1 An e-commerce company uses a central server to store customer data and manage orders. Work-from-home employees use thin-client systems to access the company's resources and order management software remotely.

Complete the table by identifying two characteristics of a thin-client.

Describe how each characteristic will be used in **this** software.

| | Thin-Client Characteristic | Description of use in this situation |
|---|---|---|
| 1 | ~~Data~~ Data is stored in the server, ~~not~~ | User can see updates of the data caused by new order or new customer. because data is store on server. |
| 2 | Data is processed on the server | It there is a lot of data to process, such as searching an order from thousands, the server is ~~more~~ usually faster than the client. ok. |

[4]

2 Data transmitted on the internet passes through multiple different systems.

(a) Describe the role of routers in the transmission of data through the internet.

Decide where the data packet should go

Decide the ~~ro~~ route ~~it~~ datapacket should take

Connects different ~~network~~ net work together.

True, but not a role of the router per se

[3] ~~X~~ (2).

(b) Describe the role of the PSTN (Public Switched Telephone Network) in the transmission of data through the internet.

It transmit data through underground wires.

X. The question isn't asking about the cables.

[2] ~~X~~ (0).

3 A computer stores binary data.

**(a)** Tick (✓) **one** box only to identify the **largest** file size:

- [ ] 1024 kibibytes 1 meb:
- [ ] 1 megabyte
- [✓] 1.5 mebibytes ✓
- [ ] 1500 kilobytes

[1]

**(b)** Subtract the denary number 50 from 100 using eight-bit registers.

Show your working.

Working 128 64 32 16 8 4 2 1 — Borrows not clearly indicated, ~~✓~~ -1
0 1 1 0 0 1 0 0
-0 0 1 1 0 0 1 0
0 0 1 1 0 0 1 0

Answer 00110010 ✓

~~[3]~~ 2

**(c)** Convert the hexadecimal number 2A3 into denary.

Show your working.

Working 256 16 1 0010 1010 8421 0011
2 A 3 512 128 32 2 1 = 675
3 + 10×16 + 2×256 = 675
16 512

Answer 675 ✓

[2]



**(d)** Convert the Binary Coded Decimal 100001011001 into denary.

Show your working. 8421, 8421, 8421
Working 1000 0101 1001
8 5 9
859

Answer 859 ✓

[2]

4 A screenshot is stored as a bitmap image.

**(a)** The screenshot has a resolution of 1200 pixels wide by 400 pixels high. The bit depth is 4 bytes. Calculate an estimate for the file size of the photograph in megabytes.

Show your working.

Working $\frac{1200 \times 400 \times 4}{1000 \times 1000} = \frac{1200 \times 1600}{1000000}$
12 $= \frac{1920000}{10^6}$
×1.6 $= 1.92$ mb
72
12
1.92

Answer 1.92 megabytes

[2]

**(b)** The screenshot is compressed before being sent in a chat service using direct messaging.

Give **three** benefits of this screenshot being compressed using lossy compression instead of lossless compression.

1 smallar size after compress using lossy. Take up less space ✓
2 faster upload speed to the cloud (due to smaller size) ✓
3 faster danload speed by the reciever (due to smaller size) ✗ Makes the same point as 2

~~[3]~~ 2

6 The following database table is not normalised:

| EmployeeID | EmployeeName | Department | Projects | ProjectCodes |
|---|---|---|---|---|
| 001 | Sara Liang | IT | Website, App | W1, A1 |
| 002 | Jack Brown | HR | Recruitment | R1 |
| 003 | Vicky Xie | Marketing | Social media, Ads | SM1, AD1 |
| 004 | Alan Kirakosian | IT | App | A1 |

Explain how to modify the table to put it into First Normal Form (1NF).

Remove projects and projectCodes from the table

Create another table where one EmployeeID have many project Code. EmployeeID ProjectCode (EmployeeID, one or ProjectCode)

Create another table where one ProjectCode have one Project. ≠ ProjectTable (ProjectCode, Project)

In the ~~two~~ first new table, Employee ID and project code are all foreign key.

What about Primary keys?

[4]

notation: 3
not an Explanation.

EmployeeName is not Atomic

2

7 An e-commerce platform wants to store data about products, customer orders, and order items in a database.

Part of the database design includes the following tables:

PRODUCT(ProductID, ProductName, Category, Price, StockQuantity)

ORDER_ITEM(OrderItemID, OrderID, ProductID, Quantity, TotalPrice)

**(a)** Sample data for the table ORDER_ITEM is shown:

| OrderItemID | OrderID | ProductID | Quantity | TotalPrice |
|---|---|---|---|---|
| 1001-001 | O-1001 | P001 | 100 | 999.00 |
| 1001-002 | O-1001 | P002 | 150 | 1198.50 |
| 1002-001 | O-1002 | P001 | 30 | 299.70 |
| 1003-003 | O-1003 | P003 | 90 | 13499.10 |

Write a Structured Query Language (SQL) script to define the table ORDER_ITEM.

```
CREATE TABLE ORDER_ITEM(
    OrderItemID VARCHAR
    OrderID VARCHAR
    ProductID VARCHAR
    Quantity INTEGER
    TotalPrice DataType?
);
ALTER TABLE ORDER_ITEM ADD PRIMARYKEY (OrderItemID)
```

[3]

**(b)** Write the SQL script to return the number of "P001" products have been ordered.

```
SELECT Quantity SUM(Quantity)
FROM ORDER_ITEM
WHERE ProductID = 'P001'
```

[2]



**(c)** The company would like to expand their database to store data about customer, their orders, and the products in each order. To do this, they will create two new tables, ORDER and CUSTOMER.

