



COMPUTER SCIENCE

ATAR course examination 2023

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Short answer

40% (97 Marks)

Question 1

(2 marks)

Outline **two** legal obligations developers need to consider when creating new software.

Description	Marks
For each legal obligation (2 x 1 mark)	
Outlines a legal obligation developers need to consider when creating new software	1
Total	2
Answers could include: Developers have legal obligations to protect users' privacy and personal information. They also need to ensure that their software does not infringe on intellectual property rights, such as copyright or patents. Accept other relevant answers.	

Question 2

(2 marks)

Describe **one** difference between 'source code' and 'executable code'.

Description	Marks
Describes one difference between source code and executable code	2
States one difference between source code and executable code	1
Total	2
Answers could include: Source code is written in a high-level programming language and is human-readable, while executable code is machine-readable and is the result of compiling or interpreting the source code. Source code can be modified, edited, and reviewed, while executable code cannot be easily modified or understood by developers. Accept other relevant answers.	

Question 3

(3 marks)

Explain the role of the control unit (CU), arithmetic logic unit (ALU), registers and program counter in performing the following $A = B + C$.

Description	Marks
Explains the role of the CU, ALU, registers and program counter in performing the calculation	3
Describes the role of the CU, ALU, registers and program counter in performing the calculation	2
Makes a general comment about the role of the CU, ALU, registers and program counter	1
Total	3
Answers could include: The computer loads the values of variables B and C into two separate registers in the memory. The CU uses the program counter to fetch the instruction to perform this calculation from memory. The CU interprets the instruction and sends the control signals to the ALU to perform the addition operation. The values of B and C are sent to the ALU via the data bus and the ALU performs the addition operation. The result of the calculation is stored in a third register in memory and is transferred to the memory location for variable A, completing the calculation. The program counter is incremented so that the next instruction can be executed. Accept other relevant answers.	

Question 4

(5 marks)

- (a) Explain a purpose of a standard operating environment (SOE). (3 marks)

Description	Marks
Explains a purpose of an SOE	3
Describes a purpose of an SOE	2
Makes a general comment about an SOE	1
Total	3
<p>Answers could include:</p> <p>A purpose of an SOE is to simplify the management and maintenance of computer systems by reducing the number of variables that IT staff need to deal with. This makes it easier to deploy software updates, patches, and other changes, as IT staff only need to test and validate them against a single, standardised environment. By ensuring that all systems are operating on the same SOE, an organisation can also improve security and compliance by enforcing standard configurations and policies.</p> <p>Accept other relevant answers.</p>	

- (b) Describe
- one**
- advantage of a standard operating environment (SOE) to an organisation. (2 marks)

Description	Marks
Describes one advantage of an SOE to an organisation	2
Makes a general comment about one advantage of an SOE to an organisation	1
Total	2
<p>Answers could include:</p> <p>An SOE can improve system performance and reliability by minimising the number of unique configurations and variations and can enhance security by enforcing consistent policies, settings and updates across all systems.</p> <p>Accept other relevant answers.</p>	

Question 5

(3 marks)

Describe the role of 'data mining'. Include an example in your response.

Description	Marks
Example of data mining	1
Subtotal	1
Describes the role of data mining with an example	2
Makes a general comment about the role of data mining	1
Subtotal	2
Total	3
<p>Answers could include:</p> <p>Data mining is the process of analysing large datasets to discover hidden patterns, relationships, and insights that can be used to make informed decisions. One example of data mining is analysing customer purchase history to identify which products are frequently bought together, allowing retailers to create targeted marketing campaigns or bundle deals.</p> <p>Accept other relevant answers.</p>	

Question 6

(5 marks)

(a) Compare the terms 'referential integrity' and 'domain integrity'. (2 marks)

Description	Marks
Compares the terms referential integrity and domain integrity	2
Defines referential integrity or domain integrity	1
Total	2
<p>Answers could include:</p> <p>Referential integrity ensures that relationships between tables are valid, while domain integrity ensures that data in the domain is accurate and meaningful. Referential integrity is typically enforced through constraints, while domain integrity is enforced through data validation rules.</p> <p>Accept other relevant answers.</p> <p>Note: answers could include similarities and/or differences</p>	

(b) Define the following terms in relation to databases: (3 marks)

- aggregation
- concatenated field
- calculated field.

Description	Marks
For each term (3 x 1 mark)	
Defines the term	1
Total	3
<p>Answers could include:</p> <p>Aggregation is a database tool that allows you to perform mathematical operations on a set of data, such as calculating the sum, average, or maximum of a group of values.</p> <p>A concatenated field is a database tool that combines two or more fields into a single field, separated by a delimiter or other character.</p> <p>A calculated field is a database tool that derives its value from one or more other fields, using a specified formula or expression.</p> <p>Accept other relevant answers.</p>	

Question 7

(3 marks)

As a programmer, you have been asked to create an algorithm to hold numerical scores for a basketball team. These scores are then used to calculate the average score for each player. Which data type would be the most appropriate to use in the algorithm? Justify your answer.

Description	Marks
Justifies which data type would be most appropriate	3
Describes which data type would be most appropriate	2
Identifies a data type that would be most appropriate	1
Total	3
Answers could include:	
<p>The most appropriate data type for this task would be a real floating-point number. This data type is designed to store decimal values with a high degree of precision, making it ideal for storing basketball scores. Furthermore, using a floating-point data type would allow the programmer to perform arithmetic operations on the scores, such as adding up all the scores and calculating the average score for each player, with a high degree of accuracy.</p>	
<p>Integers could be used for numerical scores, however the average must be calculated through a floating-point number. Furthermore, using a floating-point data type would allow the programmer to perform arithmetic operations on the scores, such as adding up all the scores and calculating the average score for each player, with a high degree of accuracy.</p>	
Accept other relevant answers.	

Question 8

(5 marks)

- (a) Outline a purpose for each of the following layers within the Department of Defence (DOD) transmission control protocol/internet protocol (TCP/IP) model. (3 marks)

- Transport layer
- Network layer
- Application layer

Description	Marks
For each layer (3 x 1 mark)	
Outlines the purpose of a layer	1
Total	3
<p>Answers could include:</p> <p>Transport layer: its purpose is to provide reliable end-to-end data transfer between applications running on different hosts.</p> <p>Network layer: responsible for the efficient forwarding of data packets within a single network segment and oversees how data is physically sent through the network.</p> <p>Application layer: its purpose is to provide network services to user applications, such as email, file transfer, web browsing or remote login.</p> <p>Accept other relevant answers.</p>	

- (b) Apart from the number of bits required, identify **two** differences between the IP4 and IP6 protocols. (2 marks)

Description	Marks
For each difference (2 x 1 mark)	
Identifies a difference between the IP4 and IP6 protocols	1
Total	2
<p>Answers could include:</p> <p>IP4 allows for approximately 4.3 billion unique addresses, while IP6 allows for an almost unlimited number of unique addresses.</p> <p>IP4 does not support built-in security features, whereas IP6 includes support for IPSec, which provides authentication, encryption, and other security services to protect network traffic. Differences between fragmentation, address assignment and routing.</p> <p>Accept other relevant answers.</p>	

Question 9

(8 marks)

- (a) Describe **one** difference between the following programming concepts and identify **one** benefit of each: (4 marks)

- modularisation
- functions.

