There are two ways of constructing a software design. One way is to make it so simple that there are obviously no deficiencies. And the other way is to make it so complicated that there are no obvious deficiencies.

—C.A.R. Hoare

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Question 1:
Develop an Entity Relationship Model to capture the data needed for the system.

Answer:

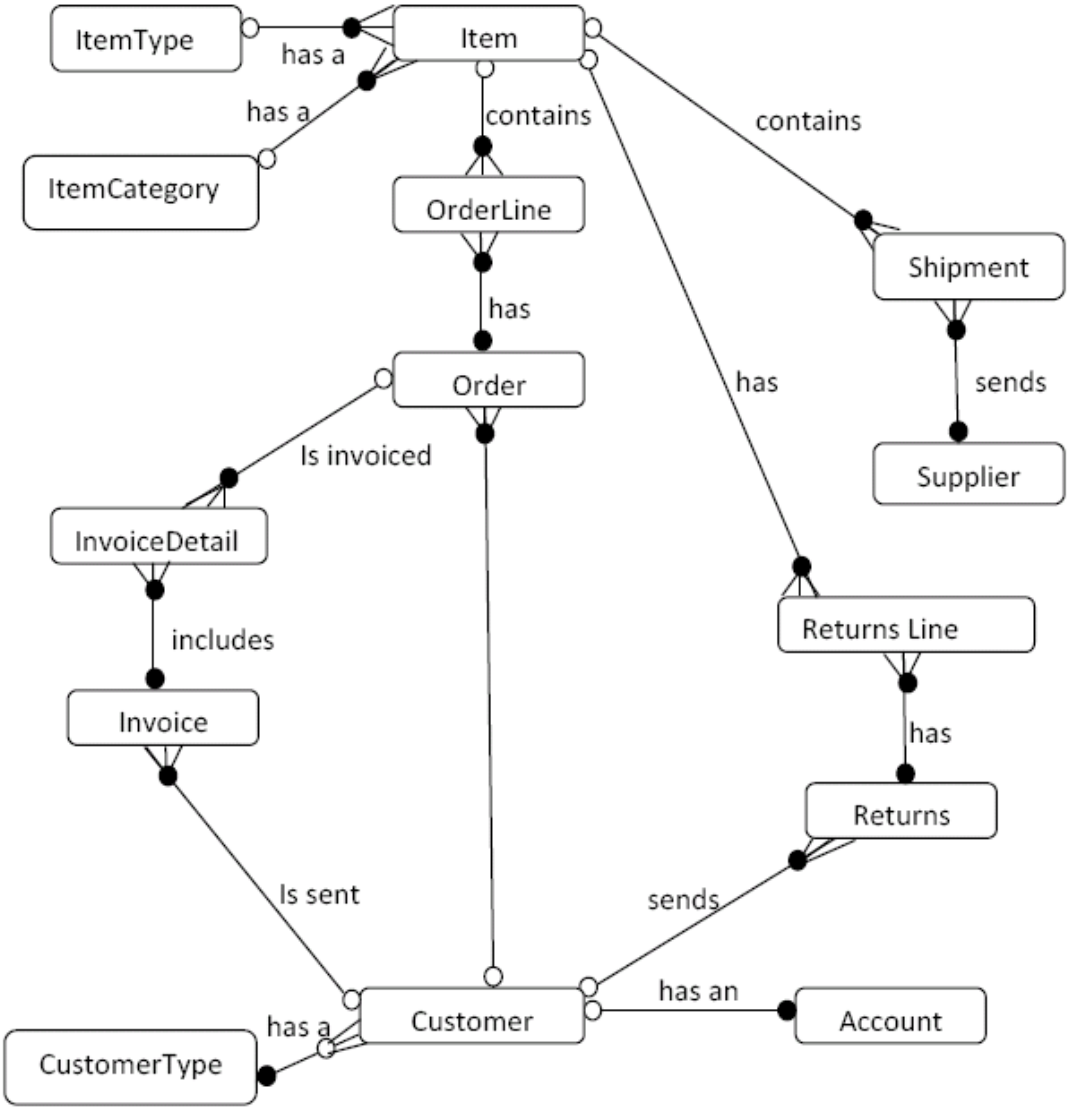

Figure 1: ER Diagram for the Shop

Entity Description

Identifier: *E1*

Name: *Customer*

Description: *A person who orders a product for the university shop.*

Attributes: *Customer Identifier (string)* ***Primary Key***

Customer First Name (string) ***Mandatory***

Customer Last Name (string) ***Mandatory***

Customer Address (string) ***Mandatory***

Customer Postcode (string) ***Mandatory***

Customer Telephone Number (number) ***Mandatory***

Constraints: *Customer removed after graduation from the university.*

Assumptions: *None*

Comments: *The date the customer joined will be required. And in this case, the customers are probably students.*

Attribute Description

Identifier: *A1*

Name: *Customer Identifier*

Description: *The unique identifier of a customer.*

Data Type: *String*

Data Values: Customer Number [8 digits [0 to 9]]

Constraints:

Comments *: The customer number is the student's ID Number given by the university.*

Owner: *Sales*

Attribute Description

Identifier: *A2*

Name: *Customer First Name*

Description: *The first name of the customer.*

Data Type: *String*

Data Values: *16 characters*

Constraints: -

Comments*:*

Owner: *Sales*

Attribute Description

Identifier: *A3*

Name: *Customer Last Name*

Description: *The Last name of the customer.*

Data Type: *String*

Data Values: *16 characters*

Constraints: -

Comments*:*

Owner: *Sales*

Attribute Description

Identifier: *A4*

Name: *Customer Address*

Description: *The street address of the customer.*

Data Type: *String*

Data Values: *100 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A5*

Name: *Customer PostCode*

Description: *The post code of customer's address.*

Data Type: *String*

Data Values: *8 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A6*

Name: *Customer Telephone Number*

Description: *The telephone number of the customer.*

Data Type: *Number*

Data Values: *10 digits maximum*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E2*

Name: *Account*

Description: *An account for managing order.*

Attributes: *Customer username (string)* ***Primary Key***

Customer password (string) ***Mandatory***

Customer password reminder question (string) ***Mandatory***

Customer password reminder answer (string) ***Mandatory***

