



GCE A LEVEL MARKING SCHEME

SUMMER 2024

**A LEVEL
DIGITAL TECHNOLOGY - UNIT 3
1540U30-1**

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCE AS DIGITAL TECHNOLOGY – UNIT 3

SUMMER 2024 MARK SCHEME

| Question | Answer | AO1 | AO2 | Total |
|----------|---|-----|-----|-------|
| 1 | <i>Describe, using suitable examples, passive and active data collection and their advantages and disadvantages</i> | 6 | | 6 |
| | <p>Indicative content</p> <p>Passive Data Collection</p> <ul style="list-style-type: none"> • Data is gathered without direct interaction with the data subject / in the background. <p>Examples:</p> <ul style="list-style-type: none"> • Web browsing history: Collected via cookies and trackers • Smartphone usage patterns: Apps recording user behaviour • Environmental sensors: Monitoring temperature, humidity, and light without user input. <p>Advantages:</p> <ul style="list-style-type: none"> • Non-intrusive: Does not require active participation from users • Continuous data stream: Provides real-time, consistent data • Broad scope: Can cover a wide range of activities and environments. <p>Disadvantages:</p> <ul style="list-style-type: none"> • Privacy concerns: Users might be unaware of the data being collected • Possible breach of data protection laws • Accuracy issues: May collect irrelevant or noisy data • Limited context: Lacks the context of why certain actions were taken by users. <p>Active Data Collection</p> <ul style="list-style-type: none"> • Data is gathered through direct interaction with the data subject, requiring their active participation. <p>Examples:</p> <ul style="list-style-type: none"> • Surveys and questionnaires: Users provide specific answers to posed questions • Interviews and focus groups: In-depth, interactive data collection through conversation | | | |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| | <ul style="list-style-type: none"> Feedback forms: Users submit opinions and experiences about a product or service <p>Advantages:</p> <ul style="list-style-type: none"> Specific and relevant: Directly addresses the questions and context needed by researchers Higher accuracy: Data is often more accurate and contextually rich User consent: Participants are aware and often willing, reducing privacy concerns. <p>Disadvantages:</p> <ul style="list-style-type: none"> Time-consuming: Requires significant time from both researchers and participants Participant bias: Responses may be influenced by how questions are asked or the participant's mood Limited scope: May not capture spontaneous or unplanned behaviour. | | | |

| Band | AO1 |
|----------|--|
| 3 | <p>5 – 6 marks</p> <p>A very good description, which shows:</p> <ul style="list-style-type: none"> thorough knowledge and understanding of passive and active data, including suitable examples a confident grasp of the advantages and disadvantages of passive and active data collection |
| 2 | <p>3 - 4 marks</p> <p>A good description, which shows:</p> <ul style="list-style-type: none"> generally secure knowledge and understanding of passive and active data, which may include suitable examples a generally secure grasp of the advantages and / or disadvantages of passive and active data collection. |
| 1 | <p>1 - 2 marks</p> <p>A basic description, which shows:</p> <ul style="list-style-type: none"> some knowledge and understanding of passive and active data, which may include suitable examples some grasp of the advantages and / or disadvantages of passive and active data collection. |
| | <p>0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|---|-----|-----|-------|
| 2 | <i>A large media streaming company allows its users to search for content and play related videos online.</i> | | | |
| | (a)(i) <i>Describe two compression methods used to store video files.</i> | 6 | | 6 |
| | <p>Indicative content</p> <ul style="list-style-type: none"> • Lossy Compression <ul style="list-style-type: none"> ○ This method discards some of the video data that is deemed less important ○ Reducing the resolution ○ Lossy compression can be used in video codecs like H.264, H.265, and VP9 • Lossless Compression <ul style="list-style-type: none"> ○ This method compresses the video data without discarding any information ○ Lossless compression can be used in video codecs like Huffyuuv, Lagarith, and UtVideo • Spatial Compression <ul style="list-style-type: none"> ○ This method reduces the video data by removing the redundant information in each frame, such as removing the background of the scene, or reducing the number of colours used ○ Spatial compression can be used in video codecs like JPEG and GIF • Temporal Compression <ul style="list-style-type: none"> ○ This method reduces the video data by removing the redundant information between frames, such as motion vectors, motion compensation, and keyframe generation ○ Temporal compression can be used in video codecs like MPEG-1, MPEG-2, and MPEG-4 • Hybrid Compression <ul style="list-style-type: none"> ○ This method combines the above methods to achieve an optimal balance between file size and video quality ○ Hybrid compression can be used in video codecs like H.264, H.265, and VP9 | | | |

