



**GCE**

**Computer Science**

**H046/01: Computing principles**

AS Level

**Mark Scheme for June 2022**

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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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Question			Answer	Mark	Guidance
1	(a)		1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Stored in ROM</li> <li>• Tests hardware/components (are working)</li> <li>• Boots up the operating system</li> </ul>	2 AO1.2 (2)	Accept description of POST/Power On Self Test for BP2  Accept loads up instead of boots up (BP3)
1	(b)	(i)	1 mark for any of the following bullet points: <ul style="list-style-type: none"> <li>• Round Robin</li> <li>• Multi-level feedback queues</li> <li>• Shortest job first</li> <li>• Shortest time remaining</li> </ul>	1 AO1.1 (1)	Do not Allow: <ul style="list-style-type: none"> <li>• First come First Served</li> </ul>
1	(b)	(ii)	1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Jobs dispatched on a FIFO basis</li> <li>• Each job/packet is equal priority</li> <li>• Each job/packet switch has the same processing time</li> </ul>	2 AO2.1 (2)	Accept processed instead of dispatched (Bp1)  Do not accept task/data instead of jobs (BP1 to 3)
1	(c)		1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Paging uses physical addressing....</li> <li>• ....Segmentation uses logical addressing</li> <li>• Paging uses fixed size memory blocks....</li> <li>• .... Segmentation uses variable length memory blocks</li> </ul>	2 AO1.2 (2)	Answer must cover paging and segmentation for 2 marks.  Do not accept data instead of memory
1	(d)	(i)	1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Uses separate memory blocks for instructions and data</li> <li>• Has separate buses (data and address) for data and instructions</li> <li>• Has fixed memory sizes for data and Instructions</li> <li>• Instruction memory may be ROM</li> </ul>	2 AO1.1 (1) AO1.2 (1)	Accept unit instead of blocks (BP1)
1	(d)	(ii)	1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Fixed instruction size</li> <li>• No need for memory to be shared between data and instructions</li> <li>• Removes need for secondary storage</li> <li>• Instructions would never be changed</li> </ul>	2 AO2.1 (2)  Any 2 (Max 2)	

1	(e)	(i)	1 mark for any of the following points, e.g: <ul style="list-style-type: none"> <li>• GUI will need to remove open file manager windows</li> <li>• OS will need to remove open files/release locks</li> <li>• Inform the CPU to cease transferring files</li> </ul>	1 AO2.1 (1)	Allow other suitable alternative answers.
1	(e)	(ii)	1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Stacks use LIFO/FILO storage</li> <li>• As processes are halted by an ISR they are pushed on the stack</li> <li>• When they are returned, they are popped from the top of the stack</li> <li>• So they are returned to in correct order</li> </ul>	2 AO1.2 (2)	
2	(a)		1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Word Processing <ul style="list-style-type: none"> <li>◦ Writing letters to customers</li> </ul> </li> <li>• Spreadsheets <ul style="list-style-type: none"> <li>◦ Completing accounts</li> </ul> </li> <li>• Presentation Software <ul style="list-style-type: none"> <li>◦ Create\Show business plans</li> </ul> </li> <li>• DTP <ul style="list-style-type: none"> <li>◦ Creating marketing literature</li> </ul> </li> <li>• Graphics Package <ul style="list-style-type: none"> <li>◦ Editing photographs of procedures/marketing photos</li> </ul> </li> </ul>	2 AO1.1 (1) AO2.1 (1)	1 Mark for a suitable package and 1 mark for a relevant example for that package.  Do not allow: <ul style="list-style-type: none"> <li>• Non-business software (E.g. games)</li> <li>• Brand names (e.g Word/ Excel)</li> <li>• Database software</li> </ul>
2	(b)		1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>• Disk Defragmentation...</li> <li>• ...To keep optimal r/w speed for her HDD</li> <li>• File management...</li> <li>• ...To allow easy access to her file system</li> <li>• Disk Drivers...</li> <li>• ... To allow her to use new peripheral devices</li> <li>• System Clean-up...</li> <li>• ... to keep her system free of redundant files</li> <li>• Anti-Virus/Malware...</li> </ul>	4 AO1.1 (2) AO1.2 (2)	1 Mark for a suitable utility and 1 mark for a relevant example for that utility.  Do not accept task manager  Accept: <ul style="list-style-type: none"> <li>• Compression Software ...</li> <li>• ... to make the file size smaller</li> <li>• Backup Software ...</li> <li>• ... to make copies of files</li> </ul>

