Chhetri Academy

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GCSE COMPUTER SCIENCE

1.1

OCR J277 | Specification point 1.1.3

Embedded systems

Untiered

Answers and examiner comments

2	2019-2023	Untiered
question groups	available papers	tier

Using this booklet

1. Answer numbers match the companion question booklet.
2. Follow the original question number on marking tables.
3. Examiner comments are included where available.

Name _____ **Date** _____

Some entries use full source marking material in an appendix. Any unavailable mark schemes are identified beside the relevant answer.

Original question 2

The full source mark scheme begins on page 5. Use the original paper code, tier and question number shown above.

Question			Answer	Mark	Guidance
7			1 mark for example: e.g. • Auto lights • Auto window wipers • Sat nav // GPS • Airconditioning // climate control • Radio/entertainment/infotainment system/media system • Lane assist • Engine management system • Auto-park • Cruise control • Auto-brake • Follow-me • Dashcam 1 mark each to max 2 for explanation. • **Limited** functions // by example e.g. the system **only** checks the light and turns lights on/off • **Dedicated** microprocessor // by example e.g. there is a microprocessor that is only checking the lights • Hard to change function // by example e.g. the user cannot make the light system do any other role	3	Allow anything that could be reasonably within a car. If example is not clear if it's an embedded system, read explanation for justification e.g. hazard lights – could be embedded if they are activated automatically when the car crashes. Award the example in the explanation if this occurs. If justification is generic features of an embedded system max 1 for explanation. Do not award 'built into the car/larger machine' because this is in the question.

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PMT

GCSE (9–1)

Computer Science

J276/01: Computer systems

General Certificate of Secondary Education

Mark Scheme for June 2019

PMT

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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J276/01 Mark Scheme June 2019

Annotations

Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
^	Omission mark
BOD	Benefit of doubt
C	Subordinate clause/Consequential error
	Cross
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	Benefit of doubt not given
P	Point being made
REP	Repeat
	Slash
	Tick

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J276/01 Mark Scheme June 2019

Subject Specific Marking Instructions

LEVELS OF RESPONSE QUESTIONS:
For answers marked by **levels of response**:
• to determine the level – start at the highest level and work down until you reach the level that matches the answer
• to determine the mark within the level, consider the following

The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement*.

Highest mark: If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.

Lowest mark: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.

Middle mark: This mark should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.
Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.
*When only two marks are available (low mark band) only use Highest and Lowest mark guidance for 'best-fit'.

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J276/01 Mark Scheme June 2019

	AO2.1a	**AO2.1b**
High (thorough) (6 – 8 marks)	Precision in the use of terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and principles of computer science.	Understanding of concepts is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.
Middle (reasonable) (3 – 5 marks)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to make use of acquired knowledge and concepts are not always taken	Understanding of concepts is shown and is applied to context. There is clear evidence that an argument builds and develops through the response but there are times when opportunities are missed to use an example or relate an aspect of understanding to the context provided.
Low (basic) (1 – 2 marks)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply understanding of key concepts in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.
0 marks	No response or no response worthy of credit.	No response or no response worthy of credit.

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J276/01 Mark Scheme June 2019

Question			Answer	Mark	Guidance
1	a	i	1 mark for each completed word CPU stands for **Central Processing Unit**. It is the part of the computer that fetches and executes the **instructions** that are stored in **(main) memory**. The CPU contains the Arithmetic **Logic** Unit (ALU) and the **Control** Unit (CU).	5 AO1 1a (5)	Accept: • RAM/registers in place of "memory" • bod cache/MDR/CIR in place of memory • 'and Logic' in place of Logic • ignore 'data' if they put 'data and instructions' but no mark for data on its own • Do not award command for instructions • Bod central processor unit • Bod logical
1	a	ii	1 mark per bullet to max 2 • Dual core is 2 processors/cores // double the number of processors/cores • Parallel processing can take place • … which means each processor can execute a separate instruction **at the same time** // each processor can run a different part of the program **at the same time** // each core can process instructions **independently** of each other • ...which enables multitasking • Some processes/software **cannot** be split between two processors so it does not increase the performance	2 AO1 1b (1) AO2 1b (1)	• Needs the notion of the processors acting at the same time i.e. not just 'it can run twice as many instructions' without 'at the same time'. • Do not award more instructions per second - this could be achieved by having a faster clock speed. • Allow FDE for 'executing instructions'. • Do not allow 'cores can split the tasks' – need to be how i.e. one task for each core to run at the same time. • BOD run more than one program at once