| Band | AO1 |
|------|---|
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>A very good description, which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of video compression methods • a confident grasp of how video compression methods can be carried out. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>A good description, which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of video compression methods • a generally secure grasp of how video compression methods can be carried out |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>A basic description, which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of a video compression method • some grasp of how video compression methods can be carried out. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | | Answer | AO1 | AO2 | Total |
|----------|---------|--|-----|-----|-------|
| 2 | (a)(ii) | <p><i>A video stored on the company's server requires approximately 5 MB of storage for each uncompressed frame. The video was recorded at a frame rate of 60 fps and is 120 seconds long.</i></p> <p><i>Uncompressed sound and meta data in the video file require an additional 20 MB storage.</i></p> <p><i>Calculate the total storage size of this video file in gigabytes.</i></p> <p><i>Show all your workings.</i></p> | | 5 | 5 |
| | | <p>Award one mark for each of the following, up to a maximum of five marks:</p> <ul style="list-style-type: none"> • 5 x 60 x 120 • 36,000 • 36,000 + 20 = 36,020 • 36,020 / 1000 or 36,020 / 1024 • 36.02 GB or 35.18 GB | | 5 | 5 |
| | (b) | <p><i>Describe the importance of monitoring data usage and size on Content Delivery Networks (CDNs).</i></p> | 6 | | 6 |
| | | <p>Indicative Content</p> <ul style="list-style-type: none"> • Cost Management <ul style="list-style-type: none"> ○ CDNs are typically charged based on the amount of data transferred, so monitoring data usage and size can help organisations control costs and avoid overage charges • Bandwidth Optimisation <ul style="list-style-type: none"> ○ Monitoring data usage and size can help organisations identify patterns of usage and optimise the way they distribute content, to ensure that the most popular content is delivered more efficiently • Quality of Service (QoS) <ul style="list-style-type: none"> ○ CDNs are often used to deliver high-bandwidth content, such as video, audio and gaming, so monitoring data usage and size can help organisations ensure that their customers are receiving the best possible quality of service ○ Restricting bandwidth to ensure an even distribution of bandwidth to all users • Security <ul style="list-style-type: none"> ○ Monitoring data usage and size can help organisations detect and prevent malicious activities, such as DDoS attacks and data breaches | | | |

| Question | | Answer | AO1 | AO2 | Total |
|----------|--|--|-----|-----|-------|
| | | <ul style="list-style-type: none"> • Performance Optimisation <ul style="list-style-type: none"> ○ CDNs are often used to improve website and application performance, so monitoring data usage and size can help organisations ensure that the content is being delivered quickly and efficiently • Compliance <ul style="list-style-type: none"> ○ Monitoring data usage and size can help organisations ensure that they are complying with regulatory requirements, such as data retention policies and data privacy laws • Capacity Planning <ul style="list-style-type: none"> ○ Monitoring data usage and size can help organisations plan for future growth and ensure that they have the necessary infrastructure and resources to support increased data usage. | | | |

| Band | AO1 |
|----------|--|
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>A very good description, which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of content delivery networks • a confident grasp of the importance of monitoring data usage and size. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>A good description, which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of content delivery networks • a generally secure grasp of the importance of monitoring data usage and size. |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>A basic description, which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of content delivery networks • some grasp of the importance of monitoring data usage and size. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | | Answer | AO1 | AO2 | Total |
|----------|-----|---|-----|-----|-------|
| 3 | (a) | <i>Describe the uses of cloud storage technology.</i> | 6 | | 6 |
| | | <p>Indicative content</p> <ul style="list-style-type: none"> • Data Backup and Disaster Recovery <ul style="list-style-type: none"> ○ Cloud storage can be used to store and protect critical business data, making it easy to recover in case of a disaster • Data security <ul style="list-style-type: none"> ○ Cloud storage providers allow industry standard methods for protecting the security of data • File Sharing and Collaboration <ul style="list-style-type: none"> ○ Cloud storage allows for easy sharing and collaboration of files among teams, regardless of location • Data Synchronisation <ul style="list-style-type: none"> ○ Synchronise data (e.g. passwords) across multiple devices, ensuring that users have the most current version of their data • Scalability <ul style="list-style-type: none"> ○ Provide scalable storage solutions that can be adjusted based on the user's needs, without the need for physical hardware upgrades • Accessibility <ul style="list-style-type: none"> ○ Allow access to data from any location with an internet connection, enhancing mobility and remote work capabilities • Cost Efficiency <ul style="list-style-type: none"> ○ Reduce costs associated with purchasing and maintaining physical storage infrastructure. • Data Archiving <ul style="list-style-type: none"> ○ Cloud storage can be used to store and access historical data and records for compliance or legal purposes • Big Data Analysis <ul style="list-style-type: none"> ○ Cloud storage can store and process large amounts of data, making it easier to perform complex analytics and machine learning tasks • Software Development <ul style="list-style-type: none"> ○ Cloud storage can be used to store and manage code, as well as to host and test software applications • Media Streaming <ul style="list-style-type: none"> ○ Cloud storage can be used to store and stream large media files such as videos, games and music • Internet of Things (IoT) <ul style="list-style-type: none"> ○ Cloud storage can be used to collect, store, and analyse data from IoT devices, making it easy to gain insights and make data-driven decisions. | | | |