H046/01

Mark Scheme

June 2022

		<ul style="list-style-type: none"> <li>... to find and remove/quarantine viruses/malware (A worms/trojans etc)</li> </ul>		
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<b>2</b>	<b>(c)</b>	<p><b>Mark Band 3–High Level (7-9 marks)</b> The candidate demonstrates a thorough knowledge and understanding of open and closed source software; the material is generally accurate and detailed. The candidate has covered all 4 sections of cost, usability, security and Support available and for the top of this mark band will have covered all 4 well. Evidence/examples will be explicitly relevant to the explanation.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Mark Band 2-Mid Level (4-6 marks)</b> The candidate demonstrates reasonable knowledge and understanding of open and closed source software; the material is generally accurate but at times underdeveloped. The candidate has covered all at least 2 of the 4 sections of cost, usability, security and Support available. Evidence/examples are for the most part implicitly relevant to the explanation.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p><b>Mark Band 1-Low Level (1-3 marks)</b> The candidate demonstrates a basic knowledge of how the layers of open and closed source software; the material is basic and contains some inaccuracies.</p>	<p>AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)</p>	<p><b><u>Knowledge:</u></b> <b>Cost</b> Open Source</p> <ul style="list-style-type: none"> <li>(generally) free to use</li> <li>May have to purchase maintenance contracts</li> <li>Staff training if “non-standard”</li> </ul> <p>Closed Source</p> <ul style="list-style-type: none"> <li>(sometimes) have to pay to license the software</li> <li>If paid will (usually) it will come with some level of support</li> </ul> <p><b>Usability/extensibility</b> Open Source</p> <ul style="list-style-type: none"> <li>Tends to have a lower focus on UI</li> <li>Source code released (under license)</li> <li>Source can be edited</li> <li>Can be redistributed (under license)</li> </ul> <p>Closed Source</p> <ul style="list-style-type: none"> <li>Professionally developed</li> <li>Distributed with a restrictive license</li> <li>Only executable/object code is distributed//source code not distributed</li> <li>Cannot be redistributed</li> </ul> <p><b>Security</b> Open Source</p> <ul style="list-style-type: none"> <li>potentially massive bank of volunteer developers working on the product</li> <li>Many of the contributors may not be professional</li> <li>Code available to be scrutinised by anyone...</li> </ul>
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		<p>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.</p> <p><i>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.</i></p> <p><b>0 marks</b> No attempt to answer the question or response is not worthy of credit.</p>	<ul style="list-style-type: none"> <li>• ...but this may include people with malicious intentions</li> </ul> <p><b>Closed Source</b></p> <ul style="list-style-type: none"> <li>• Closed teams of developers</li> <li>• More work scrutiny for code</li> <li>• security fixes usually addressed quicker</li> </ul> <p><b>Support Available</b></p> <p><b>Open Source</b></p> <ul style="list-style-type: none"> <li>• Source code released (under license)</li> <li>• Source can be edited</li> <li>• Open communities mean lots of support options could be available</li> </ul> <p><b><u>Closed Source</u></b></p> <ul style="list-style-type: none"> <li>• <u>Support may be available from the company producing the software.</u></li> <li>•</li> </ul> <p><b><u>Application:</u></b></p> <p><b>Cost</b></p> <p><b>Open Source</b></p> <ul style="list-style-type: none"> <li>• Lower overheads to company</li> <li>• Extra staff training and hardware cost could lead to total cost of ownership being higher</li> </ul> <p><b>Closed Source</b></p> <ul style="list-style-type: none"> <li>• Support from vendor can lead to quicker fixes.</li> </ul> <p><b>Usability</b></p> <p><b>Open Source</b></p> <ul style="list-style-type: none"> <li>• The ability to edit source code means bespoke functionality can be developed in house</li> <li>• Lower focus on UI can mean a harder to use product (leading to higher training costs)</li> </ul> <p><b>Closed Source</b></p> <ul style="list-style-type: none"> <li>• Due to professional development, finish tends to be a higher standard</li> </ul>
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					<ul style="list-style-type: none"> <li>• As the organisation protects their IP they generally tend to be less buggy as the organisation reputation/business model will rely on it</li> <li>• Lack of source code means extra features can only be developed by the vendor.</li> </ul> <p><b>Security</b></p> <p>Open Source</p> <ul style="list-style-type: none"> <li>• Tends to be less secure as more people working on it, not always under rigorous oversight</li> <li>• No paid developers mean people may not work on security fixes straight away</li> </ul> <p>Closed Source</p> <ul style="list-style-type: none"> <li>• Developers work under tighter standards</li> <li>• Code being scrutinised more will mean less likely to be ship with bugs</li> <li>• Professional standards lead to quicker turnaround of bugs</li> </ul> <p><b>Support Available</b></p> <p>Open Source</p> <ul style="list-style-type: none"> <li>• Editable source code means could self-support</li> <li>• Open communities mean there is vast amounts of knowledge available.</li> </ul> <p><b><u>Evaluation:</u></b></p> <p><b>Open Source</b></p> <ul style="list-style-type: none"> <li>• Open source would lead to potential cost savings if Charlie looked to self support by using online communities or handling the code herself.</li> </ul> <p><b>Closed Source</b></p> <ul style="list-style-type: none"> <li>• If Charlie lacked technical skills, the better UI design from professional developers may make the UX smoother</li> <li>• Charlies would have a legal obligation to the data stored for her business. Closed source tighter security may strengthen this</li> </ul>
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H046/01

