



L-Università  
ta' Malta

MATSEC  
Examinations Board



**Marking Scheme**

IM Computing

**Main Session 2024**

Marking schemes published by the MATSEC Examination Board are not intended to be standalone documents. They are an essential resource for markers who are subsequently monitored through a verification process to ensure consistent and accurate application of the marking scheme.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with the MATSEC Examinations Board when in doubt.

**SECTION A**

Question		Detail Required	Division of marks	Mark
1	a	<pre> graph TD     Start([START]) --&gt; Login[USER LOGIN]     Login --&gt; Search{SEARCH QUERY?}     Search -- N --&gt; Login     Search -- Y --&gt; ReadBook[READ BOOK DETAILS]     ReadBook --&gt; Found{IS BOOK FOUND?}     Found -- N --&gt; NotFound[/DISPLAY SEARCH NOT FOUND/]     NotFound --&gt; Search     Found -- Y --&gt; DisplayResult[/DISPLAY SEARCH RESULT/]     DisplayResult --&gt; AddCart{ADD TO CART?}     AddCart -- N --&gt; Search     AddCart -- Y --&gt; ReadyCheckout{READY FOR CHECKOUT?}     ReadyCheckout -- N --&gt; Search     ReadyCheckout -- Y --&gt; ReadPayment[READ PAYMENT INFO]     ReadPayment --&gt; ValidPayment{IS PAYMENT VALID?}     ValidPayment -- N --&gt; ReadyCheckout     ValidPayment -- Y --&gt; DisplayThank[/DISPLAY THANK YOU/]     DisplayThank --&gt; End([END])     </pre>	<p>½ mark for correct start/end symbol</p> <p>½ mark for correct decision symbol</p> <p>½ mark for correct process symbol</p> <p>½ mark for correct display symbol</p> <p>3 marks for correct overall flowchart</p>	5
	b	Textual or pseudocode		
<b>Total:</b>				<b>6</b>