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J276/01 Mark Scheme June 2019

1	a	iii	1 mark per bullet to max 2 • Cache stores frequently/recently/next to be used instructions/data • …that can be **accessed** faster than **accessing** them from RAM • …which means more cache improves the performance of the CPU // less cache decreases the performance of the CPU • Too much cache can be detrimental … • …as it will take longer to find the instructions in cache	2 AO1 1b (2)	• No mark for just defining cache as being fast memory or close to the CPU. • No mark for cache is faster than RAM - faster at what? • Bod - More cache makes the processing faster • Bod - More cache makes the computer run faster

J276/01 Mark Scheme June 2019

<table>
<tr>
<td>1</td><td>b</td><td>i</td>
<td>1 mark for each row
<table>
<tr><th></th><th>RAM</th><th>ROM</th></tr>
<tr><td>Stores data</td><td>✓</td><td>✓</td></tr>
<tr><td>The memory is volatile</td><td>✓</td><td></td></tr>
<tr><td>Data will not be lost when the computer is turned off</td><td></td><td>✓</td></tr>
<tr><td>Data is read-only, cannot be changed.</td><td></td><td>✓</td></tr>
<tr><td>Stores currently running data and instructions</td><td>✓</td><td></td></tr>
</table>
</td>
<td>5
AO1 1a (5)</td>
<td></td>
</tr>
<tr>
<td>1</td><td>b</td><td>ii</td>
<td>1 mark
• RAM is volatile // Flash memory is non-volatile
• RAM is faster to access/store data than Flash memory // Flash memory is slower to access/store data than RAM
• RAM stores currently running programs/instructions/data/OS // Flash memory stores files and software
• RAM can be directly accessed by CPU // Flash data has to go to RAM before CPU</td>
<td>1
AO2 1a (1)</td>
<td>• Accept description of volatile/non-volatile
• Bod - RAM is primary // Flash is secondary</td>
</tr>
<tr>
<td>1</td><td>c</td><td>i</td>
<td>1 mark for any suitable example
e.g.
Solid state drive // SSD // flash drive
USB memory stick // USB drive
Memory card // SD card</td>
<td>1
AO1 1b (1)</td>
<td>• USB on its own is incorrect.
• Accept USB stick // memory stick
• Do not accept Hard drive, bod solid state hard drive</td>
</tr>
</table>

J276/01 Mark Scheme June 2019

1	c	ii	Secondary	1 AO1 1b (1)	• FT from (i) e.g. if RAM is given for 1ci then this answer must be primary. • FT USB (NE 1ci) as secondary. • If 1ci is NR or not an example of primary or secondary storage, then 0 for whatever is here.
1	c	iii	**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors.	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Portability</u> • Both are Small in size / portable and can easily be moved between Kerry's home and work • Solid state can be smaller • Solid state less likely to break <u>Robustness</u> • Optical are not robust i.e. easily scratched/damaged while being moved • Solid state has no moving parts so unlikely to break if dropped <u>Capacity</u> • CDs have small capacity • Depends on Kerry's files if they are small files e.g. text documents then a CD

PMT

			There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		might be large enough bit if there are lots large files e.g. videos/software then solid state may be more appropriate <u>Cost</u> • Optical cost is small per GB • Solid state can be reused more times because it's more durable so may be cost effective in the long term
1	c	iv	1 mark for correct working e.g. 5*1024 // 5*1000 1 mark for 5120 MB // 5000 MB	2 AO2 1b (2)	

PMT

J276/01 Mark Scheme June 2019

2	a		1 mark per bullet to max 3 e.g. • He can place his files into folders/directories • He can (re)name files/folders • He can move his files/folders • He can copy/transfer/export files/folders • He can delete his files/folders • He can set permissions/access rights • He can search for files • He can view file details/extensions/file size/type • He can create files/folders • He can sort files/folders // he can put files into a specific order // by example • He can open files/folders	3 AO2 1a (3)	• Answers must be clear as to what the answer is applied to i.e. 'you can open it' - what is it? • Mark first answer on each section. • Do not award: o defragment o view files o download o compression o preview o edit/read/write files • 'Organise files' without what into - is not enough.

