check to both inputs. Fewer candidates achieved the third mark for ensuring the input was repeated until correct inputs were made.

(ii) This question was well answered with candidates who correctly identified presence check and type check as the necessary validation checks, and then went on to give a good description of each, achieved the best marks.

Question 6

Most candidates achieved some marks for this question. Candidates who named two of the loops from: count controlled, pre-condition or post-condition, and then went on to give a good description for each of their chosen loop types were awarded all four marks.

Question 7

(a) A generally well answered logic circuit question, with virtually all candidates achieving some marks. Many candidates achieved high marks.

(b) A well answered truth table question, with many high or full mark answers seen.

Question 8

Most candidates achieved some marks, with many candidates achieving high marks. A few common errors were seen such as failure to initialise `NumberGroups` and `Total` to `0`, additional incorrect punctuation such as quotation marks or words such as ‘is’ in the OUTPUT. However, these were limited to a small number of candidates.

Question 9

(a) (i) The majority of candidates correctly identified `StorageID` as the primary key field.

(ii) The majority of candidates stated that the reason for choosing the field in part **(a)(i)** as the primary key was that it is a unique identifier.

(b) This question was mostly well answered with candidates correctly identifying suitable data types for the given fields. It should be noted that the list of acceptable data types for a database is slightly different to the list of acceptable data types for programming languages.

(c) There was a mixed set of responses to this question, with most candidates achieving at least one mark, while other candidates achieved all the marks for completing a structured query language

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statement for the stated query. It was important for candidates to make sure that the data being searched for in the `Hoist` field was written to match the data type they had given in part **(b)**.

Question 10

This question was answered well by most candidates. It required candidates to explain the techniques that can be used to make a program maintainable, with many high scoring responses. Most candidates achieved some marks here. The techniques described included: use of comments, use of meaningful identifier names, use of procedures and functions, use of indentation and white space. Candidates who identified at least three of these and gave a good description for each one achieved all six marks.

Question 11

Candidates were required to complete an extended program using either pseudocode or Python or Java or VB.NET to meet a set of requirements given in a scenario based on students recording their daily screen time usage for a week. The program calculated the total screen time for each student, the average screen time for the class, the number of days for each student where more than 300 minutes were spent in front of a screen and the student with the lowest weekly minutes of screen time. A comprehensive set of outputs to show this data was also required.

A wide range of quality of responses was seen, with most responses using either pseudocode or Python, but a small number of candidates used Java to create their solutions.

Candidates whose responses closely matched the requirements stated in the scenario, ensuring that all points were fully covered, achieved the highest marks.

Candidates who achieved full or near full marks also followed the remaining additional guidance at the end of the scenario. This included the comprehensive use of comments to explain the purpose or function of each part or sub-part of the 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, for example, the array `ScreenTime[]` was expected to be a two-dimensional (2D) array to store the screen time for each student, for each day of the week in separate cells. `StudentName[]` was a one-dimensional (1D) array to store the names of the students in the class.

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