Description	Marks
Describes one difference between modularisation and functions	2
Makes a general comment about one difference between modularisation and functions	1
Subtotal	2
Identifies one benefit of modularisation	1
Identifies one benefit of functions	1
Subtotal	2
Total	4
<p>Answers could include:</p> <p>Modularisation refers to breaking down a program into smaller, more manageable modules or components. Functions refer to reusable blocks of code that perform a specific task or operation.</p> <p>One benefit of modularisation is that it can make a program easier to understand, debug, and maintain, as each module can be designed and tested independently.</p> <p>One benefit of functions is that they can help reduce code duplication and improve code reuse and must return a single value.</p> <p>Accept other relevant answers.</p>	

- (b) Create the function *SecondsToMinutes*, which will convert seconds to minutes. (4 marks)

Description	Marks
Function called <i>SecondsToMinutes</i>	1
Parameter of seconds correctly identified	1
Calculation of seconds to minutes correctly done	1
Returns minutes	1
Total	4
<p>Answers could include:</p> <pre>function SecondsToMinutes(seconds: integer): real; begin SecondsToMinutes ← seconds / 60; end</pre> <p>Accept other relevant answers.</p>	

Question 10

(10 marks)

- (a) Explain how a program evaluation review technique (PERT) chart can be used to manage a project. (3 marks)

Description	Marks
Explains how a PERT chart can be used to manage a project	3
Describes how a PERT chart can be used to manage a project	2
Identifies how a PERT chart can be used to manage a project	1
Total	3
<p>Answers could include:</p> <p>A program evaluation and review technique (PERT) chart is a project management tool that can be used to plan, schedule, and manage complex projects. PERT charts are designed to help project managers identify critical activities, estimate time and resource requirements, and determine the sequence of tasks needed to complete the project. By using a PERT chart, project managers can create a visual representation of the project, showing how individual tasks are related and how long each task will take to complete. This allows project managers to identify potential bottlenecks, prioritise activities, and allocate resources more effectively.</p> <p>Accept other relevant answers.</p>	

- (b) Identify the stage in the system development life cycle (SDLC) where you would draw a PERT chart. (1 mark)

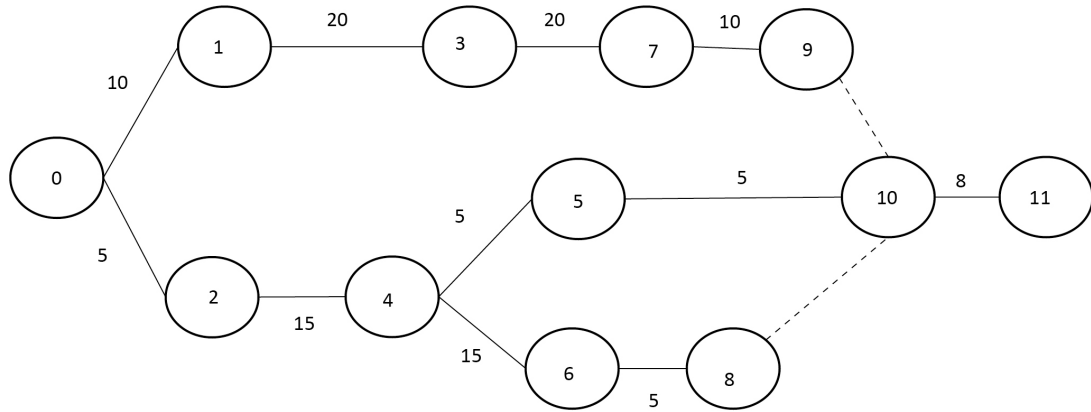
Description	Marks
Preliminary analysis	1
Total	1
Accept other relevant answers.	

(c) Draw a PERT chart illustrating the following information:

(6 marks)

Description	Marks
Branching from 0 to 1 and 2	1
Sequential order of 1, 3, 7 and 9	1
Sequential order of 2 and 4	1
Branching from 4 to 5 and 6	1
Sequential order from 5, 10 and 11	1
Correct amount of days on diagram for each task	1
Total	6

Answers could include:



Accept other relevant answers.

Question 11

(6 marks)

Write an algorithm in pseudocode to:

- store 10 product prices using a one-dimensional array
- find the average price
- print the average price.

Description	Marks
For loop with correct assign of range	1
Input prices through loop	1
Calculation of total price	1
Calculation for average price	1
Output of the average price	1
Use of one-dimensional array	1
Total	6
Answers could include: FOR i = 0 TO 9 DO INPUT (price) prices[i] = price total_price = total_price + price END FOR average_price = total_price / 10 PRINT "The average price is: ", average_price Accept other relevant answers.	

Question 12

(6 marks)

Describe each of the **two** factors and outline **one** solution for each that could improve the network performance.

Description	Marks
For each description (2 x 2 marks)	
Describes how bandwidth/network design could affect the network	2
Makes a general comment about how bandwidth/network design could affect the network	1
Subtotal	4
For each solution (2 x 1 mark)	
Outlines a solution	1
Subtotal	2
Total	6
<p>Answers could include:</p> <p>Bandwidth Bandwidth is the amount of data that can be transmitted over the network at any given time. Insufficient bandwidth can cause slow network performance, especially when there are more users and devices connected to the network.</p> <p>One solution to improve network performance due to bandwidth issues is to upgrade the network's bandwidth capacity by increasing the available bandwidth or by implementing technology that can prioritise network traffic.</p> <p>Network design Network design can also affect network performance. Poor network design can lead to network congestion and slow performance, especially when there are more users and devices connected to the network.</p> <p>One solution is to include adding more switches, routers, and/or wireless access points to the network to improve connectivity or redesigning the network to provide load balancing.</p> <p>Accept other relevant answers.</p>	

Question 13**(4 marks)**

Describe how the following strategies are used to compromise the security of networks.