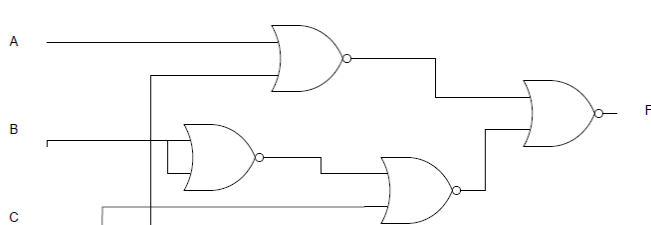
2	a		<p>½ mark for each correct symbol of NOT, AND, OR</p> <p>1 ½ mark for correct circuit</p>	3																										
	b	<table border="1"> <thead> <tr> <th>EXPRESSION</th> <th>LAWS/RULES</th> </tr> </thead> <tbody> <tr> <td><math>C = A + B</math></td> <td></td> </tr> <tr> <td><math>P(Q + R) + P + \underline{QR}</math></td> <td>Substitute</td> </tr> <tr> <td><math>PQ + PR + P + \underline{QR}</math></td> <td>Distributive</td> </tr> <tr> <td><math>PQ + P(R + 1) + \underline{QR}</math></td> <td>Distributive</td> </tr> <tr> <td><math>PQ + P + \underline{QR}</math></td> <td>Law of tautology <math>R+1=1</math></td> </tr> <tr> <td><math>P(Q + 1) + \underline{QR}</math></td> <td>Distributive</td> </tr> <tr> <td><math>P + \underline{QR}</math></td> <td>Law of tautology <math>Q+1=1</math></td> </tr> </tbody> </table> <p><b>Note:</b> Absorption can be used too and, in that case, marks should be awarded.</p>	EXPRESSION	LAWS/RULES	$C = A + B$		$P(Q + R) + P + \underline{QR}$	Substitute	$PQ + PR + P + \underline{QR}$	Distributive	$PQ + P(R + 1) + \underline{QR}$	Distributive	$PQ + P + \underline{QR}$	Law of tautology $R+1=1$	$P(Q + 1) + \underline{QR}$	Distributive	$P + \underline{QR}$	Law of tautology $Q+1=1$	<p>1 mark for substitution</p> <p>1 mark for distributive law</p> <p>½ x 2 mark for tautology laws</p>	3										
EXPRESSION	LAWS/RULES																													
$C = A + B$																														
$P(Q + R) + P + \underline{QR}$	Substitute																													
$PQ + PR + P + \underline{QR}$	Distributive																													
$PQ + P(R + 1) + \underline{QR}$	Distributive																													
$PQ + P + \underline{QR}$	Law of tautology $R+1=1$																													
$P(Q + 1) + \underline{QR}$	Distributive																													
$P + \underline{QR}$	Law of tautology $Q+1=1$																													
<b>Total:</b>				<b>6</b>																										
3	a	<table border="1"> <tbody> <tr> <td>4</td> <td>2</td> <td>1</td> <td>½</td> <td>¼</td> <td>1/8</td> </tr> <tr> <td></td> <td></td> <td></td> <td>0.5</td> <td>0.25</td> <td>0.125</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td colspan="3">6</td> <td colspan="3">625 (5/8)</td> </tr> </tbody> </table> <p><b>6.625 or 6 5/8</b></p>	4	2	1	½	¼	1/8				0.5	0.25	0.125	1	1	0	1	0	1	6			625 (5/8)			<p>1 mark for correct integer part</p> <p>1 mark for correct fraction part</p>	2		
	4	2	1	½	¼	1/8																								
				0.5	0.25	0.125																								
1	1	0	1	0	1																									
6			625 (5/8)																											
b	<table border="1"> <tbody> <tr> <td></td> <td>-128</td> <td>64</td> <td>32</td> <td>16</td> <td>8</td> <td>4</td> <td>2</td> <td>1</td> </tr> <tr> <td>3</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>-3</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>1</td> </tr> </tbody> </table> <p><b>-3 = 11111101</b> or <b>3 = 0000 0011</b> <b>Invert all the bits: 1111 1100</b> <b>Add 1 to the result: 1111 1101</b></p>		-128	64	32	16	8	4	2	1	3	0	0	0	0	0	0	1	1	-3	1	1	1	1	1	1	0	1	<p>1 mark for correct register</p> <p>1 mark for correct answer</p>	2
	-128	64	32	16	8	4	2	1																						
3	0	0	0	0	0	0	1	1																						
-3	1	1	1	1	1	1	0	1																						
c	i	$402_{10} = 0100\ 0000\ 0010_2$		1																										
	ii	<b>2 bytes</b>		1																										
<b>Total:</b>				<b>6</b>																										

4	a	i			1
		ii		1 mark for pop  1 mark for push	2
	b	Any sorting algorithm from bubble sort or insertion sort		1	
	c	Appropriate dry run based on answer to b.		2	
<b>Total:</b>					<b>6</b>
5	a		The web server hosts and delivers website content, and the web client, through a web browser, facilitates the user's interaction with and viewing of the requested web pages.	1 mark for each description	2
	b		<ol style="list-style-type: none"> <li>1. the <i>protocol</i> to use</li> <li>2. the name of the webserver to contact, and</li> <li>3. a path specifying a file on that webserver.</li> </ol> <p> <a href="http://www.matsec.edu/Users/cs/wcbrown/index.html">http://www.matsec.edu/Users/cs/wcbrown/index.html</a>  </p>	1 x 3 for correct component  1 mark for correct URL example	4
<b>Total:</b>					<b>6</b>

