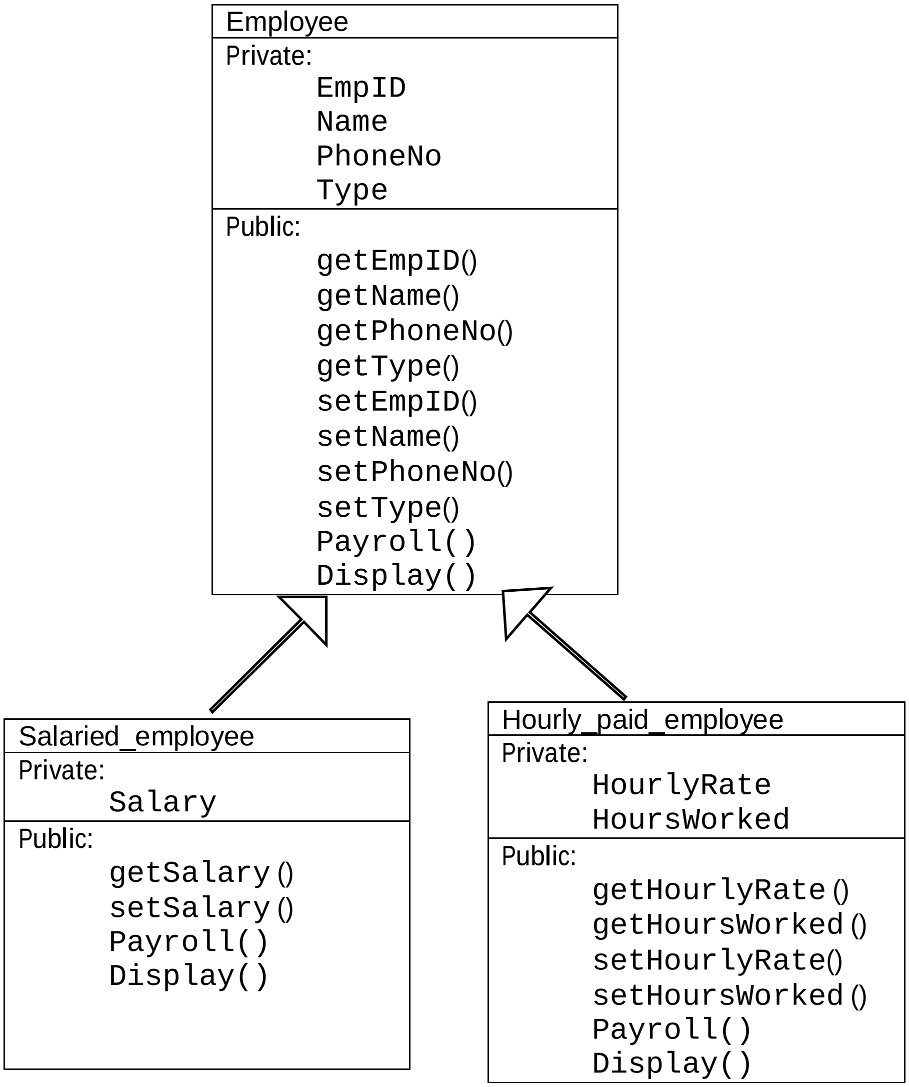
1

a) [18]

Ans:



(b) Ans: Batch count [1]

(c) Ans: Length check: 8, format check [every character is a digit] [2]

(d) Ans: object diagram [2]

(e) Ans: This is known as polymorphism.

Polymorphism usually means that classes Hourly_paid_employee and Salaried_employee derive from class Employee, or class Hourly_paid_employee and Salaried_employee implements an interface that represents class Employee.

The primary usage of polymorphism is the creation of objects belonging to different classes to respond to method [Payroll()], field, or property calls of the same name, each one according to an appropriate class-specific The programmer (and the program) does not have to know the exact type of the object in advance, and so the exact behaviour is determined at run time.