Customer Identifier (string) ***Mandatory*** **(Foreign key from Customer)**

Constraints: *Customer can have only one account.*

Assumptions: None

Comments: -

The primary key of 'Customer' entity is added to the 'Account' entity as a foreign key because in 1-1 relationships, its better to add foreign keys to the entity that has total participation as explained by [Trinty, 2001].

Attribute Description

Identifier: *A7*

Name: *Customer username*

Description: *The unique username for a customer.*

Data Type: *string*

Data Values: *6- 25 characters*

Constraints: - *minimum 6 characters and maximum 25 characters*

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A8*

Name: *Customer password*

Description: *The password for customer's username.*

Data Type: *string*

Data Values: *6- 25 characters*

Constraints: - *minimum 6 characters and maximum 25 characters. It shouldn't have customer first name, last name or other easily guessable information.*

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A9*

Name: *Customer password reminder question*

Description: *The password reminder question for customer's username.*

Data Type: *string*

Data Values: *6- 30 characters*

Constraints: - *minimum 6 characters and maximum 30 characters. It shouldn't be relevant to customer's information.*

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A10*

Name: *Customer password reminder answer*

Description: *The password reminder answer for customer's reminder question.*

Data Type: *string*

Data Values: *6- 30 characters*

Constraints: - *minimum 6 characters and maximum 30 characters. It shouldn't be relevant to customer's information.*

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E3*

Name: *Item*

Description: *A product that is available for purchase at the store.*

Attributes: *Item Number (number)* ***Primary Key***

Item code (string) ***Mandatory***

Item price (currency) ***Mandatory***

Item name (string): ***Mandatory***

Item description (string): ***Mandatory***

Item weight (number) : ***Mandatory***

Item quantity (number): ***Mandatory***

Item minimum stock holding level (number): ***Mandatory***

Item re-order quantity (number): ***optional***

Item discontinued (character): (y / n) ***optional***

Item expected delivery date (date): ***optional***

ItemType Identifier (number): ***Mandatory (Foreign Key)***

ItemCategory Identifier (number): ***Mandatory (Foreign Key)***

Constraints: *All the items are checked for a certain stock level, if falling from it, then the purchase order for them is send to the customer according to the business rules for each item. For instance at start of every term the university shop stocks 50% of the textbooks for each course on basis of enrollment.*

