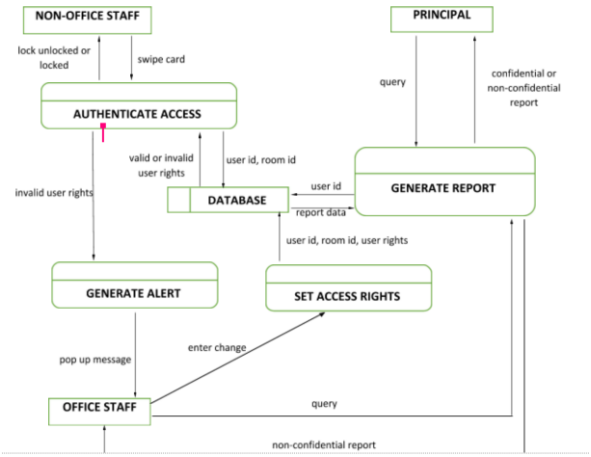
Question	Solution

1a	The administrative group:
	• The office staff/operation manager who will control the access right of each card based on the owner of the card. These people need to be interviewed because they are the one who will be monitoring the whole system. They can give exact information on:
	  ○ the locations where the swipe card system to be installed
	  ○ the GUI of the control page
	  ○ the procedure in making changes in the access privilege of every single card
	  ○ number of cards need to be issued
	  ○ the procedure when an unauthorised tap-in occurs
	  ○ the procedure when special incidence e.g. a fire occurs
	  ○ the procedure when a card is reported lost
	The users
	• The teachers/The principal/The school workers or cleaners/students who will eventually be using the system. They should also be interviewed as they can give users information on:
	  ○ The frequency/pattern of card usage
	  ○ The duration of door unlocks after swipe. E.g. Does always it need to be open or lock immediately after swipe. A classroom used by students and teachers should be open from 7am-5pm. A computer lab should be locked upon card swipe.
	  ○ The time at which different users unlock the door. For example, the school cleaners usually will swipe the card in the morning and the evening

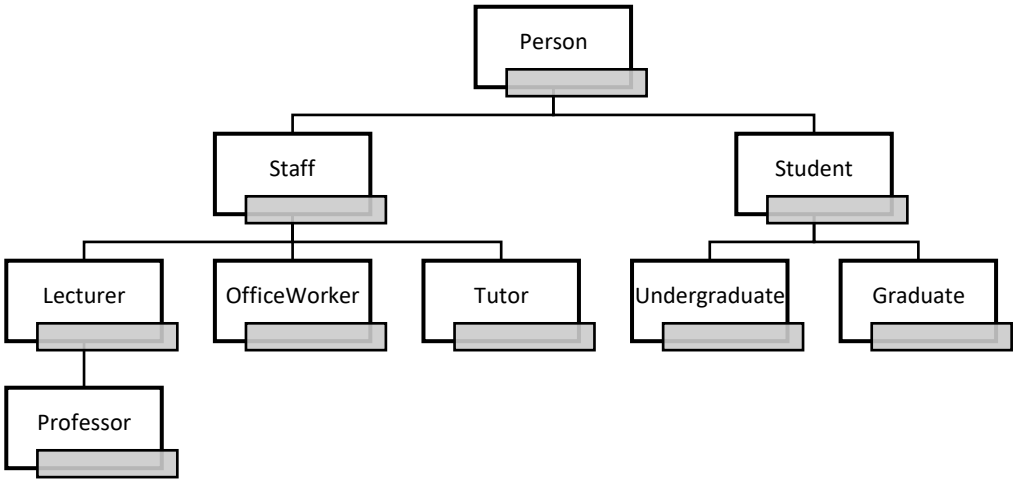
1b	**DFD on old system instead** Entities • office staffs • staffs (teachers) • Principal Datastores • Key Information • Key Movement Log Process • Issue Key • Return Key • Check key access privilege • Update key access privilege • Check key movement • Update key movement **Below is for new system (This is not the solution for 1b)** Entities • office staffs • staffs (teachers) • Principal Datastores • Room (room_id,room_name, room_status) • Staff (staff_id, staff_name, staff_privilege)

	• Card (card_id) Process • Produce report • Authenticate access • Raise unauthorised entry pop up • Make changes/adjust card access privilege 
1ci	System design check by looking through some deliverables of the software design stage should be produced at the end of this stage e.g. ER diagram, database schema, UML class diagram, interface design, algorithm design. These designs need to be checked for correctness and/or efficiency, usability, etc. either manually by domain specific experts or by members using semi-automated or automated tools. Requirement on hardware should also be decided at the end of this stage. The hardware e.g. hard disk, computer and card reader etc to be purchased should be compatible with the software used, able to handle the required number of users. Other checks can also include budget check, human resources check.
1cii	• ER diagram and database schema - database administrator will need to check that the normalised design adheres to third normal form (1NF, 2NF and no non-key/transitive dependencies), no many-to-many relationships in the ER diagram, table specification contains appropriate field names and data types, with primary key, valid integrity (eg non-null fields, default values, etc.) and referential constraints (foreign key), as well as multi-level security access to the tables and reports • interface design - interface designer will need to check that input forms contain appropriate controls, navigation and labels are clear and consistent, useful prompts for intrusion/error messages and confirmation actions, appropriate use of colours and contrast with corporate style and identity, minimise number of steps/clicks to perform actions, input data validation, etc. • UML class diagram - object-oriented analysis and design trained developer to check for well-designed classes with private data and public methods to ensure encapsulation, inheritance to promote code reuse and facilitate modification/maintenance, polymorphic method names across related classes

