

2023 JC2 Prelim P1 Solution

No	Solution	Marks																																																																																																									
1	<p>One mistake 1 mark</p> <table><tr><th>Condition</th><th>C1</th><th>C2</th><th>C3</th><th>C4</th><th>C5</th><th>C6</th><th>C7</th><th>C8</th></tr><tr><td>A</td><td>Y</td><td>N</td><td>Y</td><td>N</td><td>Y</td><td>N</td><td>Y</td><td>N</td></tr><tr><td>B</td><td>Y</td><td>Y</td><td>N</td><td>N</td><td>Y</td><td>Y</td><td>N</td><td>N</td></tr><tr><td>C</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>N</td><td>N</td><td>N</td><td>N</td></tr><tr><th>Outcome</th><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>2</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table> <table><tr><th>Condition</th><th>135 7</th><th>C2</th><th>C4</th><th>C5 C6</th><th>C8</th></tr><tr><td>A</td><td>Y</td><td>N</td><td>N</td><td>-</td><td>N</td></tr><tr><td>B</td><td>-</td><td>Y</td><td>N</td><td>Y</td><td>N</td></tr><tr><td>C</td><td>-</td><td>Y</td><td>Y</td><td>N</td><td>N</td></tr><tr><th>Outcome</th><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>X</td><td></td><td></td><td>X</td><td></td></tr><tr><td>2</td><td>X</td><td></td><td>X</td><td>X</td><td></td></tr></table>	Condition	C1	C2	C3	C4	C5	C6	C7	C8	A	Y	N	Y	N	Y	N	Y	N	B	Y	Y	N	N	Y	Y	N	N	C	Y	Y	Y	Y	N	N	N	N	Outcome									1	X		X		X	X	X		2	X		X	X	X	X	X		Condition	135 7	C2	C4	C5 C6	C8	A	Y	N	N	-	N	B	-	Y	N	Y	N	C	-	Y	Y	N	N	Outcome						1	X			X		2	X		X	X		3
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2a	[4 , 3 , 2 , 3 , 4]	2																																																																																																									
2b	Removes all items from the the lst that has value starting from index i.	2																																																																																																									
2c	[1 , 4 , 3 , 2]	2																																																																																																									
2d	Remove all duplicates	1																																																																																																									
2e	<p>Any of the two:</p> <ul style="list-style-type: none">return address of the callerargument variables passed to the method calllocal variables of the method call <p>What is the difference between parameter and argument? A parameter is a variable in a function definition. It is a placeholder and hence does not have a concrete value. An argument is a value passed during function invocation. In a way, arguments fill in the place the parameters have held for them.</p>	2																																																																																																									
2f	<p># Note: it works for all method, not just recursive method. When a method is called, a stack frame consists of information such as:</p> <ul style="list-style-type: none">return address of the callerargument variables passed to the method calllocal variables of the method call <p>is placed into the call stack. This tells the run-time where it should return to when the current method finishes executing.</p> <p>Each recursive call pushes a new stack frame into the call stack until the base case is reached.</p> <p>When the base case is reached, the run-time will return to the caller of the function by popping off the stack frame containing the return address, the values of the local variables are restored.</p> <p>The process of popping off stack frame will continue until the control is back to the first caller to the function.</p>	0 1 1 1																																																																																																									
3a	Insertion	1																																																																																																									
3b	The list is divided into two parts – one sorted and not sorted. The algorithm begins inserting the elements 3, 8, 1, 4, 9, 7, 2 and 5 one by one into the sorted region of the lst.	1																																																																																																									
3c	O(n**2)	1																																																																																																									
3d	Nearly sorted array	1																																																																																																									