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2	b	i	1 mark per bullet to max 4 e.g. • Use an algorithm • …to remove **repeated/unnecessary** data • Could use lossy/lossless • **lossless** will not remove data permanently // **lossless** means original file will be restored • **lossy** is **permanent** deletion // **lossy** means original file will not be restored • Reduce number of pixels // reduce resolution • Record the changes in the colour for each pixel • … instead of the colour • Run length encoding • … record the colour and number of consecutive pixels of that colour • … instead of the colour of every pixel • Decrease colour depth//decrease number of colours	4 AO2 1a (2) AO2 1b (2)	• 'lossy removes unnecessary data permanently' gets 3 marks, 1 for lossy, 1 for 'removes unnecessary data' if not already awarded and 1 for lossy = permanent • Do not award 'not noticeable to the human eye', or 'keeps same/reduces quality' - this does not explain **how** the file is compressed. • Do not accept information for data.
2	b	ii	1 mark per bullet to max 2 E.g. • Defragmentation software • Encryption software • Backup software • Anti-virus • Firewall • Anti-spyware • Disk checker/cleaner • Auto-update • Disk formatting	2 AO1 1a (2)	• Do not accept compression • Accept anti-malware
2	c	i	Smart watch	1 AO2 1a (1)	CAO

PMT

J276/01 Mark Scheme June 2019

2	c	ii	1 mark per bullet for justification to max 2 • A smart watch is not a general-purpose computer • … which means the smart watch has one/limited/specific/dedicated function(s) • Smart watch has a microprocessor • … on a single circuit board • It is a computer system that is built within the watch • Runs firmware • Smart watch has built-in OS // difficult to change/manipulate the OS/function • Smart watch has few components all essential to its purpose • Smart watch has specific hardware required to function i.e. speaker/headphones	2 AO2 1b (2)	• Answers must be applied to scenario. Do not award generic definitions. • Allow opposite reasons for why a laptop is not an embedded system but do not allow repeated points.

PMT

J276/01 Mark Scheme June 2019

3	a	i	1 mark per bullet to max 3 e.g. • Malware could be put on the computer • Data protection legislation states personal data must be protected / breaks Data protection legislation • … breach of privacy • …he could lose his job • Delete files // change data • … so the important work is lost/changed • Steal files/data/information // copy data/files/information // keylogger transmits data/files/information to third party • … use for illegal activities • … e.g. profit from the data // gain private information // leak information to the public • Data could be locked	3 AO2 1b (3)	
3	a	ii	1 mark for naming, 1 for description to max 2 per method e.g. • Password • No access without the password // **description** of strong password // limit attempts to guess // changing it regularly • Limited attempts to get into laptop • before laptop is locked • Firewall • Monitor incoming and outgoing transmissions // Stop unauthorised/unwanted incoming/outgoing transmissions/packets. • Biometrics • Need fingerprint/retina scan • Do not leave laptop logged on/unattended • So that other people cannot physical access it • Physical security // keep in locked room • So that people cannot physically access the laptop	4 AO1 1a (2) AO2 1a (2)	• Do not accept encryption/anti-malware, this will not prevent unauthorised access. • Do not accept penetration testing - it's a laptop, not a network. • Login is NE for password • Do not accept access rights - it's access to the laptop

			• Do not connect laptop to network // standalone computer • So that there are no network threats • Two-step verification // two-factor authentication • For example sending code to mobile phone		
3	b	i	1 mark per bullet to max 2 • Uses an algorithm to • … jumble/scramble/mix up the data // turns it into cypher text // by example • If it is accessed it cannot be **understood** // it is **unintelligible** • Use of keys to encrypt/decrypt data	2 AO1 1a (1) AO2 1b (1)	• 'Need the key to understand the data' can get both MP2 and 3 • Cannot read the data // data is unreadable is NBOD