6	a		<ul style="list-style-type: none"> <li>- employees from different offices can access shared resources, such as databases, servers, and applications, regardless of their physical location.</li> <li>- can collaborate on projects, share files</li> <li>- communicate through video conferencing or VoIP (Voice over Internet Protocol) calls.</li> </ul> [Accept reasonable]		1
	b		<ul style="list-style-type: none"> <li>- Lower implementation cost, flexible and easy to install</li> <li>-Despite shortcomings, copper wires are relatively effective over short distances.</li> </ul> [Accept reasonable]		1
	c		In larger branches of the corporation or high-bandwidth demanding environments.		1
	d	i	<ul style="list-style-type: none"> <li>In Analog signals amplitude and frequency can change steadily over time and can have any one of an infinite set of values in a range.</li> <li>- Digital signals have distinct amplitude levels and fixed frequencies, making them less prone to interference and more reliable.</li> </ul>	1	2
		ii	These signals are susceptible to interference and degradation over long distances. They can be transmitted over long distances without significant quality loss.	1	1
<b>Total:</b>					<b>6</b>
7	a		Address bus		1
	b		Directly addressable RAM is limited by the number of unique locations an address bus can directly access and calculated by $2^n$ where n is the number of lines on the address bus.		1
	c		The word length determines the number of bits that can be sent and received in one operation.		1
	d		Accept answers related to CPU clockspeed, number of cores, HDD vs. SSD, malicious software etc. (Max of 2 marks)	1 each	2
	e		DRAM needs to be dynamically refreshed but SRAM does not.		1
<b>Total:</b>					<b>6</b>

8	a		A process holding one resource may be requesting a resource currently being held by another process, which in turn requires a resource currently held by the first process. Hence both processes are caught in a deadlock.		1
	b		Central processes may be left waiting while less important ones are being serviced, leading CPU time to be used inefficiently.		1
	c		The priority an operating system gives to each interrupt will determine the order in which such interrupts are addressed and hence impact the user experience.		1
	d		It prevents processes from accessing space allocated to other jobs.		1
	e		Candidates may discuss voice input, GUI features, lift to speak, gesture recognition etc.		1
<b>Total:</b>					<b>5</b>
9	a	i	The field Service Level in the Clients Table is linked to the field Service_Level_id in the Services Table.	1 1	2
		ii	One-to-Many – Each client is registered for only one Service Level. Each Service Level will be opted for by multiple clients	1 1	2
	b		To a <u>maximum of 2 marks</u> , award 1 mark for any mention of the following: <ul style="list-style-type: none"> <li>- Improved data consistency</li> <li>- Improved data portability</li> <li>- Control over data redundancy</li> <li>- Greater security</li> </ul>		2
<b>Total:</b>					<b>6</b>
10	a	i	Feasibility Study		1
		ii	Design		1
		iii	Implementation		1
	b	i	Faster replacement of the old system, no redundancy		1
		ii	May mention reduced risks, improved customer feedback, etc		1
		iii	May mention minimising risk, use in a critical environment.		1
<b>Total:</b>					<b>6</b>

**SECTION B**

1	a	i	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th><math>X_1</math></th> <th><math>X_2</math></th> <th><math>X_3</math></th> <th><math>Z</math></th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td><b>1</b></td></tr> <tr><td>0</td><td>0</td><td>1</td><td><b>1</b></td></tr> <tr><td>0</td><td>1</td><td>0</td><td><b>1</b></td></tr> <tr><td>0</td><td>1</td><td>1</td><td><b>0</b></td></tr> <tr><td>1</td><td>0</td><td>0</td><td><b>1</b></td></tr> <tr><td>1</td><td>0</td><td>1</td><td><b>1</b></td></tr> <tr><td>1</td><td>1</td><td>0</td><td><b>1</b></td></tr> <tr><td>1</td><td>1</td><td>1</td><td><b>0</b></td></tr> </tbody> </table>	$X_1$	$X_2$	$X_3$	$Z$	0	0	0	<b>1</b>	0	0	1	<b>1</b>	0	1	0	<b>1</b>	0	1	1	<b>0</b>	1	0	0	<b>1</b>	1	0	1	<b>1</b>	1	1	0	<b>1</b>	1	1	1	<b>0</b>	<p>1 mark for correct identification of inputs</p> <p>1 mark for correct combination</p> <p>1 mark for correct output</p>	3
$X_1$	$X_2$	$X_3$	$Z$																																						
0	0	0	<b>1</b>																																						
0	0	1	<b>1</b>																																						
0	1	0	<b>1</b>																																						
0	1	1	<b>0</b>																																						
1	0	0	<b>1</b>																																						
1	0	1	<b>1</b>																																						
1	1	0	<b>1</b>																																						
1	1	1	<b>0</b>																																						
		ii	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th><math>X_1 \backslash X_2</math></th> <th>00</th> <th>01</th> <th>11</th> <th>10</th> </tr> </thead> <tbody> <tr> <th><math>X_3</math></th> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>0</th> <td>1</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <th>1</th> <td>1</td> <td>1</td> <td>0</td> <td>1</td> </tr> </tbody> </table> <p style="text-align: center;"><math>Z = \underline{X_3} + \underline{X_2}</math></p>	$X_1 \backslash X_2$	00	01	11	10	$X_3$					0	1	1	0	1	1	1	1	0	1	<p>1 mark for correct mapping</p> <p>1 mark for correct grouping</p> <p>1 mark for correct simplified expression.</p>	3																
$X_1 \backslash X_2$	00	01	11	10																																					
$X_3$																																									
0	1	1	0	1																																					
1	1	1	0	1																																					
	b		$F = (A + C)(\underline{B} + C)$ $\overline{F} = (A + C)(\underline{B} + C)$ $\overline{F} = \underline{(A + C)} + \underline{(B + C)}$ 	<p>1 mark for correct expression</p> <p>2 marks for correct digital circuit</p>	3																																				
c		i	<p>Sample answer: In the context of database systems, a data dictionary is a comprehensive metadata collection that details the database's structure, including information about tables, columns, data types, and relationships between tables.</p>	2	5																																				