Mark Scheme

June 2022

					<ul style="list-style-type: none"> <li>Charlies business will rely on the uptime of her system. Professional support offered by the developers may mean less downtime in the case of software issues.</li> </ul>
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Question			Answer	Mark	Guidance				
3	(a)		<ul style="list-style-type: none"> <li>A set of rules (for communication)</li> </ul>	1 AO1.1 (1)	Do not accept instructions instead of rules				
3	(b)	(i)	1 mark for each completed row up to a maximum of 2 marks:  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>Application</td></tr> <tr><td><b>Transport</b></td></tr> <tr><td><b>Network</b></td></tr> <tr><td>Link</td></tr> </table>	Application	<b>Transport</b>	<b>Network</b>	Link	2 AO1.1 (2)	<ul style="list-style-type: none"> <li>Accept in any order</li> <li>Accept Internet instead of Network</li> </ul>
Application									
<b>Transport</b>									
<b>Network</b>									
Link									
3	(b)	(ii)	1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>Allows different layers to be worked on independently</li> <li>Allows layers to be replaced/upgraded without affecting others</li> <li>Allows for layers from different providers to be used interchangeably</li> </ul>	2 AO1.2 (2)					

3	(c)	<p><b>Mark Band 3–High Level (7-9 marks)</b> The candidate has weighed up benefits and drawbacks of the technology and has applied the moral, legal and ethical issues to both the customer and the business; 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 will have come to a fully justified conclusion.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Mark Band 2-Mid Level (4-6 marks)</b> The candidate has weighed up benefits and drawbacks of the technology. They will have explored some of the moral, legal and ethical issues but they may not be equally spread across both the customer and the business; 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 will have come to a conclusion although they may not fully justify it.</p>	<p>AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)</p>	<p><b><u>Knowledge:</u></b> <b>Benefits</b> Customer:  <ul style="list-style-type: none"> <li>• Personalised offers</li> </ul> Business:  <ul style="list-style-type: none"> <li>• Targeted adverts</li> <li>• Able to track movement habits of customers</li> <li>• Provide more personalised shopping experiences.</li> </ul> <b>Drawbacks</b>  Customer:  <ul style="list-style-type: none"> <li>• Personal intrusion</li> <li>• Invasion of privacy</li> <li>• Pressured selling</li> </ul> Business:  <ul style="list-style-type: none"> <li>• Cost of infra structure</li> <li>• Viewed as invading personal privacy</li> </ul> <b>Moral and Ethical issues</b> <ul style="list-style-type: none"> <li>• Violation of civil liberties</li> <li>• Recording people on the street who are not going into the shop</li> </ul> <b>Legal issues:</b> <ul style="list-style-type: none"> <li>• under data protection laws the shop would need to <ul style="list-style-type: none"> <li>○ Keep any data recorded secure</li> <li>○ Personal data should be accurate and up to date</li> </ul> </li> </ul> <b><u>Application:</u></b> <b>Benefits</b> Customer:</p>
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		<p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p><b>Mark Band 1-Low Level (1-3 marks)</b> The candidate identifies some of the benefits and drawbacks, though they have probably shown little consideration of the legal, ethical and moral issues; 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 may not reach a recognisable conclusion.</p> <p><i>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.</i></p> <p><b>0 marks</b> No attempt to answer the question or response is not worthy of credit.</p>		<ul style="list-style-type: none"> <li>• Personalised experience will lead to more convenient shopping trips</li> <li>• Staff will give personalised service</li> </ul> <p>Business:</p> <ul style="list-style-type: none"> <li>• Tracking movement of customers means able to identify best opening times</li> <li>• Tracking customers around shop allows better analysis of popular products</li> <li>• Use of modern technology will make the shop be seen as forward thinking.</li> </ul> <p><b>Drawbacks</b></p> <p>Customer:</p> <ul style="list-style-type: none"> <li>• Customers may not want to be “pressured” meaning they decide not to shop there anymore.</li> <li>• Tracking data could be hacked and used by criminals</li> </ul> <p>Business:</p> <ul style="list-style-type: none"> <li>• Extra hardware costs may lead to higher prices/competitors undercut them.</li> <li>• Customers who feel their privacy has been invaded may “vote with their feet”</li> </ul> <p><b>Moral and Ethical issues</b></p> <ul style="list-style-type: none"> <li>• Abuse of civil liberties could damage reputation of shop</li> </ul> <p><b>Legal issues:</b></p> <ul style="list-style-type: none"> <li>• Shop may need to add extra software to blur out faces of non-customers</li> <li>• Shop will need to spend more money on data protection compliance, leading to higher costs.</li> </ul> <p><b>Evaluation:</b></p> <p>Benefits</p> <ul style="list-style-type: none"> <li>• Increased revenue from directed sales offset extra costs from hardware/legal obligations</li> </ul>
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H046/01

