2022 Prelim P1 suggested solutions

No	Suggested solution	marks
1a	Yes, the additional memory required by the programming during execution is constant.	2
1b	1 [6, 5, 7, 2, 4, 3] 2 [7, 6, 5, 2, 4, 3] 3 [7, 6, 5, 2, 4, 3] 4 [7, 6, 5, 4, 2, 3] 5 [7, 6, 5, 4, 3, 2]	3
1c	Insertion	1
1d	O(i), O(n**2) where n is the number of integers in the list	2
1e	Base case 1: line 3 and 4 Base case 2: line 5 and 6 Recursive function : line 9	3
1f	lst[1:] will takes up additional memory during run time.	2
1g	O(n**2) -> because of the string slicing	1
| 1h | ```python
def UnknownSearch_inplace(lst, target):
    def helper(i, lst):
        if i < len(lst):
            if lst[i] == target:
                return True
            else:
                return helper(i+1, lst)
        else:
            return False
    return helper(0, lst)
``` | 4 |
| 1i | ```python
def UnknownSearch_sorted(sorted_lst, target):
    def helper(i, sorted_lst):
        if i < len(sorted_lst):
            if sorted_lst[i] == target:
                return True
            elif sorted_lst[i] < target:
                return False
            else:
                return helper(i+1, sorted_lst)
        else:
            return False
    return helper(0, sorted_lst)
```<br><br>Optimisation happen only when target is not found in the sorted_lst and it has not reached the end of the list. | 3 |