| Band | AO1 |
|------|---|
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>A very good description, which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of cloud storage technology • a confident grasp of the uses of cloud storage technology. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>A good description, which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of cloud storage technology • a generally secure grasp of the uses of cloud storage technology. |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>A basic description, which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of cloud storage technology • some grasp of the uses of cloud storage technology. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| (b) | <i>Evaluate the benefits of blockchain storage over centralised systems, such as cloud storage.</i> | | 5 | 5 |
| | <p>Indicative content</p> <ul style="list-style-type: none"> • Decentralisation <ul style="list-style-type: none"> ○ Blockchain storage is decentralised, meaning that there is no single point of failure ○ This makes it more resilient to attacks and outages • Immutability <ul style="list-style-type: none"> ○ Once data is stored on a blockchain, it cannot be altered or deleted ○ This provides a higher level of security and trust in the data • Transparency <ul style="list-style-type: none"> ○ Blockchain storage allows for a transparent and auditable record of all transactions, providing greater visibility and accountability • Interoperability <ul style="list-style-type: none"> ○ Blockchain technology allows for the creation of decentralised applications and smart contracts that can interact with other blockchain networks ○ This enables the development of a truly decentralised ecosystem • Cost-effective <ul style="list-style-type: none"> ○ Blockchain storage can be more cost-effective than centralised storage solutions as it does not require the maintenance and upkeep of a centralised infrastructure • Privacy <ul style="list-style-type: none"> ○ Blockchain storage can provide better privacy and security as it allows for the creation of private and permissioned blockchain networks where access to the data can be controlled. | | | |

| Band | AO2 |
|----------|---|
| 3 | <p style="text-align: center;">5 marks</p> <p>A very good evaluation, which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of the benefits of blockchain storage • a confident grasp of their benefits over centralised systems. |
| 2 | <p style="text-align: center;">2 - 4 marks</p> <p>A good evaluation, which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of the benefits of blockchain storage • a generally secure grasp of their benefits over centralised systems. |
| 1 | <p style="text-align: center;">1 mark</p> <p>A basic evaluation, which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of the benefits of blockchain storage • some grasp of their benefits over centralised systems. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| 4 | <i>A supermarket sells a range of food and non-food products, including fresh and frozen food, drinks, bakery, home and entertainment products, and electrical goods.</i> | | | |
| | (a) <i>Consider how descriptive data analytics can provide useful information for the supermarket's management team.</i> | | 8 | 8 |
| | <p>Indicative Content</p> <ul style="list-style-type: none"> • Understanding customer demographics <ul style="list-style-type: none"> ○ Descriptive analytics can be used to create a demographic profile of a supermarket's customers ○ This can help the supermarket understand its target market and make informed decisions about which products to stock and how to market them • Identifying popular products <ul style="list-style-type: none"> ○ Descriptive analytics can be used to identify which products are most popular among customers ○ This can help the supermarket optimise its product mix and stock levels. • Identifying patterns / trends in customer behaviour <ul style="list-style-type: none"> ○ Descriptive analytics can be used to identify patterns in customer behaviour ○ For example, which days of the week or times of day customers are most likely to visit the supermarket ○ This information can be used to optimise staffing and to plan sales and promotions • Identifying customer preferences <ul style="list-style-type: none"> ○ Descriptive analytics can be used to identify customer preferences ○ For example, which brands or types of products are most popular among customers ○ This can help the supermarket make informed decisions about which products to stock and how to market them • Identifying customer segment <ul style="list-style-type: none"> ○ Descriptive analytics can be used to segment the customer base into different groups based on demographic, psychographic and geographic information ○ This can help the supermarket to tailor its marketing and sales strategies to different customer segments • Identifying inventory optimisation <ul style="list-style-type: none"> ○ Descriptive analytics can be used to identify patterns in inventory levels and sales ○ This can help the supermarket optimise its inventory management and reduce waste | | | |

