Jurong Pioneer Junior College

2022 H2 Computing (Syllabus 9569) Paper 1

Extended Curriculum (Post Term 2)

Mock Practice 1 Suggested Solutions

2020 A Level Paper 1 Question 1

1. A software company is writing a program for a vehicle business. Both cars and vans are available for hire.

For all vehicles, the data that will be stored include:

Vehicle Registration Number (VRN)
Model
Total distance travelled (km)
Date hired
Date of return
Cost per day
Available for hire

For cars, the additional data stored include:

Number of seats
Fuel type (petrol, diesel, electric, hybrid)

For vans, the additional data stored include:

Load volume (m^3)
Maximum load (kg)

The odometer in the vehicle displays the total distance the vehicle has travelled since manufacture.

When a vehicle is hired:

- total distance travelled is set to the odometer's value
- date hired is set to the current date
- return date is set to the date the vehicle is expected to be returned
- available for hire is set to `FALSE`.

When a vehicle is returned:

- hire cost is returned as the cost per day multiplied by the number of days the vehicle was hired
- total distance travelled is set to the odometer date
- date returned is set to the current date
- available for hire is set to `TRUE`.

Object-oriented programming will be used to model vehicles.

(a) Draw a class diagram that shows the following for the situation described above.

- the superclass
- any subclasses
- inheritance

- properties
- appropriate methods [12]

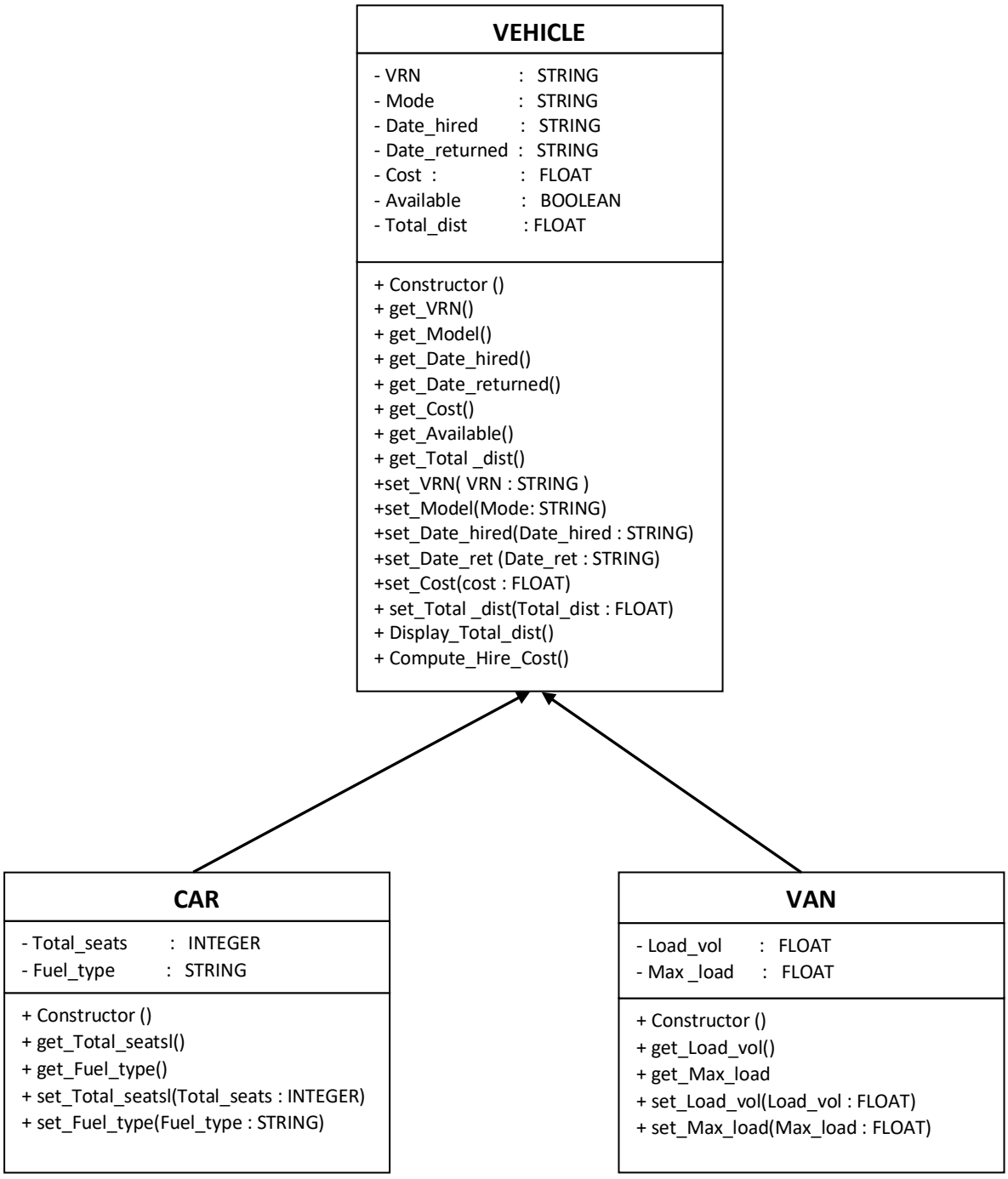
Summary of examiner's comments:

Examiners pointed out the following:

Name of a **class should be in singular** (VEHICLE, CAR and VAN rather than VEHICLES, CARS and VANS).

Inheritance arrows should have arrowheads pointing in the correct direction.

Candidates are **expected to include all the get and set methods** for all the attributes stated in the class.



(b) State the purpose of a superclass. Give an example of a superclass from the vehicle hire example. [2]

The purpose of a superclass is to allow code reusability e by allowing its subclass(es) to **inherit its attributes** and **methods** or to even **extend them further where necessary**. The superclass can first be designed, and subsequently be re-used to derive further classes (ie . subclass).

Attributes and methods of superclass VEHICLE need to be coded only once, and they can be inherited and reused by its subclasses `CAR` and `VAN` as attributes and methods without the need to do any additional coding. This way, time saved can be better utilised (eg . only need to code attributes and methods for `Total_seats` and `Fuel_type`, `Load_vol` and `Max_load` for `CAR` and `VAN` respectively)

Note:
Common for student to miss out the requirement of providing an example that is relevant **to the context** of the scenario given by the question.

Objects provide encapsulation of properties and methods.

(c) State the purposes of encapsulation. [2]

Encapsulation is the bundling/combining of the data properties and data functions/methods of a data member into single unit class.

Encapsulation allows hiding of the internal details and mechanics behind the working of an object to prevent unauthorised access.

At the same time, it also allows information hiding that restricts direct access to the data properties of a data member to prevent direct reading or writing the values of the private attributes of an object. This reduces accidental errors which may result in a state of inconsistent data.

Summary of examiner's comments:
Examiners deemed responses like "encapsulation allowed attributes to be safe from **foreign spies**" to be a common misunderstanding, and classified such responses as weak. Instead, they were looking for responses that are more realistic and probable, for instance "encapsulation allowed attributes to be safe from **careless coders,** who may….."

In addition, the examiners commented that candidates might had used the word "users" in their response to this question in a misleading way as it was not clear if users referred to the programmers, or the end-users of the final application. In this case, it should reference to the programmers working on the application using OOP.

The business wants to change the way the hire cost is calculated for a car. As well as charging per day, an additional charge of $0.05 is to be made per km travelled during this hire.

(d) Suggest a change to the class diagram to enable the new charging scheme to be used for cars. [1]

In the `CAR` class diagram, a public method `Compute_Hire_Cost` must be added to indicate that this method will behave differently from the method of the same name in `VEHICLE` as it uses a different formula to compute the hire cost
i.e. Even though `CAR` is subclass of `VEHICLE` the method `Compute_Hire_Cost` will be extended in subclass `CAR` to behave differently from the one used in `VEHICLE` depsite having the same method name.

Summary of examiner's comments:
The examiners expected candidates to mention the CAR class and deemed responses that stated specific changes to the CAR class as stronger than responses that pointed out that the VEHICLE class needed some changes.