Mark Scheme

June 2022

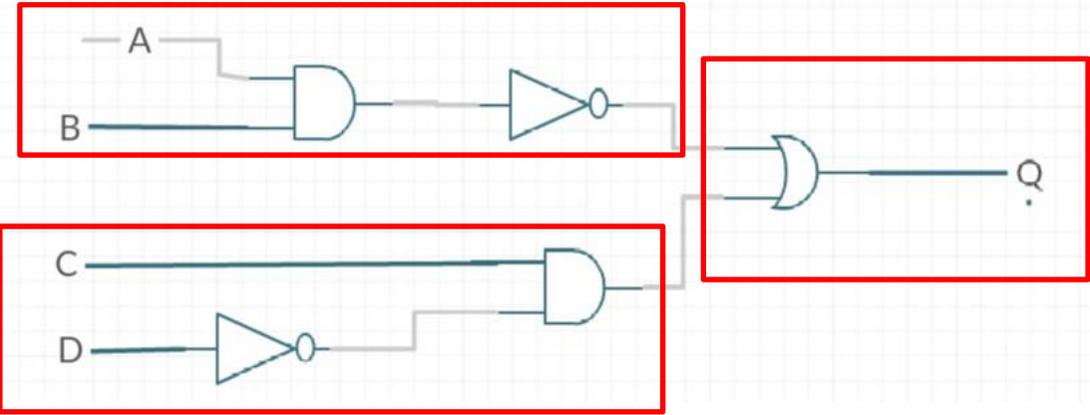
					<ul style="list-style-type: none"> <li>Improved reputation through use of modern technologies may attract more customers</li> </ul> <p>Drawbacks:</p> <ul style="list-style-type: none"> <li>Loss of customer base due to customers unhappy with “pushy techniques”</li> <li>Poor public opinion from invasive advertising puts new customers off.</li> </ul>

Question		Answer	Mark	Guidance
4	(a)	1 mark for any of the following bullet points, e.g: <ul style="list-style-type: none"> <li>Computers use binary logic for on/off or 1/0</li> <li>Computer systems are based on switches/transistors</li> <li>Binary is high tolerance</li> </ul>	1 AO1.2 (1)	
4	(b)	(i)	<ul style="list-style-type: none"> <li>0110 0001</li> </ul>	1 AO2.2 (1) Must get the whole answer right for the mark to be awarded.
4	(b)	(ii)	<ul style="list-style-type: none"> <li>AB</li> </ul>	1 AO2.2 (1) Must get the whole answer right for the mark to be awarded.
4	(b)	(iii)	<ul style="list-style-type: none"> <li>1001 1111</li> </ul>	1 AO2.2 (1) Must get the whole answer right for the mark to be awarded.
4	(b)	(iv)	<ul style="list-style-type: none"> <li>1001 0001</li> </ul>	1 AO2.2 (1) Must get the whole answer right for the mark to be awarded.
4	(c)		<ul style="list-style-type: none"> <li>Can be easily used in binary arithmetic or</li> <li>Increased range of numbers available</li> </ul>	2 AO2.2 (2) Award 0 or 2 marks
4	(d)	(i)	1 mark per bullet up to a maximum of 2 marks, e.g: <ul style="list-style-type: none"> <li>(1) 0110 0100</li> <li>suitable working out</li> </ul>	2 AO2.2 (2) Award mark for bullet point one with or without the overflow stated.