Description	Marks
For each strategy (2 x 2 marks)	
Describes how the strategy is used to compromise the security of networks	2
Makes a general comment about the strategy	1
Total	4
<p>Answers could include:</p> <p>Denial of service floods a network or system with traffic or requests to overwhelm its capacity, making it vulnerable to attacks.</p> <p>IP spoofing is when attackers falsify the source IP address of a packet to disguise their identity and location, making it difficult for network administrators to trace the origin of the attack.</p> <p>Accept other relevant answers.</p>	

Question 14**(6 marks)**

Describe each of the following errors with reference to the partial algorithm above.

Description	Marks
For each error (3 x 2 marks)	
Describes the error in the code with reference to the partial algorithm	2
Makes a general comment about the error in the code and/or with reference to the partial algorithm	1
Total	6
<p>Answers could include:</p> <p>Syntax error Prnt is a syntax error and will not display c. There should be a comma after is, c and it should read Print('the value of c is', c)</p> <p>Run-time error The Denominator = input_num/0. The error is trying to divide by 0 as this is not possible</p> <p>Logical error IF a > 0. The IF statement checks if 'a' is greater than 0, but since 'a' is 0, as 'a' was initialised to 0 at the start, the statement inside the IF block will not execute.</p> <p>Accept other relevant answers.</p>	

Question 15

(7 marks)

- (a) Describe **one** benefit of normalising data in a database to 3rd normal form (NF). (2 marks)

Description	Marks
Describes a benefit of normalising data in a database to 3 rd normal form	2
Makes a general comment about a benefit of normalising data in a database to 3 rd normal form	1
Total	2
<p>Answers could include:</p> <p>One benefit of normalising data in a database to 3rd normal form (NF) is that it reduces data redundancy and helps to eliminate data inconsistencies. By breaking up a large table into smaller, more specific tables and establishing relationships between them, each piece of data is stored only once, making it easier to maintain data integrity and consistency across the database.</p> <p>Accept other relevant answers.</p>	

- (b) Normalise the data to 3rd normal form (NF). (5 marks)

Description	Marks
Entities Student, Course, Subject, Projects (include primary keys)	1–4
Correct foreign keys in the entities	1
Total	5
<p>Answers could include:</p> <p>Student(<u>StudentNumber</u>, StudentName, CourseNumber (FK), Year, ProjectCode (FK)) Course(<u>CourseNumber</u>, CourseName) Subject(<u>SubjectCode</u>, SubjectName, CourseNumber (FK)) Project(<u>ProjectCode</u>, ProjectTitle, ProjectSupervisor, SubjectCode (FK))</p> <p>Accept other relevant answers.</p>	

Question 16

(3 marks)

Explain how a code of conduct policy promotes ethical and lawful use of technology and data.

Description	Marks
Explains how a code of conduct policy promotes ethical and lawful use of technology and data	3
Describes how a code of conduct policy promotes ethical and lawful use of technology and data	2
Outlines a code of conduct policy that promotes ethical and lawful use of technology and data	1
Total	3
Answers could include: A code of conduct policy promotes ethical and lawful use of technology and data by setting clear expectations for appropriate behaviour and actions, defining ethical principles and values, and providing guidelines and consequences for violations. It helps establish a culture of integrity, accountability, and trust within an organisation or community, and encourages individuals to act in ways that align with the shared values and goals. It ensures that employees have a lawful understanding of the use of technology and data within their organisation.	
Accept other relevant answers.	

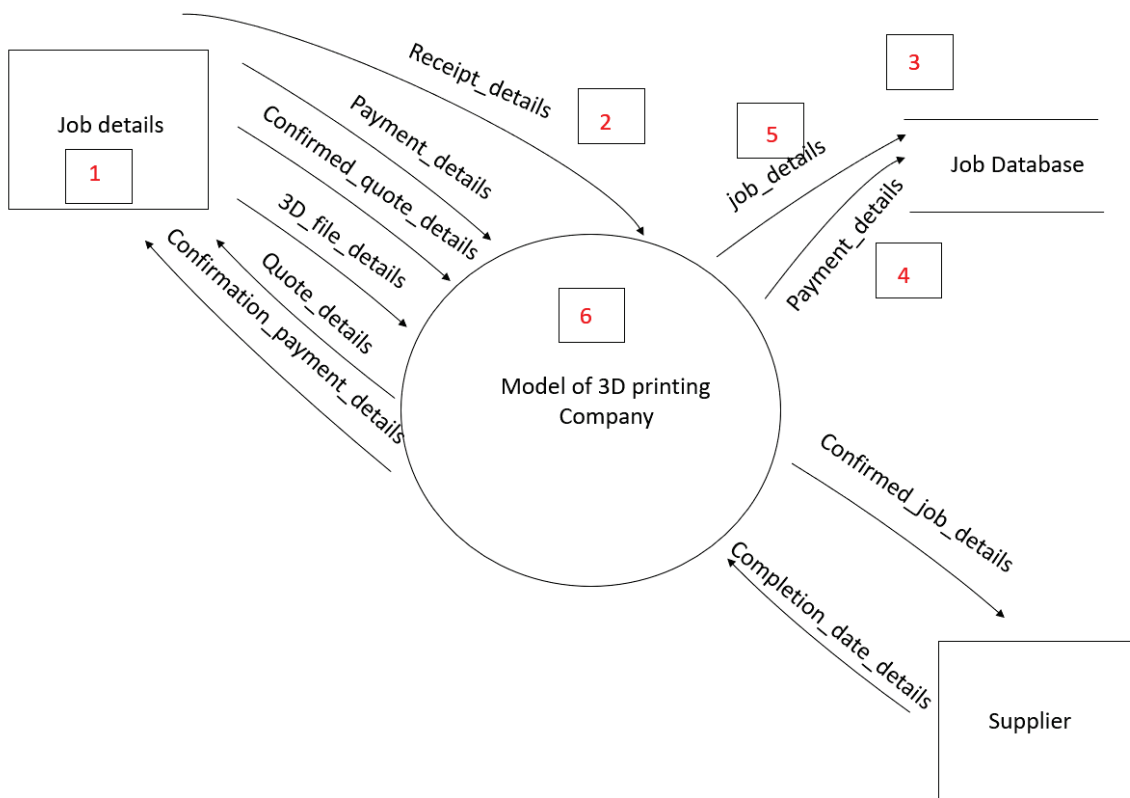
Question 17

(4 marks)

There are several errors in the diagram. Indicate **four** errors on the diagram by numbering the errors 1 to 4 and outline each of the errors indicated in the table below. Ensure the number corresponds to the number identified on the diagram.

Description		Marks
Any four of		
1	Entity written as a data flow	1-4
2	Data flow should be pointing to the entity not the system	
3	Database should not be in a CD	
4 and 5	should be coming from the system to the Supplier	
6	System name is incorrect (should state the name of the system, such as 3D printing system)	
Total		4

Answers could include:



Accept other relevant answers.

