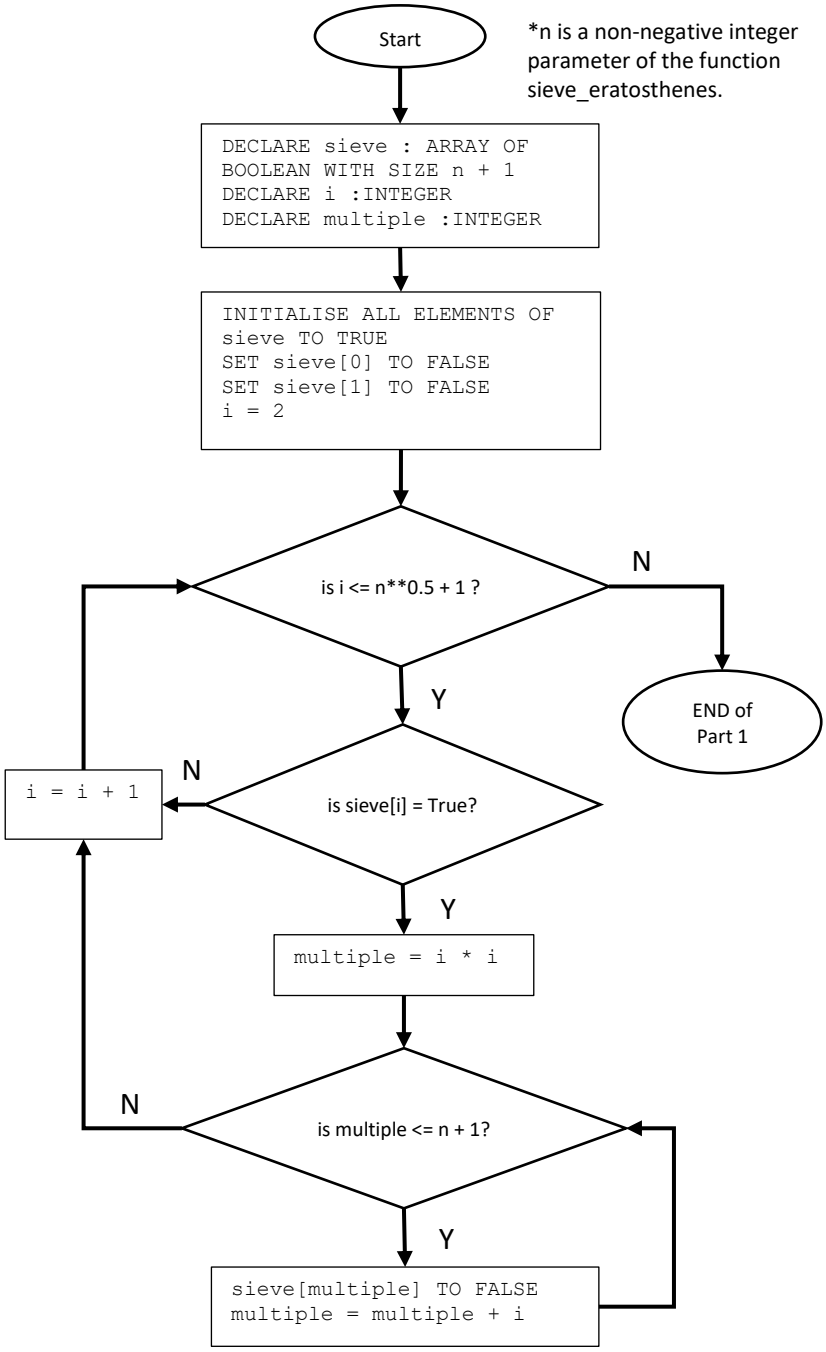
No	Solution	Marks
1a	One mistake 1 mark	6

Condition	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
Is a head	Y	Y	Y	Y	N	N	N	N
Is a spade	Y	Y	N	N	Y	Y	N	N
Is a six	Y	N	Y	N	Y	N	Y	N
Outcome								
Win small prize		X	X		X			
Win big prize	X							

Condition	**C1**	**C2**	**C3**	**C4/8**	**C5**	**C6/8**	**C7/8**
Is a head	Y	Y	Y	-	N	N	N
Is a spade	Y	Y	N	N	Y	-	N
Is a six	Y	N	Y	N	Y	N	-
Outcome							
Win small prize		X	X		X		
Win big prize	X						

1b		6

```
02    DECLARE sieve : ARRAY OF BOOLEAN WITH SIZE n + 1
03    INITIALISE ALL ELEMENTS OF sieve TO TRUE
04    SET sieve[0] TO FALSE
05    SET sieve[1] TO FALSE
06    FOR i FROM 2 TO SQUARE ROOT OF n + 1
07        IF sieve[i] IS TRUE THEN
08            FOR multiple FROM i * i TO n + 1 STEP i
09                SET sieve[multiple] TO FALSE
10            ENDFOR
11        ENDIF
12    ENFOR
```