(f) Any two benefits and shortcomings each for using native and web applications. [8]

Ans: Benefits of Native Applications

Optimum Access to Device Hardware and Features
Potential for High Performance and High Responsiveness
Enhanced User Experience
Offline Capabilities

Ans: Shortcomings of Native Applications

Longer Development Time and Higher Development Costs
App Store Approval
Limited Distribution and Discoverability Outside App Stores
Fragmentation and Compatibility Challenges

Ans: Benefits of Web Applications

Cross-Platform Compatibility
No Requirements for Installation
Updating and Application Maintenance
Cost-Effective Development
Greater Discoverability

Ans: Shortcomings of Web Applications

Internet Connectivity Dependency
Limited Device Feature Access
Performance Constraints
Security considerations

(g) [4]

Ans:

1. **Visibility of System Status**
2. **Match between system and the real world**
3. **User control and freedom**
4. **Consistency and standards**
5. **Error prevention**
6. **Recognition rather than recall**
7. **Flexibility and efficiency of use**
8. **Aesthetic and minimalist design**
9. **Help users recognize, diagnose, and recover from errors**
10. **Help and documentation**

Even though it is better if the system can be used without documentation, it may be necessary to provide help and

(h) Ans: [3]

- safer since less chance of external hacking or viruses
- can prevent workers accessing unwanted sites?
- can ensure information is specific to the company
- easier to send out “sensitive” messages to remain within company only

2 (a) Ans

When searching an ordered list the search can be terminated when an item greater than the search value (or less than) is reached **[1]**
When searching an unordered list the search cannot be terminated until the last item has been reached. For an ordered list a binary search can be used. **[1]**

(b) The table below includes an unordered list of maximum 10 names.

Ans:

Index	Name	Next Pointer (1)	Next Pointer (2)	Next Pointer (3)
0	Smith	4		
1	Jones	3		
2	Ahmed	5		
3	Lewis	0		
4	Thomas	**null**		
5	Brown	1		
6				
7				
8				
9				

(c) [4]
Ans:

Index	Name	Next Pointer (1)	Next Pointer (2)	Next Pointer (3)
0	Smith		4	
1	Jones		3	
2	Ahmed		5	
3	Lewis		6	
4	Thomas		**null**	
5	Brown		7	
6	Murphy		0	
7	Collins		1	
8				
9				

(d) [2]
Ans:

Index	Name	Next Pointer (1)	Next Pointer (2)	Next Pointer (3)
0	Smith			4
1	Jones			3
2	Ahmed			5
3	Lewis			6
4	Thomas			**null**
5	Brown			7
6	Murphy			4
7	Collins			1
8				
9				

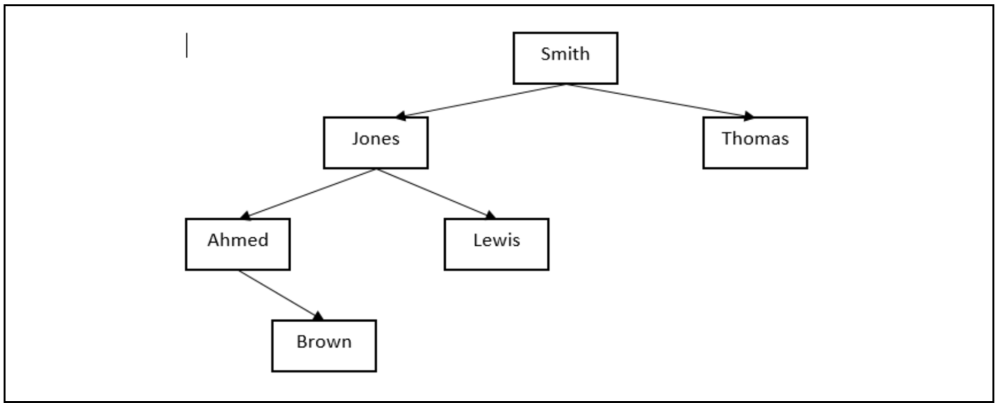
(e) Ans: [3]

- Traverse the list until the last Name was found. Then insert the new Name to the end of the list. Name that have to consider special cases such as list being empty or full.
- In case of a list being empty, returning the updated head of the linked list because in this case, the inserted Name is the first as well as the last Name of the linked list.
- In case of the list is being full, returning with message `"List is full. Insert failed!"`

(f) Ans: [3]

This can be achieved by linking up the unused nodes to form another linked list, which becomes the **free space list**. A free space list needs to be used for maintaining the unused elements in the table.