H046/01

Mark Scheme

June 2022

Question	Answer	Mark	Guidance																																				
5 (a)	<p>Solution:</p> <table border="1"> <tr> <td></td> <td></td> <td>AB</td> <td>AB</td> <td>AB</td> <td>AB</td> </tr> <tr> <td></td> <td></td> <td>00</td> <td>01</td> <td>11</td> <td>10</td> </tr> <tr> <td>CD</td> <td>00</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>CD</td> <td>01</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>CD</td> <td>11</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>CD</td> <td>10</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> </table> <p>1 mark per bullet up to a maximum of 4 marks:</p> <ul style="list-style-type: none"> <li>• 1 mark for filling in the table correctly</li> <li>• 1 mark for the group shown in red</li> <li>• 1 mark for the group shown in green</li> <li>• 1 mark for the simplified expression <math>A \vee (C \wedge D)</math></li> </ul>			AB	AB	AB	AB			00	01	11	10	CD	00	0	0	1	1	CD	01	0	0	1	1	CD	11	1	1	1	1	CD	10	0	0	1	1	4 AO2.1 (2) AO2.2 (2)	Brackets are not required for the simplified expression
		AB	AB	AB	AB																																		
		00	01	11	10																																		
CD	00	0	0	1	1																																		
CD	01	0	0	1	1																																		
CD	11	1	1	1	1																																		
CD	10	0	0	1	1																																		
5 (b)	 <p>1 mark per bullet up to a maximum of 3 marks:</p> <ul style="list-style-type: none"> <li>• An AND gate taking A and B as inputs with the output connecting to a NOT gate</li> <li>• An AND gate taking C and the NOT of D as the inputs</li> <li>• An OR gate taking the outputs of the NOT and AND gates</li> </ul>	3 AO3.1 (3)	Allow NAND gate as alternative for BP1																																				

Question		Answer	Mark	Guidance
6	(a)	<p>1 mark per bullet up to a maximum of 2 marks, e.g:</p> <ul style="list-style-type: none"> <li>• Float/real/double/single/decimal/currency...</li> <li>• ...because the values in the text file contain a decimal space...</li> <li>• ...representing monetary values...</li> <li>• ...the values will be used in calculations</li> </ul>	<p>2 AO3.3 (2)</p>	
6	(b)	<p>1 mark per bullet up to a maximum of 2 marks, e.g:</p> <ul style="list-style-type: none"> <li>• To setup a loop...</li> <li>• To repeat (the same block of code)</li> <li>• for each line in the text file // until each value has been read</li> </ul>	<p>2 AO3.3 (2)</p>	
6	(c)	<p>1 mark per bullet up to a maximum of 7 marks:</p> <ul style="list-style-type: none"> <li>• Suitable logic for initialising variables outside of loop</li> <li>• Suitable logic for opening and closing Sales.txt</li> <li>• Suitable use of a loop which ends when the last line has been reached in Sales.txt</li> <li>• Suitable logic for reading each line of data from file variable</li> <li>• Suitable logic for increasing total (and count) including conversion from string to numeric data type</li> <li>• Suitable logic for calculating averages by dividing total by count</li> <li>• Suitable logic for printing the number of days, the total sales and the daily average</li> </ul>	<p>7 AO3.1 (3) AO3.2 (4)</p>	<p>Some points (for example 5 &amp; 6) can be combined onto one line.</p> <p><b>Example Solution:</b></p> <pre> procedure salesAnalysis():     dayCount = 0     salesTotal = 0     dailySales = openRead("Sales.txt")     while NOT dailySales.endOfFile()         dailySaleFigure = float         (percentageFile.readLine())         salesTotal += dailySaleFigure         dayCount += 1     endwhile     dailyAverage = salesTotal /dayCount     print("Over " + dayCount + " days there was a total sales of £" _+ salesTotal + " and an average daily sale of £" + dailyAverage)     dailySales.close() endprocedure </pre> <p>There are many different ways that this procedure could have been achieved. Therefore other alternative methods should be given credit.</p>

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