| Question | | Answer | AO1 | AO2 | Total |
|----------|--|--|-----|-----|-------|
| | | <ul style="list-style-type: none"> • Identifying store layout optimisation <ul style="list-style-type: none"> ○ Descriptive analytics can be used to identify patterns in customer movement and behaviour within the store ○ This can help the supermarket to optimise its store layout to increase customer satisfaction and sales • Identifying Marketing campaign effectiveness (e.g. loyalty cards) <ul style="list-style-type: none"> ○ Descriptive analytics can be used to measure the effectiveness of marketing campaigns by analysing sales data, customer feedback, and other metrics ○ This can help the supermarket to optimise its marketing strategies. | | | |

| Band | AO2 |
|----------|---|
| 4 | <p style="text-align: center;">7 – 8 marks</p> <p>An excellent consideration which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding descriptive data analytics • a confident grasp of how descriptive data analytics can provide useful information for the supermarket’s management team. |
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>A good consideration which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of descriptive data analytics • a generally secure grasp of how descriptive data analytics can provide useful information for the supermarket’s management team. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>A basic consideration which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of descriptive data analytics • some grasp of how descriptive data analytics can provide useful information for the supermarket’s management team. |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>A limited consideration which shows:</p> <ul style="list-style-type: none"> • little knowledge and understanding of descriptive data analytics • little grasp of how descriptive data analytics can provide useful information for the supermarket’s management team. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

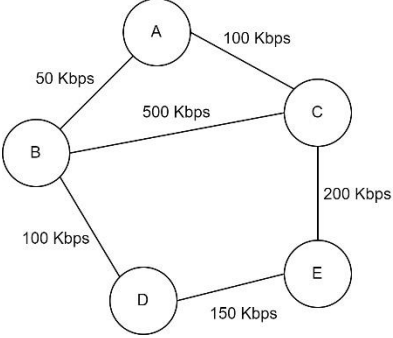
| Question | Answer | AO1 | AO2 | Total |
|----------|---|-----|-----|-------|
| (b) | <i>Explain how the supermarket's management team can use data visualisation.</i> | | 6 | 6 |
| | <p>Indicative Content</p> <ul style="list-style-type: none"> • Make data more accessible and understandable <ul style="list-style-type: none"> ○ Data visualisation can be used to present data in a visual format, such as charts and graphs ○ This can make it easier for decision-makers to understand and interpret the data • Identify patterns and trends <ul style="list-style-type: none"> ○ Data visualisation can be used to create interactive visualisations that allow users to explore data in different ways ○ This can help to identify patterns and trends that might not be immediately obvious in raw data • Communicate insights to stakeholders <ul style="list-style-type: none"> ○ Data visualisation can be used to create visualisations that can be shared with stakeholders, such as customers, suppliers, and management, ○ to communicate insights and make data-driven decisions • Identify areas of improvement <ul style="list-style-type: none"> ○ Data visualisation can be used to identify areas in which the supermarket can improve, ○ such as identifying slow-moving products and areas of the store that are not performing as well as others • Monitor performance <ul style="list-style-type: none"> ○ Data visualisation can be used to create dashboards that allow users to monitor key performance indicators, such as sales and customer satisfaction, in real-time ○ This can help the supermarket to quickly identify and respond to issues • Enhance decision-making <ul style="list-style-type: none"> ○ Data visualisation can provide context to the data and help decision-makers to understand the data ○ This can help them to make informed decisions and take action • Identify opportunities <ul style="list-style-type: none"> ○ Data visualisation can be used to identify opportunities, such as new products or services that the supermarket can offer, or new customer segments that it can target. | | | |