(g) [3]



3 (a) (i) [1]

Ans: Recipe table; A Figure 2; [1]

(ii) [1]

**Ans: contains multiple values in Ingredients field/attribute/column [1]
// data in Ingredients column not atomic // repeating groups;**

(b)(i) [1]

fully normalised:

**Ans: every attribute is dependent on the key, the whole key and nothing but the key;
OR (tables contain no repeating groups of attributes,) no partial dependencies;
no non-key dependencies;**

(ii) [1]

**Ans: to aid consistency of data // to avoid potential data inconsistency problems [1]
// to eliminate data inconsistency // to minimise data duplication**

(c)(i) Recipe(

Ans: ***<u>RecipeID</u>, Dish, PrepTime, CookTime, NoOfServings, CookInstructions*** **[1]**

)

[1]

(ii) FoodItem(....

Ans: ***<u>FoodItemID</u>, FoodItemName, PackSize, Price*** **[1]**

..)

[1]

(iii) RecipeIngredient(

Ans: ***<u>FoodItemID, RecipeID</u>, Quantity*** **[2]**

..)

(d) Ans:

```
SELECT FoodItemName, Quantity, PackSize, Price
    FROM FoodItem, RecipeIngredient, Recipe
    WHERE (Recipe.RecipeId = RecipeIngredient.RecipeId)
    AND (RecipeIngredient.FoodItemId = FoodItem.FoodItemId)
    AND (Recipe.Dish = “Feta Salad”)
    ORDER BY FoodItemName ASC
```

(e) Ans: [3]

- Access rights give chef/assistants access to different elements
  … by having different accounts / logins
  … which have different access rights e.g. read only // no access / read /write
- Specific views can be assigned to chef/assistants
  … e.g. assistants can only see the data for their own area(s)

4(a) Ans: One mark for each correct marking point [3]

- The initial order of the data
- The number of data items to be sorted
- The efficiency of the sorting algorithm

(b) Ans: One mark for each marking point

1 Use of `FOR` loop to cycle through the whole year group
2 Temporary storage of the score being ‘inserted’
3 Temporary storage of the corresponding name elements
4 Use of `WHILE` loop with correct exit clause
5 Moving of all three elements of data to next array elements
6 Correct updating of counter variable
7 Final insertion of all three data elements

Example algorithm

```
YearSize ← 249
FOR Student ← 2 to YearSize
     Temp1 ← Score[Student]
     Temp2 ← Name[Student]
     Counter ← Student
     WHILE Counter > 1 AND Score[Counter - 1] < Temp1
          Score[Counter] ← Score[Counter - 1]
          Name[Counter] ← Name[Counter - 1]
          Counter ← Counter – 1
     ENDWHILE
     Score[Counter] ← Temp1
     Name[Counter] ← Temp2
NEXT Student
```

(c)

(i) Ans: $O(N^2)$ [1]

(ii) [2]

Ans: $O(N^2)$Both the same

5 (a) Ans: [2]

sender's IP address
receiver's IP address
packet sequence number
checksum

(b) Ans: [3]
email has been split up into packets
packet has destination IP address
packets pass through many different routers in journey
packets don't take same route
routers use IP addresses
packets reassembled at destination to rebuild email

(c) Ans: [2]
email message is only read when all of it is received
time delays due to lost / delayed packets not significant
so sending different packets by different routes is not issue / is efficient
packets arriving out of order not an issue
no requirement for a continuous circuit (circuit switching)

(d) Ans: Circuit switching [1]

(e) Ans: (eg real-time video / video conferencing [2]
circuit made available is dedicated to this communication stream
full bandwidth available / no sharing
no lost packets
guaranteed quality of service