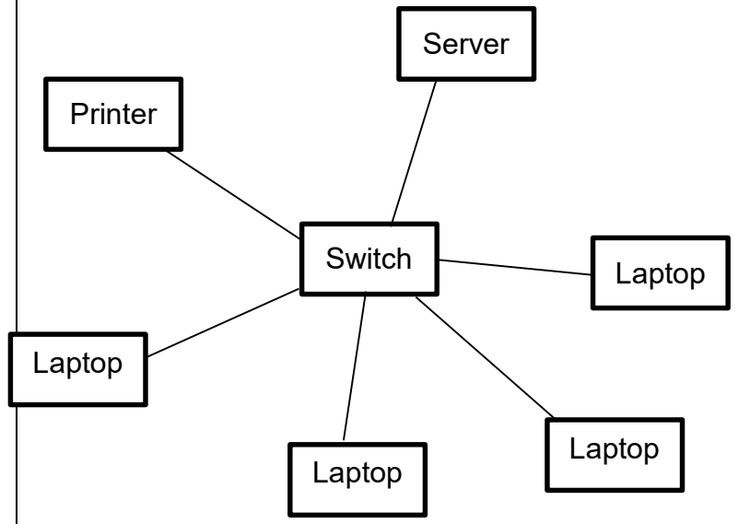
3	b	ii	1 mark for each completed piece of code
			
			`message = input("Please enter your string")`
			`newMessage = ""`
			`messageLength = message.length`
			`for count = 0 to` **`messageLength - 1//`**
			`message.length - 1`
			`  ASCIIValue = ASC(message.subString(`**`count`**`,1)`
			`  ASCIIValue = ASCIIValue +` **`1`**
			`  if ASCIIValue > 90 then`
			`  ASCIIValue =` **`ASCIIValue`** `- 26`
			`  endif`
			`  newMessage =` **`newMessage`** `& CHR(ASCIIValue)`
			`next count`
				5
				AO3 2b (5)
					• For `messageLength - 1` in loop accept `messageLength` or `message.length`
					
					• Spelling must be exact, do not penalise case.

PMT

J276/01 Mark Scheme June 2019

3	b	iii	1 mark for suitable output e.g. `output(newMessage) // print(newMessage)`	1 AO3 2b (1)	• Must logically work. Do not accept "" around `newMessage`. • Parentheses not required. • Do not accept: • `newMessage = output(newMessage)` or similar • Accept any output method • Bod - if the candidate outputs something extra it must be valid i.e. a variable from the program, or additional text in a string with suitable concatenation e.g. `print(newMessage + asciiValue)` is ok but `print(newMessage is the new message)` is not.

J276/01 Mark Scheme June 2019

4	a	i	1 mark per bullet • Four laptops/computers, a server and printer present and clearly identifiable (positions do not matter) • Switch as a device clearly identifiable… • …all devices directly connected to the switch and only the switch (FT from MP2) e.g.  	3 AO2 1a (3)	• Printer may be connected to the server or to the switch. • Accept PC for laptop • If the candidates has given server/switch or switch/server in the centre, mark the first one in their list. If they give server/switch, they do not get MP2, but allow access to MP3.
4	a	ii	1 mark per bullet to max • To connect the devices together • Receives data/packets/traffic • Direct/send data/packets/traffic **only** to its **destination** • Creates/generates a list of devices connected to it as it receives signals • Uses MAC addresses of devices connected to it	2 AO1 1a (1) AO2 1a (1)	• Do not award information, penalise once. • Do not award packet switching out of context. • Accept MP3 by example

PMT

J276/01 Mark Scheme June 2019

4	b	i	1 mark per bullet to max 2 • Wireless transmission is slower **than cabled** • More devices/users could be connected e.g. mobile phones // increase in traffic • …reducing bandwidth available for each user // insufficient bandwidth for users/demand • Wireless can be limited by interference • …such as walls that disrupt the signal // from other wireless networks/users	2 AO1 1b (1) AO2 1b (1)	• Bod - wireless has less bandwidth
4	b	ii	1 mark per factor e.g. • Bandwidth available • Number of users (using the network at the same time) • (Number of) data collisions • Interference // by example e.g. walls • Distance data has to travel // signal strength • Amount of data being transferred • Applications being used • Server/CPU performance • Using a hub instead of a switch	2 AO1 1a (2)	• Do not accept wireless/wired connections • Bod answers such as cable length