Question 18

(7 marks)

(a) Describe the following **two** data gathering techniques.

(4 marks)

Description	Marks
For each gathering technique (2 x 2 marks)	
Describes the data gathering technique	2
Outlines the data gathering technique	1
Total	4
Answers could include:	
Sampling volume of work processed by system: This data gathering technique involves selecting a representative sample of the total work processed by a system over a specific period of time, and then analysing that sample to gain insights into the system's performance.	
Observation: Observation is a data gathering technique that involves watching and recording what people do in a particular situation or environment. This technique can be used to gather both qualitative and quantitative data, depending on the purpose of the observation.	
Accept other relevant answers.	

- (b) You decide that further information is required and provide a questionnaire to all staff and conduct several interviews. Outline **three** differences between questionnaires and interviews. (3 marks)

Description	Marks
For each difference (3 x 1 mark)	
Outlines a difference between questionnaires and interviews	1
Total	3
Answers could include:	
Questionnaires are structured and consist of a fixed set of questions, often with predefined response options, whereas interviews are more flexible and allow for follow-up questions and discussion.	
Questionnaires are usually self-administered by the participant, either in paper or digital format, whereas interviews are typically conducted by a researcher or interviewer.	
Questionnaires may suffer from low response rates, incomplete answers, or biased responses, whereas interviews can provide more detailed, and contextualised information.	
Accept other relevant answers.	

Question 19

(4 marks)

- (a) Describe **one** difference between the following data validation techniques: (2 marks)
- range checking
 - type checking.

Description	Marks
Describes one difference between range and type checking	2
Makes a general comment about range and/or type checking	1
Total	2
Answers could include:	
The main difference between them is that range checking validates data against a set of permissible values or limits, while type checking validates data against a predefined data type or format.	
Accept other relevant answers.	

- (b) Describe when you would use 'type checking' in an algorithm. (2 marks)

Description	Marks
Describes when you would use type checking in an algorithm	2
Makes a general comment about when you would use type checking in an algorithm	1
Total	2
Answers could include:	
Type checking is particularly useful in situations where data types are critical to the accuracy and efficiency of the algorithm, such as in mathematical calculations or when working with external data sources. Type checking is a programming feature that verifies the data type of variables used in an algorithm to ensure that they match the expected type.	
Accept other relevant answers.	

Question 20

(4 marks)

- (a) Describe **one** advantage of implementing a linear (waterfall/cascade) system development methodology. (2 marks)

Description	Marks
Describes an advantage of implementing a linear system development methodology	2
Makes a general comment about an advantage of implementing a linear system development methodology	1
Total	2
<p>Answers could include:</p> <p>The project scope stays relatively static, meaning cost and timelines can be determined early on in the project. By completing a full design early in the project, changes to systems stay minimal, meaning the cost to fix and alter designs is kept low. A structured approach to a project means that everyone understands what needs to be done and when.</p> <p>Accept other relevant answers.</p>	

- (b) Describe **one** advantage of using an iterative rapid application development (RAD) system development methodology. (2 marks)

Description	Marks
Describes an advantage of implementing an iterative (RAD) system development methodology	2
Makes a general comment about an advantage of implementing an iterative (RAD) system development methodology	1
Total	2
<p>Answers could include:</p> <p>It offers improved flexibility as developers can adapt to required changes and incorporate new functionalities and features during the build process. You can create quick iterations that cut down time frames to make your delivery process a lot more streamlined. It is dependent on customer collaboration satisfying every stakeholder, such as users, developers, and clients.</p> <p>Accept other relevant answers.</p>	

Section Two: Extended answer

60% (148 Marks)

Question 21

(44 marks)

Refer to the information on pages 2 and 3 of the Source booklet to answer all parts of Question 21.

- (a) Outline **four** components that the feasibility study should address. (4 marks)

Description	Marks
For each component (4 x 1 mark)	
Outlines an area the feasibility study should address	1
Total	4
<p>Answers could include:</p> <p>Economical – theatre should determine the cost of developing, launching and maintaining system as well as hardware, software, etc.</p> <p>Technical – to see if the new system can be integrated with the theatre’s existing IT infrastructure and whether it can handle the expected volume of traffic.</p> <p>Operational – whether the staff have the necessary skills and training to manage the system and whether the system can be used by customers.</p> <p>Legal – assess any legal and regulatory requirements associated with the online membership system, such as privacy regulations and payment processing regulations.</p> <p>Accept other relevant answers.</p>	

- (b) Describe **two** differences between ‘distributed’ and ‘parallel’ processing. (4 marks)

Description	Marks
For each difference (2 x 2 marks)	
Describes a difference between distributed processing and parallel processing	2
Makes a general comment about a difference between distributed processing and parallel processing	1
Total	4
<p>Answers could include:</p> <p>Distributed processing uses multiple computers to process data, while parallel processing uses multiple processors or cores within a single computer.</p> <p>Distributed processing divides data among nodes, while parallel processing divides data among processors or cores. Distributed processing requires communication between nodes, while parallel processing does not.</p> <p>Accept other relevant answers.</p>	

(c) The general manager has heard about RAID and the different levels. Outline each of the following levels: (3 marks)

- Level 0
- Level 1
- Level 10

Description	Marks
For each level (3 x 1 mark)	
Outlines the level	1
Total	3
<p>Answers could include:</p> <p>RAID level 0 stripes data across multiple disks for improved performance but has no redundancy.</p> <p>RAID level 1 mirrors data across two or more disks for redundancy, but has no performance improvement.</p> <p>RAID level 10 combines striping and mirroring for both performance improvement and redundancy.</p> <p>Accept other relevant answers.</p>	

(d) Use the information in the Source booklet on page 3, to create a context diagram (CD) reflecting both the membership section and the reservation and ticket purchase section. (5 marks)