1c	Bad question. As long as you give line 2, you will get 1 mark. To be clarified in class.	1
1d	17	1
1e	The number of prime numbers in the array that needs to be returned is unknown before the program run. Therefore, dynamic memory allocation is more suitable in this case.	1

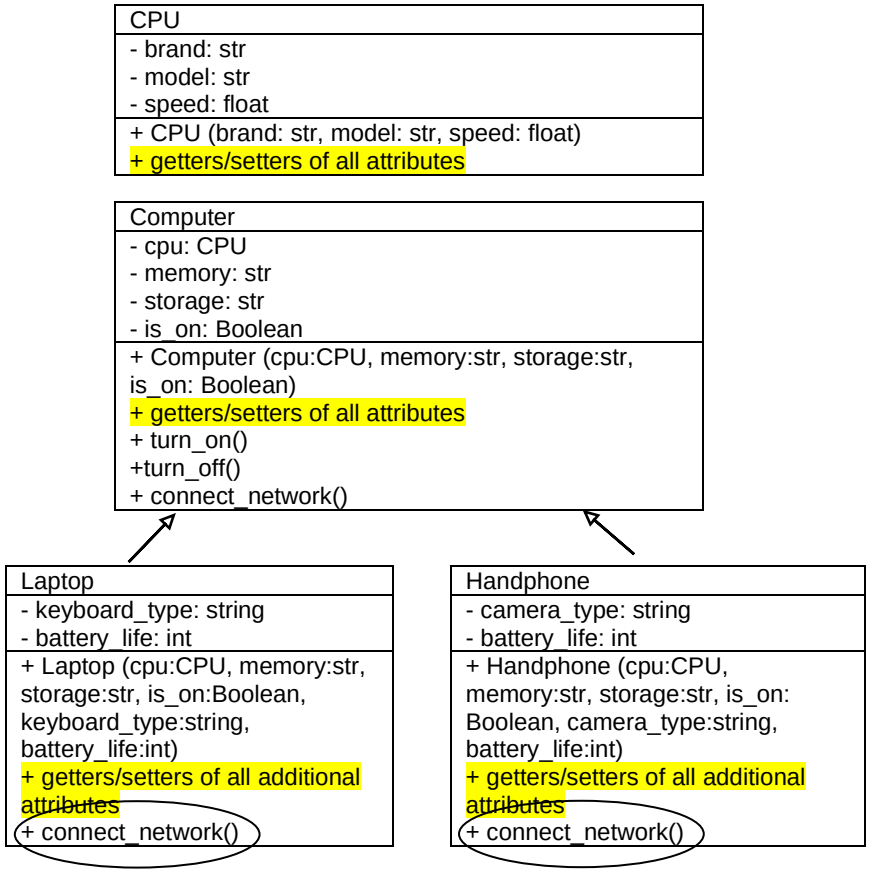
2a	`foo([1,2,3,4,5]) # return 1 + 8 = 9`
	`foo([2,3,4,5]) # return 8`
	`foo([3,4,5]) # return 3 + 5 = 8`
	`foo([4,5]) # return 5`
	`foo([5]) # return 5 + 0 = 5`
	`foo([]) # return 0`
		3

2b	FUNCTION foo_i(num_lst : ARRAY OF INTEGER) RETURNS INTEGER
	DECLARE total : INTEGER
	INITIALISE total TO 0
	WHILE num_lst IS NOT EMPTY
	DECLARE temp : INTEGER
	SET temp TO FIRST ELEMENT OF num_lst
	REMOVE FIRST ELEMENT FROM num_lst
	IF LENGTH OF num_lst MOD 2 EQUALS 0 THEN
	total := total + temp
	ENDIF
	ENDWHILE
	RETURN total
	ENDFUNCTION
		3

2c	A Insertion sort B Merge sort C Quick Sort D Bubble Sort	2
2d	1. Small datasets: Simple sorts are faster for small datasets (typically fewer than 10-20 elements) due to their lower overhead. 2. Nearly sorted data: Simple sorts perform well when the data is already partially sorted or has a small number of unique elements.	2
3a	O(n) linear search. *Explaining only using worst case is not enough. Should mention items are not arranged in order, hence iterating each item in the array to find the search item is required.*	2
3b	To enable binary search, the array must be sorted in ascending order by contact name. Therefore: - Addition operation: When adding a new contact, insert it into the appropriate position in the sorted array, shifting existing contacts as needed to maintain the sorted order. - Deletion operation: When deleting a contact, remove it from the array and shift the remaining contacts to fill the gap, maintaining the sorted order.	2
3c	Fast lookups generally O(1) time complexity if managed properly: Hash tables allow for constant-time searching, inserting, and deleting operations, making them ideal for large datasets like the phone contact book.	1
3d	It is a phone book application, so key is name and not phone number. hash(name) = sum(ASCII values of characters in name) modulo table size	1
3e	Accept a prime number just better than 500. A better answer would be the follow:	1