J276/01 Mark Scheme June 2019

4	c		1 mark per bullet to max 2 • Non-physical network • A **private** network that runs on a **public**/**existing** network • Combining 1+ physical networks into 1 logical network // 1+ logical networks on 1 physical network // partitioning part of physical network • It uses software to separate the Virtual Network from the wider network • Users in the Virtual Network can only access data in the Virtual Network • Employees can log in / join the private network from any location • Employees can access the server/documents from any location // only gives users of the Virtual Network access to the data • The connection is secured	2 AO2 1a (1) AO2 1b (1)	
5	a		1 mark per bullet to max 5 • The website is hosted on a webserver • The website/webserver has an IP address • (Browser) sends URL to DNS • URL has a linked IP • DNS finds IP • If DNS cannot find the IP it passes request to higher DNS • …if not found return error • IP address sent back to the browser/computer • (Browser) sends request to IP/webserver • Webserver processes request for the website/webpage • …webserver sends the webpage/file/data to the user	5 AO1 1b (3) AO2 1b (2)	• Do not award 'the IP goes to the webserver' • Allow domain name in place of URL • 'DNS finds the IP of the URL it is given' gets 2 marks, 1 for URL has linked IP and 1 for DNS finds the IP • MP 11 do not accept webserver *loads* the webpage on the user's computer
5	b	i	1 mark per bullet to max 2 • A layer can be removed/changed etc. • …without affecting any other layers • Each layer has its own purpose // separates the purposes // self-contained • ...so it does not need to consider what the other layers do • …so it can be programming individually • Individual protocols are each smaller/simpler to manage • Different layers can interface with different hardware	2 AO1 1a (1) AO1 1b (1)	• Do not award descriptions of what the layers do - the question asks why layers are used. • Do not award vague answers e.g. layers make it easier to work with

J276/01 Mark Scheme June 2019

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>b</td><td>ii</td><td>1 mark for each protocol.

<table><tr><th>Task</th><th>Protocol</th></tr><tr><td>Sending an email from one mail server to another</td><td>SMTP // Simple Mail Transfer Protocol</td></tr><tr><td>Transmitting a file from a client to a server</td><td>FTP // File Transfer Protocol</td></tr><tr><td>Viewing a website using a web browser</td><td>HTTP // Hypertext Transfer Protocol
HTTPS // Hypertext Transfer Protocol Secure</td></tr><tr><td>Downloading an email to your computer</td><td>IMAP // Internet Message Access Protocol
POP(3) // Post Office Protocol</td></tr></table></td><td>4
AO2 1a (4)</td><td>• Mark first answer in each box</td></tr>
<tr><td>6</td><td>a</td><td></td><td>1 mark per bullet
Benefits of not providing physical copies e.g.
• Less/no plastic/paper/raw materials used in manufacture // no need for packaging // less waste
• Less electrical power needed to manufacture
• No petrol used to distribute/collect
• …smaller carbon footprint
• Fewer disks need to be manufactured
• Fewer factory emissions // less pollution
• Old versions will be thrown away

Drawbacks of still creating a physical copy (sold online) e.g.
• Plastic/paper are used in manufacture
• Increase in waste
• Old versions will be thrown away
• Uses petrol / creates emissions to distribute</td><td>2
AO2 1b (2)</td><td>• Could be read as still physically creating but not putting in shops.

• Do not accept more use of computers/electricity to download.</td></tr>
</table>

PMT

J276/01 Mark Scheme June 2019

6	b		1 mark per bullet to max 2 for justification • She can sell it for a fee • Protects/copyrights her **source code** • …so it can't be copied/modified/redistributed	2 AO2 1b(2)	• Accept in reverse for why open source is not appropriate, but do not award same MP twice

PMT

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Question 7

7 A car comes with many embedded systems, for example parking sensors.

Identify **one** other embedded system that could be found in a car and explain why this is an embedded system.

Example embedded system .....

Explanation .....

.....

.....

.....

[3]

This question required candidates to consider embedded systems within a car.

There were a range of possible systems, the most common being GPS or satellite navigation systems. Other common responses included automated lights, automated wipers, and parking sensors.

The most common explanation was that the system has a single (or limited) purpose, but few candidates expanded beyond this. Some candidates repeated that it was built into the car but this was provided in the question.

Some candidates provided examples of embedded systems such as a washing machine, a microwave and a fridge/freezer. This was not appropriate to the context of the question.

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