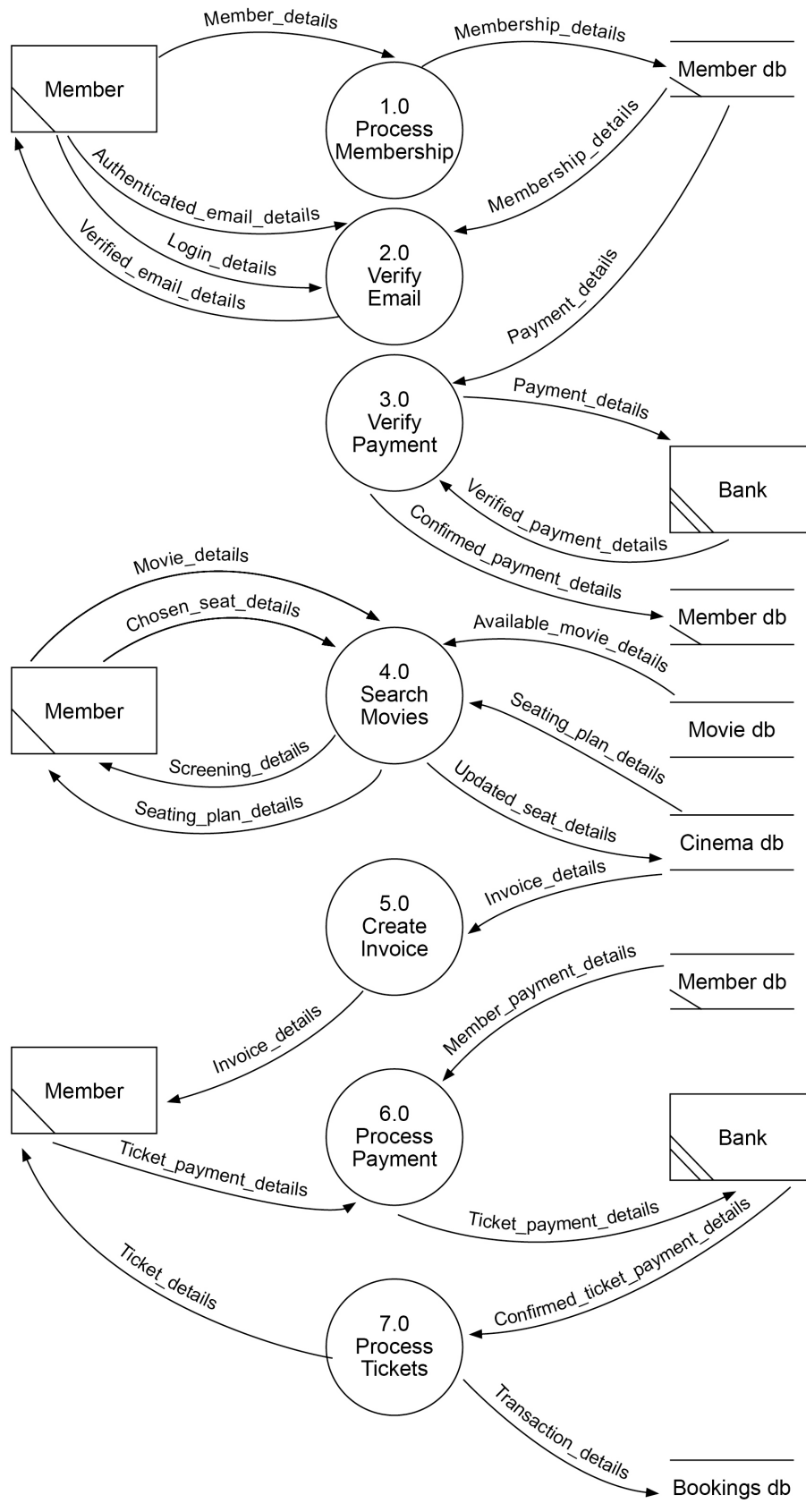
Description	Marks
Draws a context diagram that features:	
Appropriate name of System	1
Correct entities – Member and Bank (both required)	1
Appropriate flows from System to Bank and flows from Bank to System	1
Appropriate flows from Member to System – all flows	1
Appropriate flows to Member from System – all flows	1
Total	5
<p>Answers could include:</p> <pre> graph TD M1[Member] -- Member_details --> MS[Membership and reservation system] M1 -- Login_details --> MS M1 -- Authenticated_email_details --> MS MS -- Verified_email_details --> M1 M2[Member] -- Movie_details --> MS M2 -- Chosen_seat_details --> MS MS -- Invoice_details --> M2 MS -- Screening_details --> M2 MS -- Ticket_details --> M2 M2 -- Seating_plan_details --> MS M2 -- Ticket_payment_details --> MS MS -- Confirmed_ticket_payment_details --> M2 MS -- Payment_details --> B[Bank] B -- Verified_payment_details --> MS B -- Ticket_payment_details --> MS </pre> <p>Accept other relevant context diagrams.</p>	

Question 21 (continued)

- (e) Draw a Level 0 data flow diagram (DFD) to model the membership and reservation and ticket purchase system as described on page 3 of the Source booklet. (22 marks)

Description	Marks
Draws a Level 0 data flow diagram that features:	
Correct symbols	1
Subtotal	1
Entities	
<ul style="list-style-type: none"> • Member • Bank 	1–2
Subtotal	2
Data stores (named appropriately)	
<ul style="list-style-type: none"> • Member • Movies • Cinema • Bookings 	1–4
Subtotal	4
Processes (must include number and verb)	
1.0 Process membership 2.0 Verify email/CC 3.0 Verify payment 4.0 Search movie choice 5.0 Create invoice 6.0 Process payment 7.0 Process tickets	1–7
Subtotal	7
Appropriate data flows (drawn in correct direction and labelled appropriately)	
1.0 Process membership	
Appropriate data flow/s in: member details Appropriate data flow/s out: membership details	1
2.0 Verify email	
Appropriate data flow/s in: login details, membership details, authenticated email details Appropriate data flow/s out: verified email details	1
3.0 Verify bank	
Appropriate data flow/s in: payment details, verified payment details Appropriate data flow/s out: payment details, confirmed payment details	1
4.0 Search movie	
Appropriate data flow/s in: movie details, chosen seat details, seating plan details, available movie details Appropriate data flow/s out: screening details, seating plan details, updated seat details	1–2
5.0 Create booking invoice	
Appropriate data flow/s in: invoice details Appropriate data flow/s out: invoice details	1
6.0 Process payment	
Appropriate data flow/s in: member payment details, ticket payment details Appropriate data flow/s out: ticket payment details	1
7.0 Process tickets	
Appropriate data flow/s in: confirmed ticket payment details Appropriate data flow/s out: ticket details, transaction details	1
Subtotal	8
Total	22

Answers could include:



Accept other relevant answers.

Note: answers can use fewer or more processes, as long as logic is clear and works. The data flow diagram is just one example of a DFD that could be drawn for the membership and reservation and ticket purchase system.