(e) State the purpose of polymorphism. [1]

Purpose of Polymorphism is to promote code reusability and extensibility ie reuse the method name, and at the same time to implement the method of the same name in the subclass to perform tasks that differs from its superclass).

Summary of examiner's comments:
Examiners pointed out that by merely regurgitating key phrases like "code reuse" or "code reusability" without clear references to the context of the question or further elaboration create ambiguities in the responses.

2020 YIJC Prelim Paper 1 Question 5 (modified)

2. YI restaurant serves a variety of local dishes at reasonable prices and plans to provide food delivery services to its customers via a web application. A customer places an online order and an employee will be assigned by the system to deliver the order to the customer. The customer can choose to pay online when ordering or make cash payment upon delivery. Customers can choose more than one dish in the same online order and each order has a unique ID.

At the time of ordering, the application records the following data:

- Customer name, delivery address and email, if the customer has not made a booking before
- Customer ID
- Order date
- Order time
- Payment mode
- Dish and quantity.

The following shows an example of the order receipt which will be sent to the customer's email address.

ORDER RECEIPT

OrderID:	YI150920123
Customer ID:	C1234
Name:	Annabelle Dallas
Email:	annabelledallas@gmail.com
Address:	5 Yishun Ring Rd, Singapore 768675
Date:	15/09/2020
Time:	14:11:30
Payment Mode:	Online

Dish	**Quantity**	**Unit Price**	**Price**
NASI LEMAK SET	2	4.50	9.00
CURRY CHICKEN SET	1	5.00	5.00
CHICKEN RICE SET	1	4.50	4.50
		Subtotal:	18.50
		Delivery:	4.00
		Total:	22.50

The restaurant assigns a unique ID to each employee and maintains its employees' information, such as their name, contact number and bank account number. The restaurant keeps a record of the employees' delivery assignments, the date and time when the order is successfully delivered to the customer.

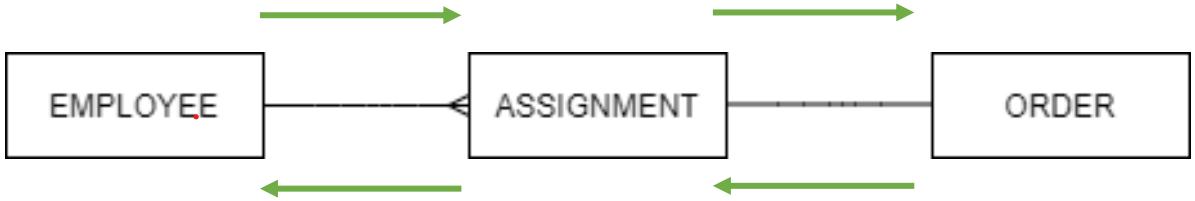
(a) The company wants to model this application using a relational database.

(i) The database needs three tables to store the data for the customers' food order: `CUSTOMER`, `ORDER` and `FOOD`.

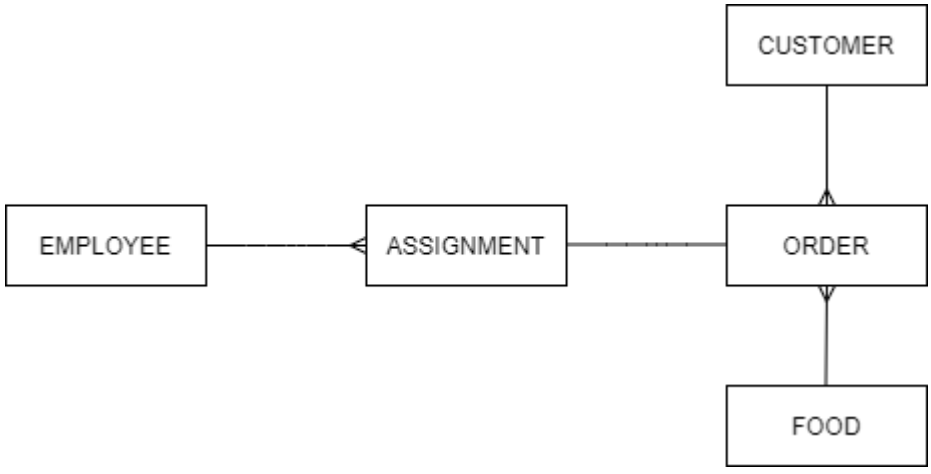
Draw an Entity-Relationship (E-R) diagram showing the **three** tables and the relationships between them. [2]

(ii) The database needs three tables to store the data for the employees' delivery assignment: `EMPLOYEE`, `ORDER` and `ASSIGNMENT`.

