Assessment Schedule – 2024

Digital Technologies and Hangarau Matihiko: Analyse an area of computer science (91908)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Analysing *an area of computer science* involves explaining: • the key aspects of the computer science area • relevant algorithms or other mechanisms behind the area • how the area is used, is implemented, or occurs, giving examples • key problems or issues related to the area and how these have been or may be addressed.	***In-depth analysis*** *of an area of computer science* involves: • providing a detailed explanation of how the technical capabilities and limitations of the area relate to humans, giving examples • comparing and contrasting different perspectives on the area.	***Critically analysing*** *an area of computer science* involves: • drawing insightful conclusions about the computer science area.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 2	3 – 4	5 – 6	7 – 8

Evidence

N1	N2	A3	A4	M5	M6	E7	E8
Makes relevant comments in some parts of the response, but not enough to holistically show understanding.	Makes relevant comments in some parts of the response, but not enough to holistically show understanding.	**Explains:** • key aspects of the chosen computer science area • relevant algorithms or mechanisms that support the area • how the area is used or implemented, or occurs, giving examples • key problems or issues related to the area, and how these have been, or may be, addressed.	Explains: • key aspects of the chosen computer science area • relevant algorithms or mechanisms that support the area • how the area is used or implemented, or occurs, giving examples • key problems or issues related to the area, and how these have been, or may be, addressed.	**Explains**, **in detail**, how the technical capabilities and limitations of the computer science area relate to humans, giving examples. Compares and contrasts different perspectives on the area.	Explains, in detail, how the technical capabilities and limitations of the computer science area relate to humans, giving examples. Compares and contrasts different perspectives on the area.	**Draws insightful conclusions** about the computer science area, which may include: • connections • implications • justified predictions • suggested improvements • justified generalisations • high-level thinking.	Draws insightful conclusions about the computer science area, which may include: • connections • implications • justified predictions • suggested improvements • justified generalisations • high-level thinking.
Responses are mostly incorrect.	Some responses may be incorrect.	Some aspects of the response may be partial or weak.		Some aspects of the response may be partial or weak.		Some aspects of the response may be partial or weak.	

N0 = No response; no relevant evidence.

QUESTION ONE: Big data

Part	Achievement	Achievement with Merit	Achievement with Excellence
(a) (i), (ii)	Explains the 3 Vs of big data, and links to datasets.	Explains, in detail, the 3 Vs of big data, and links to datasets in detail.	
(b) (i)	Names datatypes collected.		
(ii)	Explains how data could be collected. Makes links to the data collected on shopping platforms.	Explains, in detail, how data could be collected. Makes links to the 3 Vs and the resources.	
(c) (i)	Identifies and explains how companies can use big data.		
(ii)	Identifies and explains interpretation and representation of collected data.	Identifies and explains interpretation and representation links to supermarkets, authenticity.	
(d) (i)	Candidate selects one method of data analysis.		
(ii)	Explains the selected algorithm or strategy.	Explains, in detail, the selected algorithm or strategy.	
(iii)			Draws insightful conclusions in discussion about how the differences in data type collected impact the methods used to process and analyse the data. Justifies the information used to arrive at conclusions. Demonstrates critical consideration of computer science concepts, including relevance and depth of understanding.
(e)	Explains what problems may be introduced, considering positive and negative implications.	Explains, in detail, how techniques can have positive and negative implications. Makes links to the case study.	
(f)	Explains how data in different types and formats can be processed and analysed.	Explains, in detail, how data in different types and formats can be processed and analysed. Makes links to the case study.	Critically analyses how these concerns are interconnected and explores their implications. Draws insightful conclusions in discussion about the current and future implications of big data, including positives and negatives, and the effects the implications could have on people. Justifies the information used to arrive at conclusions. Demonstrates critical consideration of computer science concepts, including relevance and depth of understanding.

QUESTION TWO: Complexity and tractability

<table>
<tr><th>Part</th><th>Achievement</th><th>Achievement with Merit</th><th>Achievement with Excellence</th></tr>
<tr><td>(a)</td><td>Explains the difference between polynomial and non-polynomial in the context of algorithms and computational complexity.</td><td></td><td></td></tr>
<tr><td>(b)</td><td>Describes the algorithm’s execution time or performance. The table is correctly filled in.
<table>
<tr><td>O(1)</td><td>Constant time complexity refers to an algorithm's efficiency where the execution time or the space used by the algorithm is constant, regardless of the size of the input dataset.</td></tr>
<tr><td>O(N)</td><td>Linear time complexity refers to an algorithm's efficiency where the execution time or the space used by the algorithm increases linearly with the size of the input dataset.</td></tr>
<tr><td>$O(N^2)$</td><td>Represents the time taken for an algorithm whose performance is approximately proportional to the square of the size of the dataset – for example, selection sort.</td></tr>
<tr><td>$O(2^N)$</td><td>Exponential time complexity refers to an algorithm's efficiency where the execution time or space used by the algorithm doubles with each additional element in the input dataset.</td></tr>
<tr><td>O(log(N))</td><td>Logarithmic time complexity refers to an algorithm's efficiency where the execution time or space used by the algorithm grows logarithmically with the size of the input dataset.</td></tr>
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</td><td></td><td></td></tr>
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Part	Achievement	Achievement with Merit	Achievement with Excellence
(c)	Identifies P / NP and identifies correct notation.		