Question 21 (continued)

- (f) Describe why this is **not** recommended and suggest an appropriate implementation method. (4 marks)

Description	Marks
Descriptions	
Describes why direct cut change-over method is not recommended	2
Makes a general comment about why direct cut change-over method is not recommended	1
Subtotal	2
Appropriate implementation method	
Suggests an appropriate implementation method	2
Makes a general comment about an appropriate implementation method	1
Subtotal	2
Total	4
<p>Answers could include:</p> <p>Direct cut change-over can involve a period of downtime, which increases risks of errors compared to other change over systems. The new system can cause errors during the process; therefore, the detection of minor errors is more difficult if this method is used.</p> <p>A better change-over method is a phased approach. This approach minimises the risks, tests the system thoroughly, and ensures employee training, while identifying and addressing issues before full implementation.</p> <p>Accept other relevant answers.</p>	

- (g) The company is considering implementing server virtualisation. Describe why the company considers this to be important. (2 marks)

Description	Marks
Describes the importance of server virtualisation to the company	2
Makes a general comment about the importance of server virtualisation	1
Total	2
<p>Answers could include:</p> <p>Server virtualisation is important for the company as it provides cost savings, increased flexibility, improved resource utilisation, enhanced scalability, better disaster recovery, and improved security.</p> <p>Accept other relevant answers.</p>	

Question 22

(37 marks)

Refer to the information on page 4 of the Source booklet to answer Question 22 parts (a) to (e).

Internal documentation is a requirement in programming to explain the purpose of each block of code in an algorithm.

(a) Name the appropriate internal documentation below for each segment of code.(4 marks)

Description	Marks
For each internal documentation (4 x 1 mark)	
Names the appropriate internal documentation for segment of code	1
Total	4
Answers could include: I. Create a list of movies II. Print the list of movies III. Ask the user to select a movie IV. Check if the selected movie is in the list of movies Accept other relevant answers.	

(b) Explain what would happen if a member tried to search a movie that is not on the company's list. (3 marks)

Description	Marks
Explains what would happen, if a member tried to input a movie not on the list	3
Describes what would happen, if a member tried to input a movie not on the list	2
Makes a general comment about what would happen, if a member tried to input a movie not on the list	1
Total	3
Answers could include: If a member tries to search for a movie not in the list, the program will print the message 'Sorry, that movie is not on the list' because the 'If' condition checks if the 'selected_movie' is in the list 'movies'. If the condition is false, it means the movie is not in the list, and the program will print the message indicating that the movie is not in the list. Accept other relevant answers.	

(c) Describe how the fixed (for) loop in the algorithm works. (2 marks)

Description	Marks
Describes how the fixed (for) loop works	2
Makes a general comment about how the fixed (for) loop works	1
Total	2
Answers could include: The algorithm provided starts by defining a collection of movies. Then using the fixed (for) each loop, each element, that is, each movie in the collection of movies will be assigned the value of that element and the loop body will be executed once for each movie. The print(movie[i]) statement will print each movie in the collection. After the loop body is executed for each element in the movies collection, the loop terminates. Accept other relevant answers.	

Question 22 (continued)

- (d) Describe how the 'IF' statement in the algorithm determines whether the selected movie is in the list. (2 marks)

Description	Marks
Describes how the 'IF' statement in the algorithm determines whether the selected movie is in the list	2
Makes a general comment about how the 'IF' statement in the algorithm determines whether the selected movie is in the list	1
Total	2
Answers could include:	
The IF statement checks the list of movies. If the selected movie is present the algorithm will print ('You have selected 'selected_movie'.')	
Accept other relevant answers.	

- (e) Explain how you would modify the algorithm to allow the user to select multiple movies from the list, rather than only one. (3 marks)

Description	Marks
Explains how the modification of the algorithm would allow the user to select multiple movies from the list	3
Describes how the modification of the algorithm would allow the user to select multiple movies from the list	2
Makes a general comment about how the modification of the algorithm would allow the user to select multiple movies from the list	1
Total	3
Answers could include:	
The algorithm could be modified by adding a WHILE loop before (iii) to prompt the user to keep selecting the movies from the list until they no longer wish to continue. The loop body is executed for each iteration of the loop as long as the condition is true, that is, as long as the user wishes to continue. If condition is false, the loop will terminate and will print all the movies on the list selected.	
Accept other relevant answers.	

Refer to the incomplete algorithm on page 5 of the Source booklet to answer Question 22 parts (f) to (j).

- (f) Write the module *PrintMenu* in pseudocode. (5 marks)

Description	Marks
Begin and end of module	1
Print menu 1. Buy a ticket	1
Print menu 2. View number of tickets sold	1
Print menu 3. View total sales	1
Print menu 4. Exit	1
Total	5
Answers could include:	
<pre>Module PrintMenu(); print ('1. Buy ticket'); print ('2. View number of tickets sold'); print ('3. View total sales'); print ('4. Exit'); End module</pre>	
Accept other relevant answers.	

- (g) Write the module *ViewTicketsSold* in pseudocode. (2 marks)

Description	Marks
Begin and end of module	1
Prints the number of tickets sold	1
Total	2
Answers could include:	
<pre>Module ViewTicketsSold(numTicketSold) Print(numTicketSold, 'tickets sold') End module</pre>	
Accept other relevant answers.	

- (h) Write the module *ViewTotalSales* in pseudocode. (2 marks)

Description	Marks
Begin and end of module	1
Prints the total value of sales	1
Total	2
Answers could include:	
<pre>Module ViewTotalSales(totalSales) Print('\$', totalSales) End module</pre>	
Accept other relevant answers.	

Question 22 (continued)

(i) Write the function *BuyTicket* in pseudocode. (7 marks)

Description	Marks
Begin and end of function	1
Parameter numTickets	1
If statement to calculate whether the tickets can be purchased against the maximum	1
Statement of Result if False	1
Else calculation of number of tickets sold with the additional tickets	1
Calculation of total sales from the number of tickets sold multiplied by ticket price	1
Statement of Result if True	1
Total	7
Answers could include: Function BuyTicket(numTickets: integer): boolean IF numTickets + numTicketsSold > MAX_TICKETS then Result ← False ELSE numTicketsSold ← numTicketsSold + numTickets totalSales ← totalSales + numTickets * TICKET_PRICE Result ← True EndIF BuyTicket←Result End	
Accept other relevant answers.	

(j) Write in pseudocode the missing section in the Main Module for the first part of the case statement. (7 marks)

Description	Marks
IF statement regarding tickets available	1
Input of numTickets	1
Call function BuyTicket with parameter	1
Output total price of tickets	1
IF statement on numTicketsSold=Max_Tickets	1
Output 'Sorry, there are not enough tickets available'	1
Output, 'All tickets have been sold'	1
Total	7
Answers could include: IF ticketAvailable THEN Input(numTickets) IF BuyTicket(numTickets) then print ('Total cost: \$', numTickets * TICKET_PRICE) IF numTicketsSold = MAX_TICKETS THEN ticketAvailable ← False ELSE print('Sorry, there are not enough tickets available.') EndIF EndIF ELSE print('All tickets have been sold.') EndIF	
Accept other relevant answers.	

Question 23

(44 marks)

(a) Outline **two** reasons why this may have been suggested.