| Band | AO2 |
|------|--|
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>A very good explanation which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of data visualisation • a confident grasp of how the supermarket’s management team can use data visualisation. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>A good explanation which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of data visualisation • a generally secure grasp of how the supermarket’s management team can use data visualisation. |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>A basic explanation which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of data visualisation • some grasp of how the supermarket’s management team can use data visualisation. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| (c) | <p><i>The supermarket is considering selling its goods online and is concerned about the cyber security implications.</i></p> <p><i>Describe the following resilience controls that may be used to prevent a cyber-attack:</i></p> <ul style="list-style-type: none"> • <i>boundary firewall</i> • <i>internet gateway</i> • <i>access controls</i> • <i>malware protection.</i> | 8 | | 8 |
| | <p>Indicative Content</p> <p>Boundary Firewall</p> <ul style="list-style-type: none"> • A boundary firewall is a security control that is placed at the boundary of a network, such as the perimeter of a supermarket's internal network • It is designed to block unauthorised access to the network by controlling the flow of traffic between the internal network and the external network (e.g. the internet) • This can help to prevent cyber-attacks by blocking known malicious traffic and blocking access to sensitive data <p>Internet Gateway</p> <ul style="list-style-type: none"> • An internet gateway is a device or service that controls access to the internet for the supermarket's internal network • It can be used to filter and monitor traffic to and from the internet, and can be used to implement security controls such as firewalls, intrusion detection and prevention systems, and VPNs • This can help to prevent cyber-attacks by blocking known malicious traffic and controlling access to the internet <p>Access Control</p> <ul style="list-style-type: none"> • This includes restricting access to valuable data to authorised users only, and controlling access to systems and applications • This can help to prevent unauthorised access to sensitive data and systems, which can help to prevent cyber-attacks <p>Malware Protection</p> <ul style="list-style-type: none"> • This can include using software such as anti-virus, anti-malware, and intrusion prevention systems, as well as implementing security protocols such as regular software updates, and regular scans of the network | | | |

| Question | | Answer | AO1 | AO2 | Total |
|----------|--|--|-----|-----|-------|
| | | <ul style="list-style-type: none"> This can help to prevent the spread of malware and other malicious software that can be used to compromise the supermarket's systems and steal sensitive data. | | | |

| Band | AO1 |
|----------|---|
| | 7 – 8 marks |
| 4 | <p>An excellent description which shows:</p> <ul style="list-style-type: none"> thorough knowledge and understanding of all resilience controls and a confident grasp of how resilience controls may be used to prevent a cyber-attack. |
| | 5 – 6 marks |
| 3 | <p>A good description which shows:</p> <ul style="list-style-type: none"> generally secure knowledge and understanding of most resilience controls and /or a generally secure grasp of how resilience controls may be used to prevent a cyber-attack. |
| | 3 - 4 marks |
| 2 | <p>A basic description which demonstrates:</p> <ul style="list-style-type: none"> some knowledge and understanding of resilience controls and/or some grasp of how resilience controls may be used to prevent a cyber-attack. |
| | 1 - 2 marks |
| 1 | <p>A limited description which demonstrates:</p> <ul style="list-style-type: none"> little knowledge and understanding of a resilience control and/or little grasp of how this resilience control may be used to prevent a cyber-attack. |
| | 0 marks |
| | Response not creditworthy or not attempted. |

| Question | Answer | AO1 | AO2 | Total | | | | | | | | | | | | | | | |
|------------------|--|------------------|-----------------------------------|------------|---|-------------|----|---|--------|----|---|------------------|------|---|-------------|----|--|--|--|
| 5 | <p>(a) <i>The transmission speeds between the nodes of a network have the values shown in the diagram below.</i></p>  <p><i>A cost for routing data packets between nodes is calculated by dividing 1Mbps by the transmission speed of the link. For example:</i></p> $\text{Cost for the link A to B} = \frac{1\text{Mbps}}{50\text{Kbps}} = \frac{1,000,000}{50,000} = 20$ <p><i>Packets are transmitted between source and destination by the route which has the lowest total cost.</i></p> | | | | | | | | | | | | | | | | | | |
| | (a)(i) <i>Calculate the costs for each of the remaining 5 links in the network.</i> | | 2 | 2 | | | | | | | | | | | | | | | |
| | <p>Award two marks if all costs are correct, and one mark if at least 3 costs are correct:</p> <ul style="list-style-type: none"> • A to C = 10 • B to C = 2 • B to D = 10 • C to E = 5 • D to E = 6.7 | | | | | | | | | | | | | | | | | | |
| | (a)(ii) <i>Complete the table below to show the lowest cost routes that would be taken by packets from node A to each of the other nodes B to E.</i> | | 4 | 4 | | | | | | | | | | | | | | | |
| | <p>Award one marks each correct total cost:</p> <table border="1" data-bbox="357 1576 1118 1839"> <thead> <tr> <th>Destination node</th> <th>Route, listing intermediate nodes</th> <th>Total cost</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>A to C to B</td> <td>12</td> </tr> <tr> <td>C</td> <td>A to C</td> <td>10</td> </tr> <tr> <td>D</td> <td>A to C to E to D</td> <td>21.7</td> </tr> <tr> <td>E</td> <td>A to C to E</td> <td>15</td> </tr> </tbody> </table> | Destination node | Route, listing intermediate nodes | Total cost | B | A to C to B | 12 | C | A to C | 10 | D | A to C to E to D | 21.7 | E | A to C to E | 15 | | | |
| Destination node | Route, listing intermediate nodes | Total cost | | | | | | | | | | | | | | | | | |
| B | A to C to B | 12 | | | | | | | | | | | | | | | | | |
| C | A to C | 10 | | | | | | | | | | | | | | | | | |
| D | A to C to E to D | 21.7 | | | | | | | | | | | | | | | | | |
| E | A to C to E | 15 | | | | | | | | | | | | | | | | | |