Problem or algorithm	Polynomial, non-polynomial (exponential), or is not yet known	Complexity
Bubble sort (average case)	Polynomial	O(n^2)
Travelling salesperson problem (TSP)	Non-polynomial (exponential)	O(n!) for exact solution, approximations vary.
Returning an element from a list	Polynomial	O(1)
Finding the maximum element	Polynomial	O(n)
Knapsack problem	Non-polynomial (exponential)	O(2^n) for exact solution, polynomial approximations possible (e.g. dynamic programming O(nW)).
Selection sort	Polynomial	$O(n^2)$

Part	Achievement	Achievement with Merit	Achievement with Excellence
(d) (i) (ii)	Candidate selects one of the given algorithms. Explains best-case, worst-case, and average-case time complexities for the chosen algorithm.	Explains, in detail, best-case, worst-case, and average-case time complexities for the chosen algorithm. *Note: Clearly explains and applies knowledge and skills to an unfamiliar context*.	
(e)	Candidate describes tractability problems that occur.	Explains positive and negative considerations about an intractable problem.	Draws insightful conclusions in discussion about how the field of complexity and tractability can impact on people.
(f)	Explains how the technical components of complexity and tractability work in the context given.	Explains, in detail, how the technical components of complexity and tractability can affect people. *Note: Clearly explains and applies knowledge to an unfamiliar context.*	Draws insightful conclusions in discussion about how the field of complexity and tractability will continue to change, and how these changes will affect people. Justifies the information used to arrive at conclusions. Demonstrates critical consideration of computer science concepts, including relevance and depth of understanding.

QUESTION THREE: Network communication protocols

<table>
<tr><th>Part</th><th>Achievement</th><th>Achievement with Merit</th><th>Achievement with Excellence</th></tr>
<tr><td>(a)</td><td>The table is correctly filled in.
<table><tr><th>Layer</th><th>Protocol 1</th><th>Protocol 2</th><th>Protocol 3</th></tr><tr><td>Application</td><td>HTTPS</td><td>DNS</td><td>FTP</td></tr><tr><td>Transport</td><td>SCTP</td><td>TCP</td><td>UDP</td></tr><tr><td>Network</td><td>IPv4</td><td>IPv6</td><td>N/A</td></tr><tr><td>Link</td><td>HDLC</td><td>Ethernet</td><td>Wireless LAN</td></tr></table></td><td></td><td></td></tr>
<tr><td>(b)</td><td>Explains HTTP / HTTPS.</td><td>Explains the similarities and differences of HTTP and HTTPS. Provides specific example and links to correct usage.</td><td></td></tr>
<tr><td>(c) (i)</td><td>Correctly identifies where encapsulation and de-encapsulation are used.</td><td>Explains, in detail, how encapsulation and de-encapsulation are used.</td><td></td></tr>
<tr><td>(ii)</td><td></td><td>Explains, in detail, why encapsulation and de-encapsulation are used.</td><td></td></tr>
<tr><td>(iii)</td><td>Correctly identifies problems that could occur at the transport layer and network layer of the internet protocol suite if a packet was not de-encapsulated.</td><td></td><td></td></tr>
<tr><td>(d) (i)</td><td>Explains the consequence of FIFO / FCFS queueing within the UDP protocol.</td><td></td><td></td></tr>
<tr><td>(ii)</td><td>Explains the process that the TCP protocol would likely undertake in relation to FIFO or FCFS queueing.</td><td></td><td></td></tr>
<tr><td>(iii)</td><td></td><td>Compares and contrasts experience of people with FIFO / FCFS queueing.</td><td></td></tr>
<tr><td>(e) (i)</td><td>Explains the purpose of SSL / TLS and how it contributes to secure communications.</td><td>Explains SSL / TLS protocols in a connected environment.
Note: Clearly explains and applies knowledge to an unfamiliar context.</td><td></td></tr>
<tr><td>(ii)</td><td>Explains the process of a TLS handshake.</td><td></td><td></td></tr>
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Part	Achievement	Achievement with Merit	Achievement with Excellence
(iii)	Explains scenario between SSL / TLS.	Explains differences between SSL and TLS. Note: *Clearly explains and applies knowledge to an unfamiliar context.*	Critically discusses how communications between a client and a server can be intercepted and altered. Justifies the information used to arrive at conclusions. Demonstrates critical consideration of computer science concepts, including relevance and depth of understanding.
(f)	Explains network protocols in a connected environment.	Explains network protocols in a connected environment. *Note: Clearly explains and applies knowledge to an unfamiliar context.*	Critically discusses how network communication protocols contribute to ensuring the confidentiality, integrity, and availability of data in a connected environment. Critically analyses how these concerns are interconnected and explores their implications.