Assumptions: *None*

Attribute Description

Identifier: *A11*

Name: *Item Number*

Description: *The unique identifier for an item.*

Data Type: *number*

Data Values: *-*

Constraints: **-**

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A12*

Name: *Item Code*

Description: *The unique code for an item.*

Data Type: *string*

Data Values: *6- 30 characters*

Constraints: **-**

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A13*

Name: *Item Price*

Description: *The price for an item.*

Data Type: *currency*

Data Values: *given in £ (pounds)*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A14*

Name: *Item Name*

Description: *A short title or name given to an item.*

Data Type: *string*

Data Values: *10-50 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A15*

Name: *Item Description*

Description: *The description/details for an item.*

Data Type: *string*

Data Values: *20-100 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A16*

Name: *Item Weight*

Description: *The weight for an item.*

Data Type: *number*

Data Values: *given in pounds or kg*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A17*

Name: *Item Quantity*

Description: *The quantity of the item in stock.*

Data Type: *number*

Data Values: *depends on the business rule, how much of an item stock level they decide to hold.*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A18*

Name: *Item Minimum stock holding level*

Description: *This is an indicator of the limit after which the shop needs to send purchase order to the supplier for re-stocking.*

Data Type: *number*

Data Values: *depends on the business rule.*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A19*

Name: *Item re-order quantity*

Description: *This tracks down the quantity of the items ordered for the last time.*

Data Type: *number*

Data Values: *depends on the business rule.*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A20*

Name: *Item discontinued*

Description: *This tracks down if an item has been discontinued by the shop or not.*

Data Type: *character*

Data Values: *y or n*

Constraints: -

Comments *: - y for yes and n for no*

Owner: *Sales*

Attribute Description

Identifier: *A21*

Name: *Item Expected delivery date*

Description: *This tracks down the expected delivery for an item by the supplier.*

Data Type: *date*

Data Values: *yyyymmdd*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E4*

Name: *ItemCategory*

Description: *A category is what describes the class of an item.*

Attributes: *Item Category Identifier (Number)* ***Primary Key***

Item Category Name: (string) ***Mandatory***

Constraints: *-*

Assumptions: *None*

Comments: *An item can be of category textbook, souvenir/gifts or stationary.*

Attribute Description

Identifier: *A22*

Name: *ItemCategory Identifier*

Description: *A unique identifier for the category of an item. .*

Data Type: *Number*

Data Values: *in digits*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A23*

Name: *ItemCategory Name*

Description: *A short title or name given to an item's category.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E5*

Name: *ItemType*

Description: *A type that groups item in a certain way.*

Attributes: *Item Type Identifier (Number)* ***Primary Key***

ItemType Name (string) ***Mandatory***

Constraints: -

Assumptions: *None*

Comments: *The type can be, namely; seasonal items, common items, special items.*

Attribute Description

Identifier: *A24*

Name: *ItemType Identifier*

Description: *A unique identifier for the type of an item. .*

Data Type: *Number*

Data Values: *in digits*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A25*

Name: *ItemType Name*

Description: *A short title or name given to an item's type.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E6*

Name: *Order*

Description: *An order tracks the request for purchase by customer for an item.*

Attributes: *Order Number (number)* ***Primary Key***

Customer Identifier (string) ***Mandatory (Foreign Key)***

Delivery Address (string) ***Mandatory***

Postcode (string) ***Mandatory***

Special instructions (string): ***optional***

Date raised (date): ***Mandatory***

Raised by (string): ***Mandatory***

Packer (string): ***Mandatory***

Date dispatched (date): ***Mandatory***

Constraints: *The orders for textbooks can be made 2 weeks before the start of term and can be made until the last week of the term.*