| Question | Answer | AO1 | AO2 | Total |
|----------|---|-----|-----|-------|
| (b) | <i>Describe the role and facilities provided by:</i> | | | |
| (i) | <i>network resource and applications management.</i> | 4 | | 4 |
| | <p>Award one mark for each of the following, up to a maximum of four marks:</p> <ul style="list-style-type: none"> • This includes managing the network infrastructure, <ul style="list-style-type: none"> ○ such as routers, switches, and firewalls, as well as managing the network services, such as DNS, DHCP, and VPN. • It also includes managing the applications and services that run on the network, <ul style="list-style-type: none"> ○ such as email, file sharing, and web services. <p>Facilities provided by network resource and applications management:</p> <ul style="list-style-type: none"> • Network inventory management <ul style="list-style-type: none"> ○ Keep track of the network infrastructure and ensure it is up to date and properly configured • Network resource allocation <ul style="list-style-type: none"> ○ Allocate network resources to different departments or projects based on their needs and priorities • Network performance monitoring <ul style="list-style-type: none"> ○ Monitor the performance of the network and identify potential issues before they become critical • Network security management <ul style="list-style-type: none"> ○ Ensure that the network is secure and protect it against potential threats. | | | |

| Question | Answer | AO1 | AO2 | Total |
|----------|---|-----|-----|-------|
| (ii) | <i>network activity management.</i> | 4 | | 4 |
| | <p>Award one mark for each of the following, up to a maximum of four marks:</p> <ul style="list-style-type: none"> • This includes monitoring the traffic on the network, identifying potential security threats, and managing the access and usage of the network. <p>Some of the facilities provided by network activity management are:</p> <ul style="list-style-type: none"> • Network traffic monitoring <ul style="list-style-type: none"> ○ Monitor the traffic on the network and identify potential issues or bottlenecks. • Network security monitoring <ul style="list-style-type: none"> ○ Monitor the network for potential security threats and take appropriate action to protect the network. • Network access control <ul style="list-style-type: none"> ○ Control who has access to the network and what resources they can access • Network usage management <ul style="list-style-type: none"> ○ Monitor and manage the usage of the network resources to ensure that they are being used efficiently. | | | |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| 6 | <p><i>A friend is considering using a new Internet Service Provider (ISP).</i></p> <p><i>Advise them on the factors they should consider when choosing an ISP.</i></p> | | 8 | 8 |
| | <p>Indicative Content</p> <ul style="list-style-type: none"> • Coverage and availability <ul style="list-style-type: none"> ○ Check that the ISP provides service in the area where you need it and that the service is reliable and of good quality • Speed and bandwidth <ul style="list-style-type: none"> ○ This is important as it will affect the quality of the service and the ability to use the internet for certain applications such as video conferencing and streaming ○ FTTC or FTTP ○ Connection reliability / uptime • Reputation of the ISP <ul style="list-style-type: none"> ○ Prospective customers may look at reviews that the ISP has received from existing customer before making an informed decision • Cost <ul style="list-style-type: none"> ○ The cost of the service will vary depending on the provider, package and hardware (FTTC / FTTP) chosen ○ It is important to compare different provider and packages to ensure that you are getting the best value for your money • Technical support <ul style="list-style-type: none"> ○ The availability of customer service and technical support ○ quality of the support provided • Security <ul style="list-style-type: none"> ○ This includes ensuring that the ISP provides secure connections, firewalls and other security measures to protect your data from cyber threats • Service level agreements <ul style="list-style-type: none"> ○ These agreements specify the level of service that the ISP guarantees to provide ○ It is important to review the SLA to make sure that the service meets your requirements, and that the ISP is committed to providing the service • Additional features <ul style="list-style-type: none"> ○ Some ISPs offer additional features such as email and web hosting, static IP, cloud storage, and virtual private networks (VPNs) ○ Some ISPs offer free extenders to maximise coverage in your home. ○ Quality of hardware provision e.g. router facilities | | | |