(2 marks)

Description	Marks
For each reason (2 x 1 mark)	
Outlines a reason why a centralised database system may be used	1
Total	2
<p>Answers could include:</p> <p>Data consistency with a centralised database system, all data is stored in a single location, ensuring that all users have access to the same data. This helps to maintain data consistency and accuracy across the system.</p> <p>Easy management easier to manage than a distributed system as all data is stored in a single location. This simplifies database administration and reduces the risk of data inconsistencies.</p> <p>Scalability can easily scale to meet the growing needs of the business. Additional resources can be added to the central database server as needed, ensuring that the system can handle increased usage.</p> <p>Security can provide better security as all data is stored in a single location. This makes it easier to implement security measures, such as access controls and encryption.</p> <p>Improved data analysis it is easier to analyse data across the entire system. This can provide valuable insights into customer behaviour, booking patterns, and other business metrics.</p> <p>Accept other relevant answers.</p>	

Question 23 (continued)

(b) Describe **two** reasons why a distributed database may not be a good idea. (4 marks)

Description	Marks
For each reason (2 x 2 marks)	
Describes a reason why a distributed database may not be a good idea	2
Makes a general comment about why a distributed database may not be a good idea	1
Total	4
<p>Answers could include:</p> <p>Data consistency with a distributed database system, data is spread across multiple locations, which can create data inconsistencies and synchronisation issues.</p> <p>Security a distributed database system can be more vulnerable to security breaches as data is stored in multiple locations.</p> <p>Performance a distributed database system can have slower performance than a centralised database system due to the need to access data from multiple locations.</p> <p>Scalability while a distributed database system can offer scalability, however, it can be more difficult to scale than a centralised system. It requires additional resources and expertise to add or remove nodes, which can increase costs and management complexity.</p> <p>Complexity a distributed database system is more complex than a centralised database system. It requires additional resources and expertise to manage, which can increase costs and create additional management challenges.</p> <p>Accept other relevant answers.</p>	

(c) Describe a purpose of a data dictionary in a database. (2 marks)

Description	Marks
Describes a purpose of a data dictionary in a database	2
Outlines a purpose of a data dictionary in a database	1
Total	2
<p>Answers could include:</p> <p>A data dictionary is a tool that stores and manages information about the data in a database. It ensures that all users have a consistent understanding of the data and provides a centralised location for data definitions.</p> <p>Accept other relevant answers.</p>	

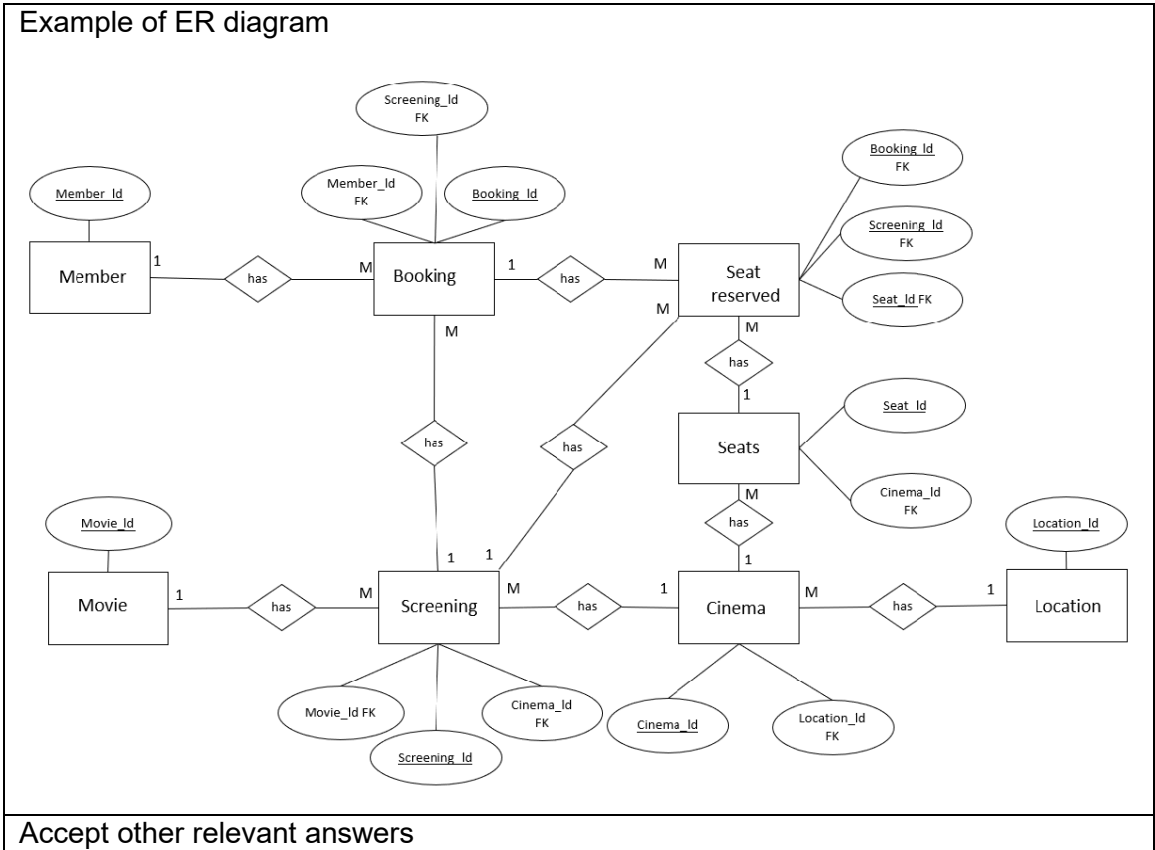
- (d) List **four** components of a data dictionary in a database. (4 marks)

Description	Marks
For each component (4 x 1 mark)	
Lists a component of a data dictionary in a database	1
Total	4
Answers could include:	
1. element name 2. data type 3. data size 4. data format	
Accept other relevant answers.	