			Award 1 mark for definition. Another 1 mark if <u>two</u> correct items are provided. Do not award the second mark if only one item is provided.		
		ii	Structured Query Language (SQL)	1	
		iii	Award 1 mark for “Querying the database” and 1 mark for “Manipulating the data in the database”	2	
d	i		Declare an integer variable named “ <b>count</b> ” and initialise with the value of 10. int count = 10;	1	6
	ii		Declare an array of integers named “ <b>numbers</b> ” with the values 2,4,6,8 and 10. int[] numbers = {2,4,6,8,10};	1	
	iii		Create an instance <b>B</b> of an object class Box. Box b = new Box(); Call method <b>DisplayBox</b> from the above object class Box. b.displayBox();	1	
	iv		Create a method <b>MyMethod</b> , with parameters x and y, which will return the subtraction of y from x. <b>[2]</b>	1 mark for correct method signature	
	v		int myMethod(int x, int y) { return x – y; }	2	
<b>Total:</b>					<b>20</b>
2	a		Computers can only directly execute machine code.		1
	b		Statement 1, Statement 3, Statement 5	1 each	3
	c		<ul style="list-style-type: none"> <li>- <i>LLL are more difficult to code in and debug</i></li> <li>- <i>HLLs are more portable</i></li> <li>- <i>HLLs have more statement power</i></li> </ul>	1 each to a max of 2	2
	d		Child objects inherit the properties and methods of their parents. (E.g. All dogs inherit the feeding method from the parent class ‘Animal’ etc) hence increasing productivity as the same elements in related classes do not to be re-coded separately.		1

e	i	A class is the blueprint for one or more objects (here this could be class Patient) and an object is the blueprint of a class (here this could be each patient registered by the clinic. _____ push _____)		1
	ii	Set i to 0. Repeat this loop: If i > n, then exit the loop. If A[i].idno = x, then exit the loop. Set i to i + 1. Return i.	1 for loop 1 for correct implementation of array and counter 1 for return of i 1 for overall algorithm	4
	iii	A static variable is shared by all instances of the class such that when its value changes, it changes in all instances of the class. It is a bad idea in this case because it would mean that all patients have the same details.	1 for definition 1 for bad idea reasoning	2
f	i	name, age, contact details (and any other relevant options)		1
	ii	Method overloading can allow the code to treat different types of patients uniformly through the base class interface while allowing each derived class to provide its own unique implementation.	1  1	2
g		The object-oriented feature is encapsulation ( <b>1 mark</b> ) and it allows data hiding so objects can shield variables from external access. Variables which are marked as private can only be seen or modified through the use of public accessor and mutator methods. Methods can also be completely hidden from external use. ( <b>1 mark</b> )		2
h		To refer to instance methods, you must instantiate the class first, then obtain the methods from the instance.  Static methods do not require instantiation as they are methods associated with the class rather than with instances of that class.	1	1
<b>Total:</b>				<b>20</b>