| Band | AO2 |
|------|--|
| 4 | <p style="text-align: center;">7 – 8 marks</p> <p>Excellent advice which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of internet service providers • a confident grasp of the considerations when choosing an internet service provider. |
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>Good advice which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of internet service providers • a generally secure grasp of the considerations when choosing an internet service provider. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>Basic advice which demonstrates:</p> <ul style="list-style-type: none"> • some knowledge and understanding of internet service providers • some grasp of the considerations when choosing an internet service provider. |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>Limited advice which demonstrates:</p> <ul style="list-style-type: none"> • little knowledge and understanding of internet service providers • little grasp of the considerations when choosing an internet service provider. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|---|-----|-----|-------|
| 7 | <i>Compare the suitability of symmetric and asymmetric encryption when sending confidential files over the internet.</i> | | 6 | 6 |
| | <p>Indicative content</p> <p>Symmetric encryption</p> <ul style="list-style-type: none"> • Suitable for sending confidential files over the internet when the sender and the recipient have a shared secret key • This shared secret key is used to encrypt the data before it is sent, and then the recipient can use the same key to decrypt the data once it is received • This method is efficient and secure as long as the secret key is kept secret • and the encryption algorithm is secure • Encryption is fast, efficient and suitable for situations where the sender and the recipient share a secret key. <p>Asymmetric encryption,</p> <ul style="list-style-type: none"> • More suitable for sending confidential files over the internet when the sender and the recipient do not have a shared secret key • Each person has a pair of keys, a public key and a private key • The sender uses the recipient's public key to encrypt the data, and the recipient uses their own private key to decrypt the data • More secure than symmetric encryption because the private key is never shared, and even if someone intercepts the data, they will not be able to decrypt it without the private key. | | | |

| Band | AO2 |
|------|--|
| 3 | <p>5 – 6 marks</p> <p>A very good comparison, which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of symmetric and asymmetric encryption • a confident grasp of the suitability of symmetric and asymmetric encryption when sending confidential files over the internet. |
| 2 | <p>3 - 4 marks</p> <p>A good comparison, which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of symmetric and asymmetric encryption • a generally secure grasp of the suitability of symmetric and asymmetric encryption when sending confidential files over the internet |
| 1 | <p>1 - 2 marks</p> <p>A basic comparison, which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of symmetric and asymmetric encryption • some grasp of the importance of suitability of symmetric and asymmetric encryption when sending confidential files over the internet. |
| | <p>0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| 8 | <p><i>Cryptocurrencies can be used for transactions and storage of funds.</i></p> <p><i>Consider the cyber security risks associated with cryptocurrencies.</i></p> | | 6 | 6 |
| | <p>Indicative content</p> <ul style="list-style-type: none"> • Decentralised nature <ul style="list-style-type: none"> ○ Cryptocurrencies operate on decentralised networks, which can be vulnerable to cyberattacks and hacking attempts, such as theft of funds secured in digital wallets • Anonymity <ul style="list-style-type: none"> ○ Transactions made with cryptocurrencies can provide anonymity ○ This can attract cyber criminals who can use this to engage in illegal activities such as money laundering or fraud • Lack of regulation <ul style="list-style-type: none"> ○ The decentralised nature of cryptocurrencies and the absence of a central authority can result in a lack of regulation ○ This can make it easier for cybercriminals to exploit vulnerabilities in the system. • Complexity <ul style="list-style-type: none"> ○ The underlying technology of cryptocurrencies, such as blockchain, can be complex and difficult for non-experts to understand ○ This can make it easier for cybercriminals to target inexperienced users with scams or phishing attacks • Vulnerabilities in exchanges / markets <ul style="list-style-type: none"> ○ Cryptocurrency exchanges, where cryptocurrencies are traded and stored, can be vulnerable to cyberattacks ○ There are many incidents of hacking and theft of funds being reported in the past. | | | |