Assumptions: *None*

Comments: - *Raised by is the name of the sales person who raises this order*

Attribute Description

Identifier: *A26*

Name: *Order Number*

Description: *A unique identifier of an occurrence of an order.*

Data Type: *Number*

Data Values: *in digits*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A27*

Name: *Delivery Address*

Description: *The street address to which the ordered item is to be delivered.*

Data Type: *string*

Data Values: *30-100 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A28*

Name: *Post Code*

Description: *The post of the street address to which the ordered item is to be delivered.*

Data Type: *sting*

Data Values: *8 characters*

Constraints: -

Comments *: - 6-8 characters.*

Owner: *Sales*

Attribute Description

Identifier: *A29*

Name: *Special instructions*

Description: *Any special instructions given by the customer or sales person for the order delivery.*

Data Type: *string*

Data Values: *30-100 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A30*

Name: *Date raised*

Description: *The date the order is raised by the sales person after the order from the customer. .*

Data Type: *date*

Data Values: *yyyymmdd*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A31*

Name: *Raised by*

Description: *The name of the sales person who raised the order.*

Data Type: *string*

Data Values: *30-50 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A32*

Name: *Packer*

Description: *The name of the person who packed the order.*

Data Type: *string*

Data Values: *30-50 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A33*

Name: *Date dispatched*

Description: *The date the order is dispatched to the customer. .*

Data Type: *date*

Data Values: *yyyymmdd*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E7*

Name: *OrderLine*

Description: *The details of the line item are described by the orderline.*

Attributes: *Order Number (number) & OrderLine Number (number)* ***Primary Key***

Quantity ordered (number) ***Mandatory***

Item Number (number) ***Mandatory (Foreign Key)***

Item description (string) ***Mandatory***

Item price (currency) ***Mandatory***

Item code (string) ***Mandatory***

Item weight (number) ***Mandatory***

Constraints: -

Assumptions: *None*

Attribute Description

Identifier: *A34*

Name: *OrderLine Number*

Description: *An identifier of an occurrence of an orderline and its association to the Order Number makes it unique.*

Data Type: *Number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A35*

Name: *Quantity ordered*

Description: *The quantity ordered of a particular item.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E8*

Name: *Returns*

Description: *A return describes the items returned by the customer to the university shop.*

Attributes: *Returns Number (string)* ***Primary Key***

Customer Identifier (string) ***Mandatory (Foreign Key)***

Date returns are received (date) ***Mandatory***

Returned by (string) ***Mandatory***

Checked in by (string) ***Mandatory***

Comments (string) ***Mandatory***

Constraints:-

Assumptions: *None*

Comments: *-*

Attribute Description

Identifier: *A36*

Name: *Returns Number*

Description: *The unique identifier of the occurrence of a return.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A37*

Name: *Date returns are received*

Description: *The date the item is returned by the customer.*

Data Type: *date*

Data Values: *yyyymmdd*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A38*

Name: *Returned by*

Description: *The name of the person who returns the item.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A39*

Name: *Checked-in by*

Description: *The name of the person who checks-in the returned item.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A40*

Name: *Comments*

Description: *The comments show the reason (if given) why the item was returned or any other note.*

Data Type: *string*

Data Values: *10-100 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E9*

Name: *ReturnsLine*

Description: *A returnsline shows the details of the items returned.*

Attributes: ReturnLine Number *(number) & Returns Number (number)* ***Primary Key***

Customer Identifier (string) ***Mandatory***

Item number (number) ***Mandatory (Foreign Key)***

Quantity (string) ***Mandatory***

Constraints: -

Assumptions: *None*

Comments: - *Returns Number is a foreign key from the 'returns' entity*

Attribute Description

Identifier: *A41*

Name: *ReturnsLine Number*

Description: *The identifier of the occurrence of a returns line and its association with the Returns Number makes it unique.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A42*

Name: *Quantity*

Description: *The quantity of a particular item returned.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E10*