3e	<p>For nearly sorted array, insertion mostly takes place at the end of the sorted items. Hence resulting a time complexity of $O(n)$.</p> <p>Or</p> <p>Insertion mostly takes place only for out of place elements. Hence, it is more efficient.</p> <p>#Note: You should not mention swaps, insertion does not perform swaps. You should use number of comparison to explain.</p>	1
3f	<p>[3, 1, 4, 2, 5, 8, 9, 7, 6] 5</p> <p>[1, 2, 3, 4, 5, 8, 9, 7, 6] 3</p> <p>[1, 2, 3, 4, 5, 8, 9, 7, 6] 1</p> <p>[1, 2, 3, 4, 5, 7, 6, 8, 9] 8</p> <p>[1, 2, 3, 4, 5, 6, 7, 8, 9] 7</p>	1 1
3g	When the pivot chosen is always the smallest or the biggest item, resulting in two very uneven parts.	1
4a	<ul style="list-style-type: none"> i. Lost or out-of-order packets that affect the quality or integrity of the data. (TRANSPORT LAYER) ii. Congestion or overload on the network causes delays or timeouts. (INTERNET LAYER) iii. Malware or viruses that infect or compromise the application or the data. (APPLICATION LAYER) iv. Broken or loose cables that prevent data from reaching the destination device. (NETWORK ACCESS LAYER) v. Blocked or filtered ports that prevent applications from communicating with each other. (TRANSPORT LAYER) vi. Authentication or authorization failures that prevent access to the application or the data. (APPLICATION LAYER) vii. Incompatible or outdated network interface cards (NICs) that do not support the required speed or protocol. (NETWORK ACCESS LAYER) viii. Invalid or duplicate IP addresses that cause conflicts or confusion. (INTERNET LAYER) <p>Mistake-mark</p> <p>0-5</p> <p>1-4</p> <p>2-3</p> <p>3/4-2</p> <p>5/6-1</p> <p>7-8-0</p>	5
4b	By dividing the TCP/IP protocol suite into layers of independent functionality, each layer can be changed or updated without affecting the other layers. For example, if a new physical medium or a new routing protocol is introduced, only the network access layer or the internet layer needs to be modified accordingly.	1
4c	<p>TCP is a connection-oriented protocol, whereas UDP is a connectionless protocol. This means that TCP establishes a connection between the sender and the receiver before sending data, while UDP does not require any connection for sending or receiving.</p> <p>TCP is more reliable than UDP, as it ensures that every packet sent is received and acknowledged by the receiver.</p>	2
4d	<p>Focus on the device function and not how it works.</p> <p>Router: A router is a device that connects different networks and routes data packets across destination networks based on their IP addresses.</p> <p>Switch: A switch is a device that connects other nodes (devices) to from a</p>	2 2

	LAN and forwards data frames based on their MAC addresses.	
4e	Firewall/Authentication <ul style="list-style-type: none"> o Unauthorized access to system or network from known IP sources IPS (anomaly-based detection) <ul style="list-style-type: none"> o Unknown network attack sources Antivirus <ul style="list-style-type: none"> o Malware Data encryption <ul style="list-style-type: none"> o Data theft or data leakage 	4
4f	192.168.3.156	2
4g	the document or message has not been tampered with and that it was indeed sent by the person or entity claiming to have sent it	2
4h	Document contents are hashed to create a digest (e.g. SHA256) Digest is encrypted by the sender with their private key Digest is embedded in the document which is then sent Recipient decrypts the digest using the sender's public key Receipt calculate a hash from the document contents If the recalculated digest matches the decrypted digest, the document has not been tampered with since it was sent.	0.5 0.5
5a	C- 1/2 mark for 3 classes PP -1/2 mark for correct use of public and private I - 1 mark for correct inheritance shown (upward pointing arrows) D - 1 mark for correct distribution of attributes M - 2 mark for identification of appropriate methods (display() and calculate_pay()) P - 1 mark for polymorphism (circle display()) Note: do not use __str__ <div style="text-align: center; margin-top: 20px;"> <pre> classDiagram class Job { - name: str - company: str - description: str - requirement: str + Job(name: str, company: str) + set_name(new_name: str) + get_name(): str + set_company(new_company: str) + get_company(): str + display(): str } class SalariedJob { - base_salary: float - bonus: float - num_pay_leaves: int } class CommissionJob { - total_sale: float - commission_percentage: float } Job < -- SalariedJob Job < -- CommissionJob </pre> </div>	6