| Band | AO2 |
|------|--|
| 3 | <p style="text-align: center;">5 – 6 marks</p> <p>A very good consideration, which shows:</p> <ul style="list-style-type: none"> • thorough knowledge and understanding of cryptocurrency • a confident grasp of cyber security risks associated with cryptocurrencies. |
| 2 | <p style="text-align: center;">3 - 4 marks</p> <p>A good consideration, which shows:</p> <ul style="list-style-type: none"> • generally secure knowledge and understanding of cryptocurrency • a generally secure grasp of cyber security risks associated with cryptocurrencies. |
| 1 | <p style="text-align: center;">1 - 2 marks</p> <p>A basic consideration, which shows:</p> <ul style="list-style-type: none"> • some knowledge and understanding of cryptocurrency • some grasp of cyber security risks associated with cryptocurrencies. |
| | <p style="text-align: center;">0 marks</p> <p>Response not creditworthy or not attempted.</p> |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| 9 | <p><i>Mobile technologies refer to a wide range of technologies that are designed to be used on mobile devices, such as smartphones and tablets.</i></p> <p><i>Outline the developments in transmitting data over mobile technologies since 2G.</i></p> | 10 | | 10 |
| | <p>Indicative Content</p> <ul style="list-style-type: none"> • GPRS (General Packet Radio Service) <ul style="list-style-type: none"> ○ GPRS was a data standard that was introduced in the early 2000s as an upgrade to the existing 2G mobile networks ○ It provided packet-based data transfer, which allowed for faster data transfer speeds than the circuit-switched data transfer used in 2G networks ○ GPRS was considered a 2.5G technology as it offered data transfer speeds of up to 114 kbps • EDGE (Enhanced Data rates for GSM Evolution) <ul style="list-style-type: none"> ○ EDGE was an upgrade to GPRS, which was introduced in the mid-2000s ○ It provided faster data transfer speeds of up to 384 kbps by using a different modulation technique ○ EDGE was considered a 2.75G technology as it provided a significant improvement in data transfer speeds over GPRS • 3G (Third Generation) <ul style="list-style-type: none"> ○ 3G was a major upgrade to the existing mobile networks, which was introduced in the late 2000s ○ It provided much faster data transfer speeds of up to 2 Mbps (megabits per second) and supported a wide range of new data services such as video calling and mobile internet browsing ○ 3G was considered a true 3G technology as it provided a significant improvement in data transfer speeds and capabilities over the previous 2G and 2.5G technologies • 4G or LTE (Long-Term Evolution) <ul style="list-style-type: none"> ○ 4G is a standard for mobile telecommunications that was introduced in the early 2010s ○ It provides data transfer speeds of up to 100 Mbps and supports a wide range of new data services such as high-definition video streaming and mobile cloud computing ○ 4G is considered a true 4G technology as it provides a significant improvement in data transfer speeds and capabilities over the previous 3G technology • 5G or Wideband and Ultrawide band <ul style="list-style-type: none"> ○ 5G is the latest and most advanced mobile telecommunications standard, which was first | | | |

| Question | Answer | AO1 | AO2 | Total |
|----------|--|-----|-----|-------|
| | <p>introduced in 2019</p> <ul style="list-style-type: none"> ○ It provides data transfer speeds of up to 10 Gbps (gigabits per second) and supports a wide range of new data services such as ultra-low latency, massive machine-type communication, and enhanced mobile broadband ○ 5G is considered as a true 5G technology as it provides a significant improvement in data transfer speeds and capabilities over the previous 4G technology ○ IoT, support higher number of connected devices e.g., accessing home security devices remotely such as doorbells. <ul style="list-style-type: none"> ● General developments <ul style="list-style-type: none"> ○ Improved coverage of data transmission ○ Integration of different technologies for communication ○ Sending photos and videos ○ Video calling / conferencing ○ Streaming videos <ul style="list-style-type: none"> ▪ Low resolution to 4K ○ Playing online games against others across the globe ○ Stronger encryption and authentication methods. | | | |

| Band | AO1 |
|----------|---|
| | 8 – 10 marks |
| 4 | <p>Excellent outline which shows:</p> <ul style="list-style-type: none"> ● thorough knowledge and understanding of developments in transmitting data over mobile technologies ● a confident grasp of the developments in transmitting data over mobile technologies. |
| | 6 – 7 marks |
| 3 | <p>Good outline which shows:</p> <ul style="list-style-type: none"> ● generally secure knowledge and understanding of developments in transmitting data over mobile technologies ● a generally secure grasp of the developments in transmitting data over mobile technologies |
| | 4 - 5 marks |
| 2 | <p>Basic outline which demonstrates:</p> <ul style="list-style-type: none"> ● some knowledge and understanding of developments in transmitting data over mobile technologies ● some grasp of the developments in transmitting data over mobile technologies |
| | 1 - 3 marks |
| 1 | <p>Limited outline which demonstrates:</p> <ul style="list-style-type: none"> ● little knowledge and understanding of developments in transmitting data over mobile technologies ● little grasp of the developments in transmitting data over mobile technologies. |
| | 0 marks |
| | Response not creditworthy or not attempted. |