Name: *Supplier*

Description: *A supplier is the provider for the items for the shop.*

Attributes: *Supplier Code (string)* ***Primary Key***

Supplier Name (string) ***Mandatory***

Supplier Address (string) ***Mandatory***

Postcode (string) ***Mandatory***

Telephone Number (string) ***Mandatory***

Fax (string) ***Mandatory***

Sales contact Name (string) ***Mandatory***

Credit Limit (number) ***Mandatory***

Discount (number) ***Mandatory***

Account Number (string) ***Mandatory***

Constraints: -

Assumptions: *None*

Comments: *The account number here is the one which the shop has with the supplier as being their customer.*

Attribute Description

Identifier: *A43*

Name: *Supplier Code*

Description: *The unique identifier of the supplier of an item.*

Data Type: *string*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A44*

Name: *Supplier Name*

Description: *The name of the supplier company.*

Data Type: *string*

Data Values: *10 – 100 characters*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A45*

Name: *Supplier Address*

Description: *The street address of the supplier company.*

Data Type: *string*

Data Values: *10 – 100 characters*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A46*

Name: *Post code*

Description: *The post code of the street address of the supplier company.*

Data Type: *string*

Data Values: *8 characters*

Constraints: -

Comments *: - It should be 6-8 characters*

Owner: *Purchase*

Attribute Description

Identifier: *A47*

Name: *Telephone Number*

Description: *The telephone number of the supplier company.*

Data Type: *number*

Data Values: *10 digits*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A48*

Name: *Fax*

Description: *The fax number of the supplier company.*

Data Type: *number*

Data Values: *10 digits*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A49*

Name: *Sales Contact Name*

Description: *The name of the sales person from the supplier company.*

Data Type: *string*

Data Values: *10 – 25 characters*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A50*

Name: *Credit Limit*

Description: *The supplier company may give the university shop a credit limit.*

Data Type: *currency*

Data Values: *given in £ (pounds)*

Constraints: -

Comments *:-*

Owner: *Purchase*

Attribute Description

Identifier: *A51*

Name: *Discount*

Description: *The supplier company may give the university shop a certain amount of discount.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *:-*

Owner: *Purchase*

Attribute Description

Identifier: *A52*

Name: *Account*

Description: *The unique identifier of the university shop with the supplier company.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Purchase*

Entity Description

Identifier: *E11*

Name: *Shipment*

Description: *A shipment is send by the supplier on order by the shop to re-stock the finished products or new products.*

Attributes: *Shipment Identifier (string) & Supplier Code (string)* ***Primary Key***

Price (currency) ***Mandatory***

Quantity (number) ***Mandatory***

Purchase order code (string) ***Mandatory***

Delivery date (date) ***Mandatory***

Item number (number) ***Mandatory (Foreign Key)***

Constraints: -*.*

Assumptions: *None*

Comments: -*Supplier Code is a foreign key from 'Supplier' entity.*

Attribute Description

Identifier: *A53*

Name: *Shipment Identifier*

Description: *The identifier of the shipment sent by the supplier company and its association with the Supplier ID makes it unique.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A54*

Name: *Price*

Description: *The price of the shipment sent.*

Data Type: *currency*

Data Values: *given in £ (pounds)*

Constraints: -

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A55*

Name: *Quantity*

Description: *The quantity of the items sent in a shipment.*

Data Type: *number*

Data Values: *-*

Constraints: **-**

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A56*

Name: *Purchase Order Code*

Description: *The unique identifier of the order placed by the university shop to the supplier company*

Data Type: *string*

Data Values: **-**

Constraints: **-**

Comments *: -*

Owner: *Purchase*

Attribute Description

Identifier: *A57*

Name: *Delivery date*

Description: *The delivery date of the shipment.*

Data Type: *date*

Data Values: *yyyymmdd*

Constraints: -

Comments *: -*

Owner: *Purchase*

Entity Description

Identifier: *E12*

Name: *Invoice*

Description: *A receipt containing list of purchased items by the customers.*

Attributes: Invoice Number *(number)* ***Primary Key***

Customer Identifier (string) ***Mandatory (Foreign Key)***

Amount (currency) ***Mandatory***

Constraints: -

Assumptions: *None*

Comments: -

Attribute Description

Identifier: *A58*

Name: *Invoice Number*

Description: *The unique identifier of the invoice sent to the customer.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A59*