2	Conditions	C1	C2	C3	C4		5
	1	Y	Y	N	N		
	2	Y	N	Y	N		
	Outcomes						
	A	X		X	X		
	B		X		X		
	C	X	X	X	X		

Conditions	C1/3	C2	C4
1	-	Y	N
2	Y	N	N
Outcomes			
A	X		X
B		X	X
C	X	X	X

3a	Apple -> Banana -> Grape -> Pear -> Orange-> NULL	3

3b	NextPtr	2
	NULL	
	7	
	NULL	
	4	
	6	
	NULL	
	1	
	NULL	

| 3c | ```
FUNCTION Search(target: INTEGER) RETURNS BOOLEAN
BEGIN
Q <- Queue()
Found <- False
LOOP i FROM 1 to Q.size()
    item <- Q.pop()
    IF target == item THEN
        Found <- True
    ENDIF
    Q.enqueue(item)
END LOOP
RETURN Found
END FUNCTION
``` | 4 |
|---|---|---|

Code to loop all the queue items [1]
Code to dequeue item to check [1]
Code to enqueue the item back [1]
Code to remember if target is found in Queue [1]

3d	[-1, 0, 1, 2, 1, 0]	2

4a	Open addressing Collisions are dealt with by searching for another empty buckets within the hash table array itself. Closed addressing A key is always stored in the bucket it's hashed to. Collisions are dealt with using **separate data structures** on a per-bucket basis.	2
4b	Linear search on an unsorted array (hash table in this case) takes O(n) time. To binary search, the items need to be sorted. The sorting process take O(nlogn) minimally. Though the search itself took O(lgn).	2
4c	• 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.	3
4d	Ethical issue related to: - Customer's right to be left alone - Company earns profit from selling customer data to other companies for them to direct marketing.	1
5a	a type of malicious software (malware) that threatens to publish or blocks access to data or a computer system, usually by encrypting it, until the victim pays a ransom fee to the attacker	1
5b	a type of social engineering where an attacker sends a fraudulent (e.g., spoofed, fake, or otherwise deceptive) message designed to trick a person into revealing sensitive information to the attacker[1] or to deploy malicious software on the victim's infrastructure like ransomware.	1
5c	- Backup - Identify software vulnerability and update patches regularly/immediately - Educate employee with knowledge and skill to protect themselves from being victims of phishing.	3
6a	UNF RecordNo, OrderDate, DStartDate, DEndDate, StoreID, StoreName, StoreContact, StoreAddr, CustID, CustName, CustContact, CustAddr, ItemID1, Title1, Comment1, Price1, Quantity1, ItemID2, Title2, Comment2, Price2, Quantity2, … 1NF: <u>RecordNo</u>, OrderDate, DStartDate, DEndDate, StoreID, StoreName, StoreContact, StoreAddr, CustID, CustName, CustContact, CustAddr, <u>ItemID</u>, Title, Comment, Price, Quantity 2NF Order (<u>RecordNo</u>, OrderDate, DStartDate, DEndDate, StoreID, StoreName,	[6]

	StoreContact, StoreAddr, CustID, CustName, CustContact, CustAddr) ItemOrder (<u>RecordNo*</u>, <u>ItemID*</u>, Comment, Quantity) Item (<u>ItemID</u>, Title, Price) 3NF: Order (<u>RecordNo</u>, OrderDate, DStartDate, DEndDate, StoreID*, CustID*) Customer (<u>CustID</u>, CustName, CustContact, CustAddr) Store (<u>StoreID</u>, StoreName, StoreContact, StoreAddr) ItemOrder (<u>RecordNo*</u>, <u>ItemID*</u>, Comment, Quantity) Item (<u>ItemID</u>, Title, Price) Legend: Underline – Primary Key Star* - Foreign Key	

b	Customer 1:n Order 1:n ItemOrder n:1 Item
	                         n
	                        :1
	                    Store
		[4]

c	Data Privacy refers to a requirement for data to be available only to authorized users. RDMBS is able to control the access of different users to different data. However, flat file system stores all data in 1 document, and everyone has access to the file would have access to all data fields. Data redundancy refers to the same data stored more than once. RDBMS went through normalization process, and minimize the data needed to be stored more than once. However, flat file system stores all data in one table without normalization, many data fields will contain repeated data.	[3] [3]
e	The copyright law protects the content creator with exclusive rights which include the right of publicly display their work. Hence taking images online might infringed copyright of other content creators. Search for images under other types of licensing such as creative commons or copyleft.	[3]
7a	1 mark for 3 classes 1 mark for correct use of public and private 1 mark for correct distribution of attributes 1 mark for identification of appropriate methods 1 mark for correct inheritance shown (upward pointing arrows) 1 mark for polymorphism (circle display()) **Ship** - name: str - d_tonnage: int + Ship (name: str, d_tonnage: int) + set_name (new_name: str) + get_name(): str + display(): str **Transport** - cargo_type: str + Transport (name: str, d_tonnage: int, cargo_type:str) + set_ctype (new_ctype: str) + get_ctype (): str + display(): str **Carrier** - no_of_aircrafts: int = 10 + Carrier (name: str, d_tonnage: int) + set_no_aircrafts (new_no: int) + get_no_aircrafts(): int + display(): str	[6]

b	A class is an abstract template or blueprint for a collection of objects where all these objects have a common set of attributes and methods. e.g. An object is an instance of a class, which contains real data inside. e.g.	[4]
c	A Submarine class can be defined with additional private int attribute which counts the maximum number of torpedo it carries, and a float attribute to store maximum depth it can go. Supporting these private attributes, public methods such as set_no_torpedo(), get_no_torpedo(), get_max_depth() and display(). The Submarine class can be a subclass from Ship class.	[3]
d	Method using same name and overwrites its implementation in the super class. display() method in Transport class overwrites it's implementation in Ship class. Same method name reflect that the methods are serving same or similar purposes, but gives the flexibility to have different implementation in super and subclass.	[3]

8a	```
	FUNCTION ISBN_CHECKDIGIT(NUM_STR: STRING, TOTAL: INT) RETURNS STRING
	    IF LENGTH(NUM_STR) > 0:
	        WEIGHT = LENGTH(NUM_STR) + 1
	        TOTAL += INT(NUM_STR[0]) * WEIGHT
	        CHECK_DIGIT = ISBN_CHECKDIGIT(NUM_STR[1:], TOTAL)
	    ELSE:
	        CHECK_VALUE = 11 - TOTAL % 11
	        IF CHECK_VALUE == 11:
	            CHECK_DIGIT = "0"
	        ELSEIF CHECK_VALUE == 10:
	            CHECK_DIGIT = "X"
	        ELSE:
	            CHECK_DIGIT = STRING(CHECK_VALUE)
	        END IF
	    END IF
	    RETURN CHECK_DIGIT
	END FUNCTION
	``
		[4]

b	`ISBN_CHECKDIGIT("184146208", 0)`	[1]
c	Know the internal structure. Test all path.	[2]
d	``` print(isbn_check("184146208", 0)) # X print(isbn_check("000000000", 0)) # 0 print(isbn_check("000000001", 0)) # 9 ```	[6]
e	Presence/format/length/range/type check Any 2 checks.	[2]