<table>
<tr><td></td><td>for code generalisation, meaningful identifier names and community adopted case and naming conventions, etc.

remember to apply to question context by giving appropriate examples.</td></tr>
<tr><td>1d</td><td>Black box vs White box testing
<table>
<tr><th>Criteria</th><th>Black Box Testing</th><th>White Box Testing</th></tr>
<tr><td>Definition</td><td>Also call functional testing. It is used to check that the output of a program, given certain inputs, would conform to the functional specification of the program.
The internal structure/ design/ implementation of the item being tested is not known to the tester.</td><td>Also call structural testing. It uses specific knowledge of programming code to test the internal structure of the program and examine the outputs. It is carried out by the programmer.
The internal structure/ design/ implementation of the item being tested is known to the tester.</td></tr>
<tr><td>Levels Applicable To</td><td>Mainly applicable to higher levels of testing:
Acceptance Testing
System Testing</td><td>Mainly applicable to lower levels of testing:
Unit Testing
Integration Testing</td></tr>
<tr><td>Responsibility</td><td>QA team</td><td>Software Developers</td></tr>
<tr><td>Programming Knowledge</td><td>Not Required</td><td>Required</td></tr>
<tr><td>Implementation Knowledge</td><td>Not Required</td><td>Required</td></tr>
<tr><td>Basis for Test Cases</td><td>Requirement Specifications</td><td>Detail Design</td></tr>
</table>
Note: Good to use some example in the context</td></tr>
<tr><td>1e</td><td>Any 3 of the following:
Purpose
o description of what the system is designed to do
Minimum hardware and software requirements of the system
o Installation Procedure
o instructions on how to load and run the system
Detailed instructions on how to operate main/important/every part of the system
o with screenshots as visual aid, showing the system in typical use
o example inputs and outputs, within the screenshots
Troubleshooting Guide
o explanations of error messages, their meaning and how to deal with them
Frequently Asked Questions (FAQ)
Contacts and Links for further assistance</td></tr>
<tr><td>1f</td><td>Corrective maintenance - maintenance of bugs undetected during testing phase, and improvements to ensure program requirements remain met.
For example, if swiping of an expired card results in unlocking of a door. The development team who is doing maintenance should solve this issue or further improve the service by sending an email to remind users about the expiry of card so that they can extend the card validity.

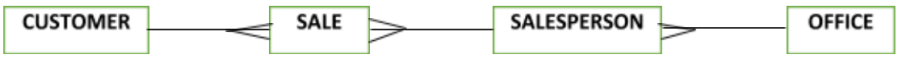
Predictive maintenance - maintenance made in anticipation for likely future changes.
For example, after a few years of card usage, the cards/card readers may not be good condition. It is better to change all access card/card readers before it generates issues</td></tr>
<tr><td>1g</td><td>Authorization is the mechanism by which you control the operations and resources an authenticated client can access. Role-based authorization controls can be enforced for office staff and the principal.
https://stackoverflow.com/questions/9894852/multiple-levels-of-authorization-not-only-role-based</td></tr>
<tr><td>1h</td><td>Card can be lost easily and picked up by others, it can even be intentionally used by students to fake attendances. A more reliable method can be the use of biometric</td></tr>
</table>

	system, for example finger print of users as one of the authentication methods to grant access.
2ai	Diagram A. In asynchronous communication, a sender inserts special start and stop bit patterns between each byte of data. This enable the receivers to distinguish the bytes in the data stream.
2aii	In asynchronous communications, large relative overhead is needed, and a high proportion of the transmitted bits are uniquely for control purposes and thus carry no useful information. This therefore affects network performance.
2b	Equipment B is a switch. It helps to connect all the terminals together and form a LAN. Equipment A is a router. Router manages the IP addresses and acts as the gateway to the Internet. Switch manages the MAC addresses of devices connected to the local area network.
2c	1) A networking device that forwards data packets between computer networks and perform the traffic directing functions on the Internet 2) It maintains a route table so that it can forward the data packets to the correct interface based on the destination address in the IP header. A router works on OSI layer 3.
2d	Advantage • Employee working from home saves up travel cost and time • Convenience for employee to work at home, productivity can be higher for some employee Disadvantage • Working from home requires company information/resources to be available or accessible from home, therefore higher security features must be in place to ensure no data/information is stolen during transmission • Hardware failure cannot be remedied immediately, IT/network engineers must be activated to go on-site to troubleshoot. • The disadvantage is should the router be down, the employee will not be able to connect to the wide area network and transfer data to her office; hence, possibly missing the deadline.
3a	An object is an instance of a class at program runtime. Each object has its own state space but shares the same method space as other objects of the same class.
3bi	
3bii	Inheritance is the ability for an object to not carry its own definition of data and methods that are generic to the class (or classes) that it is part of. A class can inherit attributes and behaviour methods from another class.