Name: *Amount*

Description: *The total amount of the items purchased by the customer.*

Data Type: *currency*

Data Values: *given in £ (pounds)*

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E13*

Name: *InvoiceDetail*

Description: *An invoice detail shows the details on the purchased items.*

Attributes: *InvoiceDetail Number (number) & Invoice Number (number)* ***Primary Key***

Order Number (number) ***Mandatory***

Constraints: -

Assumptions: *None*

Comments: - *InvoiceNumber is the foreign key from the 'Invoice' entity.*

Attribute Description

Identifier: *A60*

Name: *InvoiceDetail Number*

Description: *The identifier of the invoice detail and its association with the Invoice Number makes its unique.*

Data Type: *number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Entity Description

Identifier: *E14*

Name: *CustomerType*

Description: *A type that describes who is the customer.*

Attributes: *CustomerType Identifier (Number)* ***Primary Key***

CustomerType Name: (string) ***Mandatory***

Constraints: -

Assumptions: *None*

Comments: *A customer can be a student or a staff member.*

Attribute Description

Identifier: *A61*

Name: *CustomerType Identifier*

Description: *A unique identifier for the type of customer.*

Data Type: *Number*

Data Values: -

Constraints: -

Comments *: -*

Owner: *Sales*

Attribute Description

Identifier: *A62*

Name: *CustomerType Name*

Description: *A name for the type of customer.*

Data Type: *string*

Data Values: *10-25 characters*

Constraints: -

Comments *: -*

Owner: *Sales*

Relationship Description

Identifier: *R1*

Name: *Orders*

Entities Linked: *Customer and Order*

Description: *The linking of customers and their orders. This relationship is used in both directions.*

Definition: A *Customer* ***may*** *place* ***0*** *,* ***1*** *or* ***many*** *Order.*

An *Order* ***must*** *be placed by* ***1*** *Customer.*

Assumptions: *Joint orders are not made.*

Comments: *None.*

Relationship Description

Identifier: *R2*

Name: *OrderLine*

Entities Linked: *Item and Order*

Description: *The linking of items and their order lines. This relationship is used in both directions.*

Definition: An *item is placed in 0, 1 or many order lines.*

An *Order line* ***must*** *have only* ***1*** *item.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R3*

Name: *Category*

Entities Linked: *Item and ItemCategory*

Description: *The linking of items and their categories. This relationship is used in both directions.*

Definition: An *item is placed in only 1 category.*

A *category can have 0, 1 or many items.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R4*

Name: *Item Type*

Entities Linked: *Item and ItemType*

Description: *The linking of items and their types. This relationship is used in both directions.*

Definition: An *item is placed in only 1 type.*

A *type can have 0, 1 or many items.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R5*

Name: *Purchase*

Entities Linked: *Item and Supplier*

Description: *The linking of items and their suppliers. This relationship is used in both directions.*

Definition: An *item is supplied by 1 or more suppliers.*

A *supplier may ship 0, 1 or more items.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R6*

Name: *Returns*

Entities Linked: *Customer and Returns*

Description: *The linking of Customer and returns. This relationship is used in both directions.*

Definition: A *customer may send 0, 1 or more returns.*

A *return is send by only 1 customer.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R7*

Name: *Returns Line*

Entities Linked: *Item and Returns*

Description: *The linking of item and returns. This relationship is used in both directions.*

Definition: A *return line has only 1 item.*

An *item can be in 0, 1 or more return lines.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R8*

Name: *Invoice*

Entities Linked: *Customer and Invoice*

Description: *The linking of customer and invoice. This relationship is used in both directions.*

Definition: A *customer may receive 0, 1 ore more invoices.*

An *invoice is only for 1 customer.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R9*

Name: *Invoice Details*

Entities Linked: *Invoice and Order*

Description: *The linking of invoice and invoice details. This relationship is used in both directions.*

Definition: An *order may have 1 or more invoices.*

An *invoice can be contained by only one order.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R10*

Name: *Account*

Entities Linked: *Customer and Account*

Description: *The linking of customer and account. This relationship is used in both directions.*