	To achieve efficient search, a load factor of 0.75 is desired. Therefore, a go od hash table size would be a prime number greater than 666 (which is appr oximately 500 / 0.75). A suitable prime number could be 709 or 719, as they are both greater than 666 and provide a good balance between memory usage and performance. Using a prime number as the hash table size helps to reduce collisions and ensures a more even distribution of contacts in the table, resulting in efficien t search and retrieval operations.	
3f	Any three • Even distribution of outputs (not bias): aim to distribute outputs evenly across all possible inputs • Holistic input usage: both use all the information from the input to determine the output • Minimizes collisions • Fast to compute	3
4a	Data validation: • Length check • check digit • double entry Data verification: • Query the bank's database to confirm the account number exists and is active • Use a bank-provided API to verify the account number and account holder details.	2
4b	Normal test case • $500, expect transfer successful Abnormal test case [any 3] • E.g. source acct: 0123456939, des acct: 1243, amount: $100 • Invalid destination account, expect error message • Transfer of $50.0 • Transfer of ($5 or $ 20000) • Not enough Balance	4
4c	In white box testing, you're testing individual components and functions within the application. In black box testing, you're testing the application's functionality through its user interface, without knowing the internal workings (the source code).	1
4d	He will realise a deduction of the amount in his account only because of the if statement of src_account <> des_account	1
4e	Logic error	1
4f	An additional data validation check in the transfer feature user interface to ensure that the destination and source destination must not be the same.	1
4g	Any 2: VCS allows multiple developers to work on the project simultaneously VCS resolves conflicts when multiple developers make changes to the same part of the codebase VCS allows reversion to the older version of code if new code introduces bugs.	2
5a	Use data structures that are in the syllabus. Queue Linked list BST Array	4
5b	Static data structure is preferred over dynamic data structure when the memory space required by the application is known in advance.	1
5c		1

	5 8 4 7 2 6 3 1	
5d	1,3,2,4,6,7,8,5	2
6a	TCP provides reliable (error checked) and ordered delivery of a stream of bytes between applications. Connection orientated - 3 way handshake to establish connection first.	2
6b	• Smaller segments can be retransmitted individually if errors occur, reducing network traffic. • Segments travel through diff paths simultaneously, potentially speed up overall transmission . Isolating data into smaller segments can limit the impact of potential breaches.	
6c	1. Examine: The switch examines the packet's header to extract the destination MAC address. 2. Lookup: The switch looks up its MAC address table to determine which port is associated with the destination MAC address. 3. Forward/Filter: The switch forwards the packet to the corresponding port if the destination MAC address is in the table, or floods the packet to all ports (except the receiving port) if the address is not in the table.	
6d	**Misuse of company resources:** Using company-issued laptops for personal activities, such as online shopping, may be against company policies. **Negligence:** Sarah's failure to maintain adequate antivirus protection and software updates may be seen as negligence, violating the code of conduct.	1
6e	Weak answer -> install firewall in the company network • Use reputable antivirus software and regularly scan for malware. • Implement robust cybersecurity awareness training for all employees, focusing on phishing, social engineering, and safe computing practices. • Monitor network activity and implement threat detection and incident response plans. • Implement email filtering and spam detection to reduce phishing attempts. • Continuously monitor and analyze security event logs to detect potential security incidents. (Use of IDS or IPS)	2
7a	C- 1 mark for 4 classes I - 1 mark for correct inheritance shown (hollow arrow heads) A – 1 mark for all correct attribute with data type and getters/setters M - 1 mark for identification of appropriate methods e.g. connect(), turn_on() and turn_off() C – 1 mark for constructor P - 1 mark for polymorphism – 2 connect in subclass	6



7b	Polymorphism is the ability of an object to take on multiple forms by implementing a function of the sub class different from the parent class without changing the name of the function. ~~No need give example:~~ ~~- Laptop class: connect_network method connects to the network via WiFi~~ ~~- Handphone class: connect_network method connects to the network via 5G~~	2
7c	Data encapsulation is the concept of bundling data and methods that operate on that data within a single unit, called a class or object which allows internal implementation details to be hidden and access to the data to be controlled. The CPU class hides its internal data (brand, model, speed) and provides methods to access or modify that data. This is an example of data encapsulation, where the internal details are hidden, and access is controlled through methods.	2

8a	Reduce redundancy	
8b	Data may not be updated thoroughly leading to data inconsistency. Eg change in RC Address will produce inconsistency if not all data is being updated.	
8c	No. BBQ Pit has transitive dependencies for RC Zone and RC Address	
8d	RC (RC Zone, RC Address) BBQ Pit (Pit ID, Description, RC Zone) Residents (ID, Name, NRIC Last 5, Contact) Bookings (Booking ID, Pit_ID, Dateuse, StartTime, EndTime)	
8e	RC – one to many – bbq pits – one to many - bookings – many to one - residents	
8f	Misuse of system by non-resident booking or block booking thus depriving other residents to use the pits	
8g	1) flexible schema 2) horizonal scalability (sharding) 3) fast write and read access with no complex query	2
8h	db,collection.find({type: "pit",booking.dateofuse: "15072024"})	1
8i	User will need to navigate in and out from page 1 to page repeatedly. This is an issue pertaining to recognition principle.	2