	Inheritance is an important feature of OOP as it promotes code reusability as the super class are able to define common functionalities, while the sub-classes can extend them by adding new functionalities or override the existing ones.
3ci	The integer variable stores the index of the array which represents the top element of the stack
3cii	The array provides space (memory) to store the items of the stacks. It also define the maximum number of item can be in a stack.
3ciii	Refer to practical in class. 1) Convert from Infix notation to postfix notation e.g. 3 + 4 to 3 4 + using a stack and a queue 2) Evaluate the postfix notation using a stack. Steps involved: A) Push operands into stack B) Every time an operator is encountered, Pop 2 operands from stack and perform the required mathematical operation. C) Push the result back to stack. 3) Repeat this until the end of postfix expression, result will be in the top item of the stack.
4ai	On the centralized Server
4aii	On each computer/terminal/node that are involved in the peer to peer connection
4aiii	**Advantage of Server-Client** "1) Centralization : Unlike P2P, where there is no central administration, here in this architecture there is a centralized control. Servers help in administering the whole set-up. Access rights and resource allocation is done by Servers. 2) Proper Management : All the files are stored at the same place. In this way, management of files becomes easy. Also it becomes easier to find files. 3) Back-up and Recovery possible : As all the data is stored on server its easy to make a back-up of it. Also, in case of some break-down if data is lost, it can be recovered easily and efficiently. While in peer computing we have to take back-up at every workstation. 4) Upgradation and Scalability in Client-server set-up : Changes can be made easily by just upgrading the server. Also new resources and systems can be added by making necessary changes in server. 5) Accessibility : From various platforms in the network, server can be accessed remotely. 6) As new information is uploaded in database , each workstation need not have its own storage capacities increased (as may be the case in peer-to-peer systems). All the changes are made only in central computer on which server database exists. 7) Security : Rules defining security and access rights can be defined at the time of set-up of server. 8) Servers can play different roles for different clients."
4aiv	**Limitation of Server-Client** 1) Congestion in Network :Too many requests from the clients may lead to congestion, which rarely takes place in P2P network. Overload can lead to breaking-down of servers. In peer-to-peer, the total bandwidth of the network increases as the number of peers increase. 2) Client-Server architecture is not as robust as a P2P and if the server fails, the whole network goes down. Also, if you are downloading a file from server and it gets abandoned due to some error, download stops altogether. However, if there would have been peers, they would have provided the broken parts of file. 3) Cost : It is very expensive to install and manage this type of computing. 4) You need professional IT people to maintain the servers and other technical details of network."

4b	Every Print job is numbered and has an id. There is also a print job queue presents in the printer or another hardware to manage the order of print jobs. Printer can initiate connection to terminals according to the printer queue so that the documents to be printed can be spooled for printing.
4c	30 x 8 / 5 = 48 megabits per second
5ai	DECLARE Puzzle ARRAY[1:9,1:9] OF INTEGER
5aii	Puzzle [3,5] <- 4
5aiii	2D array is more human readable (easier to understand) than 1D array. For example: Puzzle [3, 4] means the element at 3th row and the 4th column (users can almost mediately knows which element it is referring to. To represent the same element in 1D array, for example Puzzle [23], this is not easily readable, some calculation must be done in order to know which level it is referring to. Row = 23//9, Col =23%9

5b	`OPEN filename FOR WRITE`
	`FOR row = 1 to row = 9`
	`  FOR col = 1 to col =9`
	`  line = line + Puzzle[row, col]`
	`  ENDFOR`
	`  WRITEFILE line, filename`
	`ENDFOR`
	`CLOSEFILE filename`

5c	The first debugging technique is code tracing where the flow of execution of the process is printed. Hence, the location where the error commences may be identified. The second debugging technique is condition handling where handlers are programmed within the code to catch exceptions. For each type of error that occurs, the program will return a descriptive error message. • Displaying Variables • Try-Except Blocks • IDE Debugging Tools – setting break points, execute by steps
6a	ER diagram  .
6b	SALE | Amount | Float | CHECK (Amount > 0.0)
6c	Address may contain information such as block number, unit number, building name, street number, postal code etc. With blk no, unit no and postal code, we can uniquely identify one address already. Hence storing all information in a single field may first of all create data redundancy, and this may also leads to data inconsistency if one of the address record is changed without modifying the other address record referring to the same address. Other answer: This is because it is not feasible to validate the full address. Instead, splitting the address into two fields, address and postal code, allows the database to look up a list of postal codes to validate the new address entered.
6di	SalesPersonID, SalespersonName, CustomerID, CustomerName
6dii	1. data definition language (allowing the definition of the relational structure), and 2. data manipulation language (allowing retrieval of data based on queries)