Definition: A *customer may have only 1account.*

An *account can only be for 1 customer.*

Assumptions: *None*

Comments: *None.*

Relationship Description

Identifier: *R11*

Name: *Customer Type*

Entities Linked: *Customer and CustomertemType*

Description: *The linking of customer and their types. This relationship is used in both directions.*

Definition: A *customer has only 1 type.*

A *type can have 0, 1 or many customers.*

Assumptions: *None*

Comments: *None.*

I assume that the university shop has access to the university's internal database in order to access information for textbooks, courses, professors and programs. This way it can get the ISBN # of the textbooks and use it as Item code in their database. Also to arrange

books by professor name, course and program; they can use the Item code to trace down the details from university's database. As having this all information duplicated from internal database to their shop's database doesn't sound reasonable. In short, the stock manager can have a limited access to university's internal database for just reading the information regarding textbooks, courses, professors and programs. Also, this will help them to know the program year, course start and end dates in order to maintain their stock level to fulfill student's needs and to do so they can trace down the enrollment information for each course from university's internal database.

Plus, the scenario given shows only students as a customer so no sub-typing used to define various types of customer. I have assumed that only students are the customers. But if other people from staff can buy from the university shop then for that I have introduced a customer type.

Question 2:

Part a:

Draw a 0 level DFD of the shop system.

Answer

In the following document flow diagram the receivers, senders, system boundary and forms/documents have been identified.