- (e) Create an Entity Relationship (ER) diagram for the membership and reservation system. (26 marks)

Description	Marks
Entities and appropriate Primary keys	
Member, Booking, Seat reserved, Seats, Cinema, Location, Screenings, Movies	1–8
Subtotal	8
Foreign keys in correct Entities	
Booking – Member_Id, Screening_Id	1–2
Seat Reserved – Booking_Id, Screening_Id, Seats_Id	1–3
Seats – Cinema_Id	1
Screening – Movie_Id, Cinema_Id	1–2
Cinema – Location_Id	1
Subtotal	9
Cardinality and Relationships	
All resolved cardinality and relationships to illustrate 1:M Member, Booking, Seat reserved, Seats, Cinema, Location, Screenings, Movies	1–9
Subtotal	9
Total	26
Accept other relevant answers	

Question 23 (continued)



- (f) Describe **two** design considerations that you would consider in assisting the readability and inclusivity of the movie theatre company's database user interface. (4 marks)

Description	Marks
For each design consideration (2 x 2 marks)	
Describes a design consideration to assist readability and inclusivity	2
Outlines a design considerations to assist readability and inclusivity	1
Total	4
<p>Answers could include:</p> <p>Two out of the following:</p> <p>Clarity and Simplicity A clear and simple user interface can improve readability and usability for all users. Using simple and concise language, clear labels, and easy-to-understand icons and buttons can help users to quickly and easily navigate the interface.</p> <p>Colour and Contrast Colour and contrast can be used to make the user interface more readable and accessible. Using high contrast between text and background colours can help users with visual impairments. It's also important to avoid using colours that are difficult to distinguish for users with colour blindness.</p> <p>Font Size and Type Font size and type can also impact readability. Using a legible font size, with proper spacing between letters and lines, can make it easier for users to read the text. Additionally, using sans-serif fonts, which are easier to read on screens, can improve accessibility.</p> <p>Accessibility Features Including accessibility features, such as text-to-speech, keyboard navigation, and adjustable font sizes, can improve inclusivity for users with disabilities. These features can help users who have difficulty using a mouse or reading small text to use the interface effectively.</p> <p>Accept other relevant answers.</p>	

Question 23 (continued)

- (g) Outline **two** methods the company can use to ensure their data is kept secure. (2 marks)

Description	Marks
For each method (2 x 1 mark)	
Outlines a method to ensure the data is kept secured	1
Total	2
Answers could include: Encryption Encryption is a technique that transforms data into a code that is unreadable without a specific decryption key. Access Control Access control is the practice of limiting access to sensitive data to authorised personnel only.	
Accept other relevant answers.	

Question 24

(23 marks)

Refer to the information on page 7 of the Source booklet to answer all parts of this Question.

- (a) Identify **six** recommendations that could be implemented at each cinema location to protect the building and the digital assets. (6 marks)

Description	Marks
For each recommendation (6 x 1 mark)	
Identifies a recommendation that could be implemented at each cinema location	1
Total	6
Answers could include: <ul style="list-style-type: none"> • use strong passwords • encrypt sensitive data • perform regular backups • implement two-factor authentication • upgrade hub to router • intrusion detection system • VPN • uninterruptible power supply (UPS). Accept other relevant answers.	

- (b) From your recommendations in part (a), select the **one** which has the highest priority for implementation. Justify your recommendation. (3 marks)

Description	Marks
Justifies why their choice has the highest priority	3
Describes why the choice has their highest priority	2
Outlines why their choice has the highest priority	1
Total	3
Answers could include: <p>Two-factor authentication adds an extra layer of security to the network by requiring users to provide two forms of identification, such as a password and a fingerprint or a security token. This means that even if an attacker manages to obtain a user’s password, they would still need to provide an additional form of authentication to gain access to the network. This significantly reduces the risk of unauthorised access to the network and protects sensitive data from being compromised.</p> <p>Upgrading a hub to a router is important for network security because routers have several features that hubs lack, which are essential for network security. Routers can segment a network into different subnets, which can be configured to have different levels of access and security policies. This enables administrators to control which devices and users can access sensitive information and resources on the network, preventing unauthorised access.</p> <p>An intrusion detection system (firewall) is a critical component of network security and provides the first line of defence against cyber-attacks and unauthorised access. It monitors and controls incoming and outgoing network traffic, blocking potentially harmful traffic while allowing legitimate traffic to pass through. By blocking unauthorised access and malicious traffic, firewalls can prevent data breaches, network downtime, and other security incidents.</p> Accept other relevant answers.	

- (c) You decide that a storage area network (SAN) would work best. Justify this decision. (3 marks)

Description	Marks
Justifies why a SAN would work best	3
Describes why a SAN would work best	2
Makes a general comment about why a SAN would work best	1
Total	3
<p>Answers could include:</p> <p>A storage area network (SAN) would be a suitable choice for managing digital format movies due to its scalability, high performance, centralised management, and security features. SANs can easily accommodate the addition of new movies without compromising on performance, ensuring that movies can be accessed and streamed quickly and efficiently.</p> <p>Accept other relevant answers.</p>	

- (d) Draw using the CISCO symbols, the new network diagram. (11 marks)

Description	Marks
Firewall/Routers/Switches are correctly placed	1–3
Identified wired ethernet transmission medium as appropriate	1
Identified fibre transmission medium as appropriate	1
Includes a movie server at each cinema location	1
Wireless access points	1
Central administration office contains web/streaming/booking server	1
New central administration office has an office admin server, printer and admin PC	1
Smart devices	1
Cisco conventions used	1
Total	11
<p>Answers could include:</p> <p>The diagram illustrates a network architecture. At the top, a cloud labeled 'Internet' is connected to two separate network segments. The left segment, labeled 'Cinema Location 1', contains a Firewall, a Router, a Switch, a Movie server, a Box Office POS system, and a WAP. The right segment, labeled 'Cinema Location 2', contains a Firewall, a Router, a Switch, a Movie server, a Box Office POS system, and a WAP. A third, larger segment labeled 'New Central administration Office' is connected to the Internet cloud. It contains a Firewall, a Router, a Switch, an Office admin server, a Printer, an Admin PC, a Bookings Server, a Web Server, and a Streaming Server. Connections between the Internet and the cinema locations are shown with a single line. Connections between the Internet and the central office are shown with a single line. Within each cinema location, the Router connects to the Firewall and the Switch. The Switch connects to the Movie server, Box Office POS system, and WAP. In the central office, the Router connects to the Firewall and the Switch. The Switch connects to the Office admin server, Printer, Admin PC, Bookings Server, Web Server, and Streaming Server. UTP is indicated for connections between the Router and Switch in both cinema locations, and between the Router and Switch in the central office. Fibre is indicated for connections between the Internet and the central office, and between the Switch and the servers in the central office.</p> <p>Accept other relevant answers.</p> <p>Note: All transmission medium is fibre unless stated.</p>	

ACKNOWLEDGEMENTS

- Question 20(a)** Gallagher, A., Dunleavy, J., & Reeves, P. (2019). *The Waterfall Model: Advantages, Disadvantages, and When you Should use it*. Retrieved August, 2023, from <https://developer.ibm.com/articles/waterfall-model-advantages-disadvantages/>
- Question 20(b)** Egeonu, E. (2022). *The Advantages and Disadvantages of the RAD Model*. Retrieved August, 2023, from <https://distantjob.com/blog/rad-model-advantages-and-disadvantages/>

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*Published by the School Curriculum and Standards Authority of Western Australia
303 Sevenoaks Street
CANNINGTON WA 6107*