Describe the information in the two new tables **and** explain how these tables would link to the ORDER_ITEM and PRODUCT tables.

In CUSTOMER table, it should store customerID, customerName, customerTel and more customer informations, where customerID is the primary key.

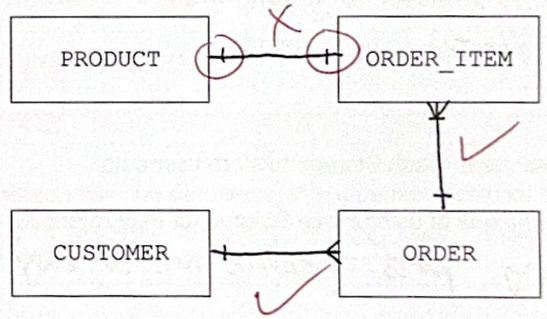
In ORDER table, it should store OrderID, CustomerID where order ID is primary key.

They link to CUSTOMER table link to Order ORDER table as foreign key in Order table, Order table then link to ORDER_ITEM table by the foreignkey orderID, and ORDER_ITEM table link to PRODUCT by having product ID as foreign key.

which field?

[5]

**(d)** Complete the entity-relationship (E-R) diagram for this relational database.




[3]

8 A technology company is developing a new wearable fitness tracker.

(a) Complete the description of the operation of this new wearable fitness tracker

The ~~motion sensor~~ is a sensor inside the device used to detect motion to track step count. All versions of the device will also contain sensors to measure heart rate, blood-oxygen, and location. Data is sent to a ~~micro processor~~ for analysis. Some upgraded versions of the device also include ~~Sound~~ sensors which allows the user to give voice commands to the device. This device uses sensors to read real-time data and uses that data to vibrate, send audio alerts and text notifications to the user and other third-party systems. This is an example of a ~~card control~~ embedded system.

[4] 2

(b) A buffer is used to handle data collected by the fitness tracker before sending it to a smartphone.

Explain how a buffer works in this scenario to manage data transfer.

∃ Buffer ~~act~~ is a temporary storage that store the data collected by the tracker. After collecting all the data into the Buffer, it will start sending data to the smart phone in a more organised way instead of ~~set~~ sending data ~~whenever~~ as soon it is collected by sensor.

[3] 1

(c) The fitness tracker uses Flash Storage to store user data.

Explain two advantages of using Flash Storage for data retention.

No moving parts therefore not so easy to broke

Fast accessing speed. (read/write speed)

[2]

(d) The fitness tracker uses a BIOS that can be updated through the app on a smartphone without the need to remove the chip.

Which ROM technology is used for this BIOS?

PROM

[1] 0



(e) The fitness tracker uses SRAM when processing real-time sensor data.

Give one advantage **and** two drawback of using SRAM for this.

Advantage 1 Faster than DRAM
data access speed.

Drawback 1 More expensive

Drawback 2 take up more volume per storage space

[3] 2

(f) The fitness tracker includes a touch screen and a speaker for user interaction and feedback:

(i) The touch screen on the fitness tracker has good visibility, even in sunlight, permits multi-touch, is very durable, but requires bare finger touches to work. Which touch screen technology is this?

capacitive

Capacity touch screen

[1] 0

(ii) Explain how the fitness tracker converts the digitised file that stores the notification sound into an audible tone the user can hear through the built-in speaker.

~~It~~ ~~It contain a~~ ~~speake~~ The speaker contains an oscillator that oscillates and vibrates at Amplitude and frequency as the file stores. It then caused membrane to vibrate therefore created sound user hear.

[2] 0

(iii) Give **two** reasons why the data sent to the speaker does not require compression.

The ~~Its~~ data is rather small that don't need compression.

the data

~~It~~ is sent to the speaker via wires that speed is not important.
so

[2] 1

9 A Robot Waiter is used in a new restaurant. The robot navigates through the restaurant using a variety of devices including cameras, accelerometers, distance sensors, etc. to detect and avoid obstacles.

Explain how the robot uses these sensors as part of a control system to avoid obstacles.

The sensors provides data for the micro processor within the robot, such as distance to an obstacle. The micro processor then decides whether the distance is smaller than a threshold ~~too close or not It~~ If it is too close, the microprocessor can control the actuators robot have to turn around in order to avoid obstacles. The Threshold of how close it should avoid is set ~~prior to the actions~~ by the developers.

3

[4]

10 The following table shows part of the instruction set for a processor. The processor has two registers: the Accumulator (ACC) and an Index Register (IX).

| Instruction | | Explanation |
|---|---|---|
| Opcode | Operand | |
| LDM | #n | Immediate addressing. Load the number n to ACC |
| LDD | <address> | Direct addressing. Load the contents of the location at the given address to ACC |
| LDI | <address> | Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC |
| LDX | <address> | Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC |
| LDR | #n | Immediate addressing. Load the number n to IX |
| ADD | #n/Bn/&n | Add the number n to the ACC |
| ADD | <address> | Add the contents of the given address to the ACC |
| SUB | #n/Bn/&n | Subtract the number n from the ACC |
| SUB | <address> | Subtract the contents of the given address from the ACC |
| INC | <register> | Add 1 to the contents of the register (ACC or IX) |

<address> can be an absolute or a symbolic address
# denotes a denary number, e.g. #123
B denotes a binary number, e.g. B01001010
& denotes a hexadecimal number, e.g. &4A