Draw an Entity-Relationship (E-R) diagram showing the three tables and the relationships between them. [2]



(iii) Draw the overall Entity-Relationship (E-R) diagram showing the five tables and the relationships between them. [1]



Note:

You should plan out sufficient space to draw your E-R diagram so that the lines do not intersect with one another.

(b) A table description can be expressed as:

```
TableName (Attribute1, Attribute2, Attribute3,...)
```

The primary key is indicated by underlining one or more attributes.

Foreign keys are indicated using a dashed underline.

Write table descriptions for the five tables. [6]

```
CUSTOMER     (CustomerID, Name, Email, Address)
FOOD         (Dish, UnitPrice)
EMPLOYEE     (EmployeeID, Name, ContactNo, BankAccNo)
ORDER        (OrderID, CustomerID*, Dish*, Quantity, OrderDate,
              OrderTime, PaymentMode)
ASSIGNMENT   (EmployeeID*, OrderID*, DeliveredDate,
              DeliveredTime)
```

(c) Describe a method to protect data from loss or corruption. [2]

Regular backing up of data can **safeguard against sudden loss/corruption**: ensure integrity of data is preserved, and that data can be restored at the soonest

Supply uninterrupted or backup power source to ensure that the data server is well powered and maintained by the secondary source of power to prevent sudden power/data losses.

(d) Explain how Singapore's Personal Data Protection Act (PDPA) protects the customers' and employees' personal data stored in the database. [2]

PDPA governs the **collection, use and disclosure of personal data by organisations** in a manner that **recognises both the right of the individuals** to **protect their personal data** and the **needs of organisations** to collect, use or disclose personal data for purposes that a reasonable person would consider appropriate in the circumstances.

Appoint a data protection officer to oversee the administration and compliance to PDPA by the company. Has clear protocols to obtain consent from the customers and to inform them on how the data is to be used before collecting, using or disclosing the customers' personal data.

Note:
If the question is phrased in a way where the personal data of consumers have already been misused, then appointing a data protecting officer cannot be one of the solutions to can protect the consumers as the misuse has already happened. Appointment of a data protection officer can only be effective at prevention.

(e) Describe the impact of such food delivery applications on the society and economy. [4]

Social:

- loss of inclusivity for citizens who have difficulties using online services, e.g. elderly who may not be familiar with using such applications, etc.
- hawkers who may not be technically savvy and not know how to use these applications to offer their services may lose businesses
- reduced opportunities to have face to face interactions with one another, socially alienates people to be confined in the comfort of their homes which may result in decreased community spirits.

Economy:

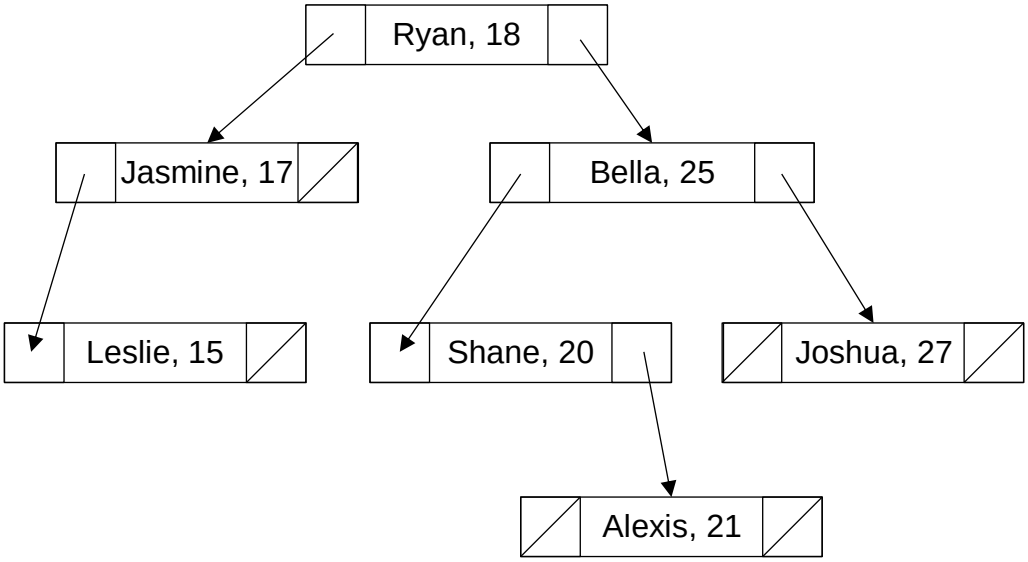
- The outcomes of spur rapid digitisation of services (F&B) can be rather mixed as the implementation of technology in certain industries result in job losses for certain group of workers, while at the same time, such a phenomenon can also create more job opportunities for certain areas like the food delivery businesses.

2020 ACJC Prelim Paper 1 Q6

3. In a computer game, players' names and scores are stored in a binary search tree, in increasing order of score.
The binary search tree has its data inserted in the following order:

Ryan	18
Bella	25
Joshua	27
Shane	20
Jasmine	17
Alexis	21
Leslie	15

(a) Draw the binary search tree. [4]



(b) The binary search tree is implemented using the two dimensional array shown below. Copy and fill in the entries in the array.

Index	Name	Score	Left Pointer	Right Pointer
0	Ryan	18	4	1
1	Bella	25	3	2
2	Joshua	27	None	None
3	Shane	20	None	5
4	Jasmine	17	6	None
5	Alexis	21	None	None
6	Leslie	15	None	None

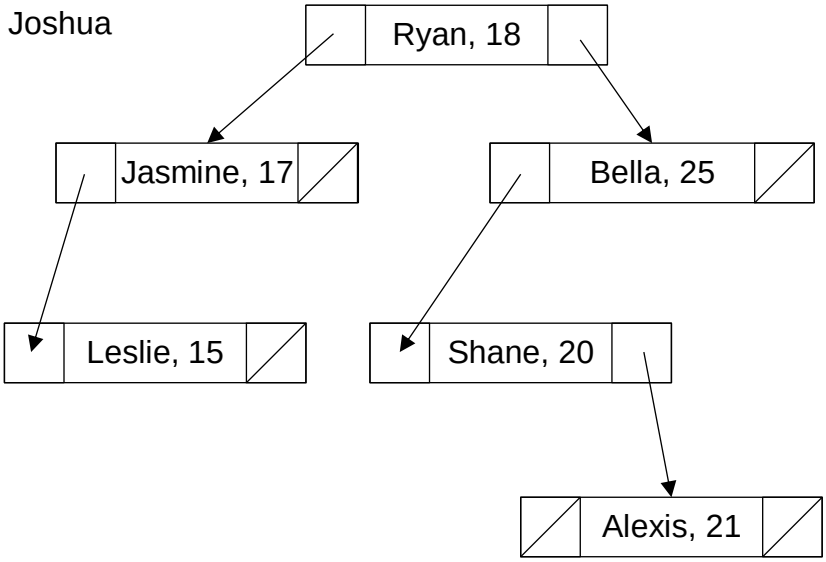
[5]

(c) To delete a node from a binary tree, the following cases are considered:

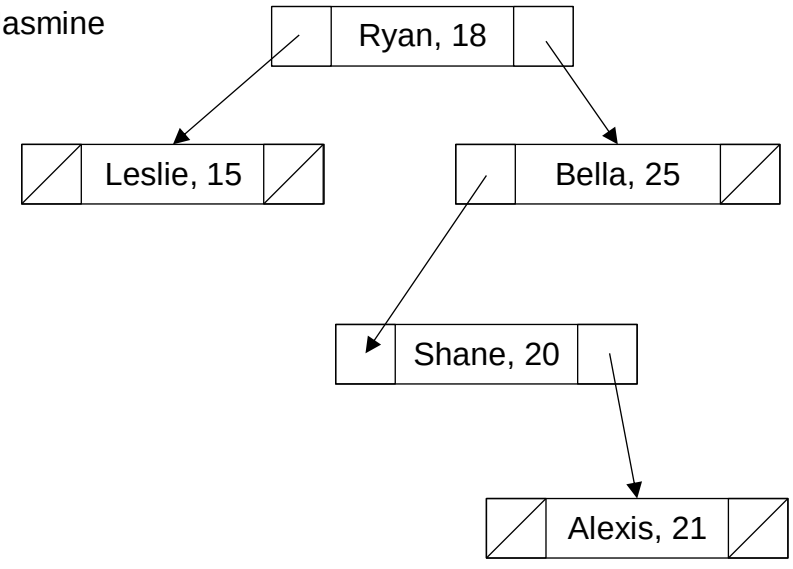
Case	**Action**
Node has no children	• Node is removed from tree
Node has one child	• Node is replaced with its child
Node has two children	• Call the node to be deleted *D*. Do **not** delete *D*. • Look for the node *E* that comes after *D* in an in-order traversal. • Copy the data of *E* into *D*. • Delete *E* using one of the previous two cases.

Draw the tree at each step after the following players are deleted, one after another:

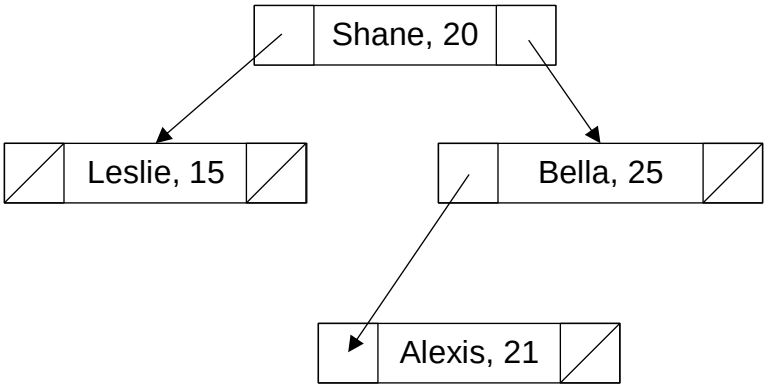
(i) Joshua [1]



(ii) Jasmine [1]



(iii) Ryan [2]



(d) The program has a feature which allows the user to enter an integer. The program then returns a list of players whose score is greater than that integer. Describe how the program can create this list using the binary search tree. [4]

Recursive program.

If the root's score is greater than input value, add the root to the list, then add every node in the right subtree to the list. Run the program recursively on the left subtree.

If the root's score is less than or equal to input value, (ignore left subtree and) run the program recursively on the right subtree.

2020 ACJC Prelim Paper 1 Question 1

4. A food delivery app offers promotions to customers based on their usage pattern.

First time customers would receive a $5 discount on their first purchase. If a customer has spent at least $1000 on the app in the last 3 months, the app would upgrade the customer to Gold status and offer 10% discount on all orders.

Gold status customers who have been inactive for 1 month would be offered an additional 5% discount on top of the existing 10% discount. Customers who have made their first purchase and have been inactive for 1 month would receive a $5 discount instead.

(a) Create a decision table to show these conditions and actions. [4]
(b) Simplify your decision table by removing redundancies from the decision table. [1]

		Rules							
Conditions	First timer	Y	Y	Y	Y	N	N	N	N
	Spent at least $1000 in past 3 months	Y	Y	N	N	Y	Y	N	N
	Inactive for 1 month	Y	N	Y	N	Y	N	Y	N
Actions	$5 discount	X	X	X	X			X	
	10% discount	X	X			X	X		
	Additional 5% discount	X				X			
	No discount								X

		Rules				
Conditions	First timer	Y	N	N	N	N
	Spent $1000	N	Y	Y	N	N
	Inactive	N	Y	N	Y	N
Actions	$5 discount	X			X	
	10% discount		X	X		
	Extra 5%		X			
	No discount					X