	<pre> + SalariedJob (name: str, company: str, base_salary: float, bonus: float) + get_base_salary(): float + set_base_salary() + get_bonus(): float + set_bonus() + calculate_pay(): float + display(): str </pre>	<pre> + CommissionJob (name: str, company: str, total_sale:float, commission_percentage: int) + get_total_sale() :float + set_total_sale() + get_commission_percentage() :int + set_commission_percentage() + calculate_pay(): float + display(): str </pre>	
5b	<p>Inheritance refers to a subclass (or child class) can retain similar implementations of attributes and behaviour methods from another class, called the superclass (or parent class).</p> <p>SalariedJob and CommissionJob class can inherit attributes and methods from Job class without coding them again.</p>	2	
5c	<p>The 4 steps:</p> <ul style="list-style-type: none"> • Consent – Organisations must obtain an individual's knowledge and consent to collect, use or disclose his/her personal data (with some exceptions). • Notification – Organisations must inform individuals of the purposes for collecting, using or disclosing their personal data. • Appropriateness – Organisations may collect, use or disclose personal data only for purposes that would be considered appropriate to a reasonable person under the given circumstances. • Accountability – Organisations must make information about their personal data protection policies available on request. They should also make available the business contact information of the representatives responsible for answering questions relating to the organisations' collection, use or disclosure of personal data. 	4	
5d	<p>Act with complete discretion when entrusted with confidential information.</p> <p>Be impartial when giving advice and will disclose any relevant personal interests</p>	2	
5e	<p>To prevent data leakage of customers information</p> <p>To prevent conflict of interest (Bribery)</p> <p>Needs to be relevant to context of the question.</p>	2	
6a	<p>Using 7-digit employee ID as key and the corresponding lucky number as value - 1</p> <p>Hashvalue = key % 10007</p> <p>Store the key-value pair into a hash table of size around 10007 (but should be a prime number) using the hashvalue - 1</p> <p>collision technique using linear probe. -1</p>	3	
6b	<p>To find the 10 lucky number, the whole hash table must be searched, that will be $O(n)$ where n is the hash table size.</p>	2	
6c	<p>Use a 2D list instead.</p> <p>According to the question there are around 7000 participants, if we are to implement a hash table of about 0.7 load factor, the hash table size would be around 10000.</p> <p>In this case, there is no need to implement a hash table since the table size used is about the same as the number of distinct lucky number ranges from 1 to 9999.</p> <p>So, we will just use a 2D array to implement the reverse match from lucky number to Employee ID instead of using a hash table. The data structure used is just a list of size 10000 and it contains n empty list at initialization. This search can also be done in $O(1)$ time.</p>	3	

	<p>IF your answer is hash table,</p> <p>As the lucky number assigned is random, there will be cases where more than one employee has the same lucky number. If a hash function is to be implemented, we need to ensure the following 2 points:</p> <p>1) modify the table buckets so that it includes a data structure to store all the employee_id using under the same lucky number (which is used as the key this time). Please take note that this is not collision as the key (lucky number) really can have more than 1 employee_id.</p> <p>In other words, the key-value pair in this case is the lucky number and a list containing the employee_id respectively. [2]</p> <p>2) The hash table size should be < than the total possible combination of lucky number. [1]</p>	
7a		3
7b	No. A should not be at that position if it is s BST.	2
7c	BACDEF	2
8a	<p>Provide any of the following reasons:</p> <ul style="list-style-type: none"> - Not atomic (device description; Loan details) - Groupings (Loan details) 	1
8b	Data redundancy is when a piece of information exist in multiple location; Tan KS and matriculation is repeated in the different loan records	1
8c	<p>Provide any of the following reasons:</p> <ul style="list-style-type: none"> - If the name of student is updated, it is easy to miss updating the same information for other entries due to data redundancy resulting in data inconsistency affecting data integrity. - If a device is to be removed from the record, associated data will also be removed 	2
8d	<p>Student – Matriculation</p> <p>PLD – Device ID</p> <p>Loan – Loan ID or Student Matriculation, Device ID, Loan Date</p> <p>Return – Return ID or Loan ID</p>	4
8e	<p>Any of the two below</p> <p>1) minimize data redundancy</p> <p>2) readable such that only related data are stored in the relation</p> <p>3) prevent/minimize data inconsistency.</p>	2
8f	Loan is in 3NF as all other attributes are only dependent to the Primary Key	2
8g	<p>2 marks for each entity and relation</p>	6
8h	<p>Student (<u>Matriculation</u>, Name) (1)</p> <p>PLD (<u>Device ID</u>, Device Brand, Device Model, Purchase Date) (1)</p> <p>Loan (<u>Loan ID</u>, <u>Student Matriculation</u>, <u>Device ID</u>, Loan Date) (3)</p> <p>Return (<u>Return ID</u>, <u>Loan ID</u>, Return Date) (2)</p>	7

Qn	Total
1 DT	3

2 Recursion	12
3 Sorting	8
4 Network	21
5 OOP + COC	16
6 Search	8
7 DS	7
8 DB	25
	100