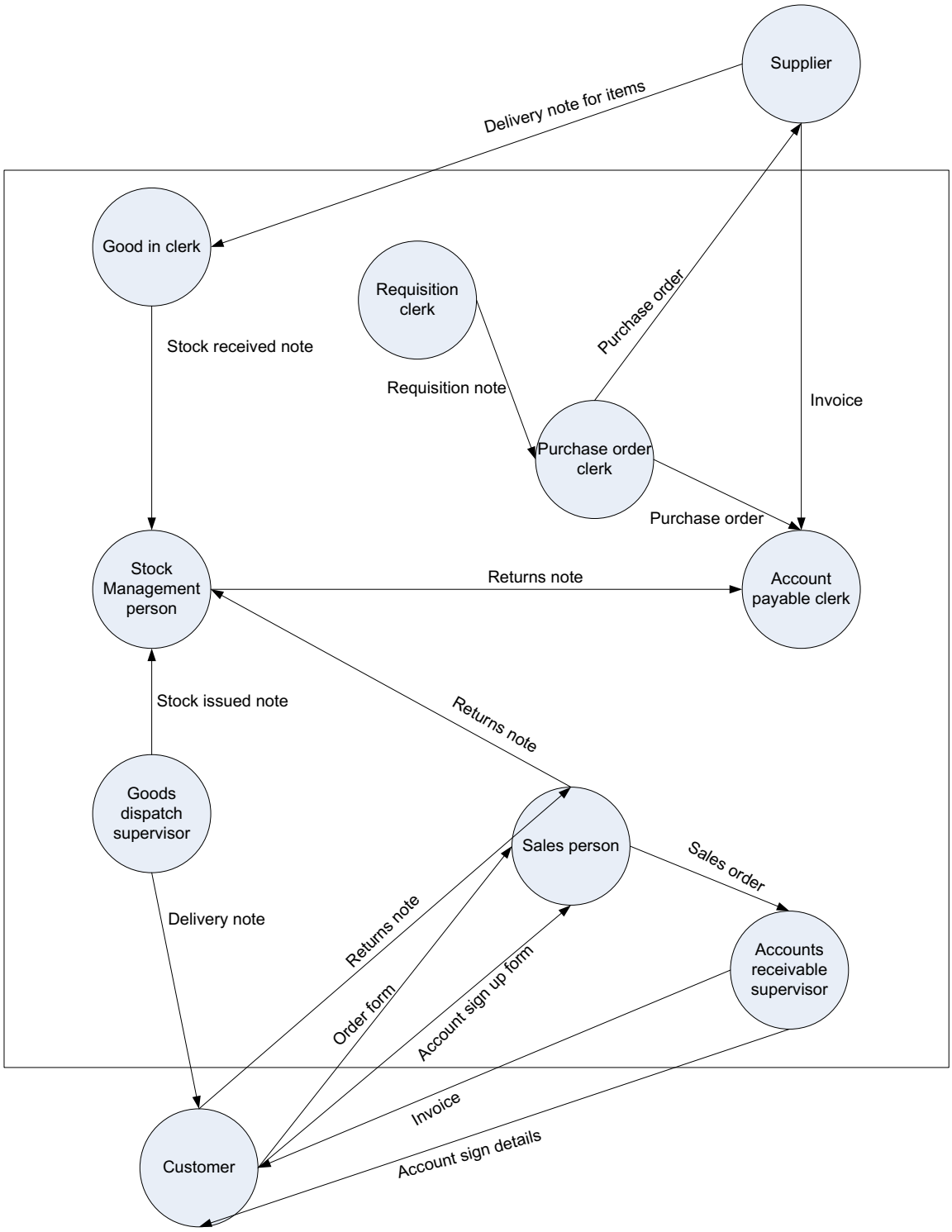

Figure 2: Document Flow Diagram

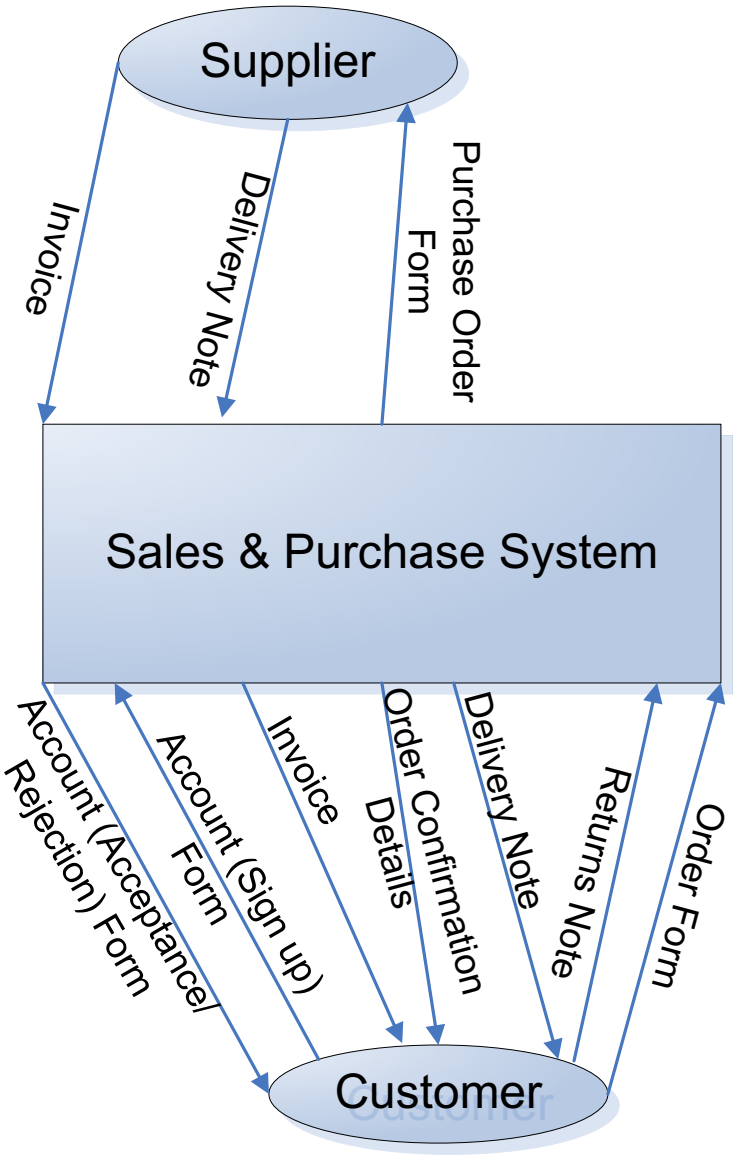

Figure 3: Level 0 DFD

Part b:

Draw level 1 DFD

Answer

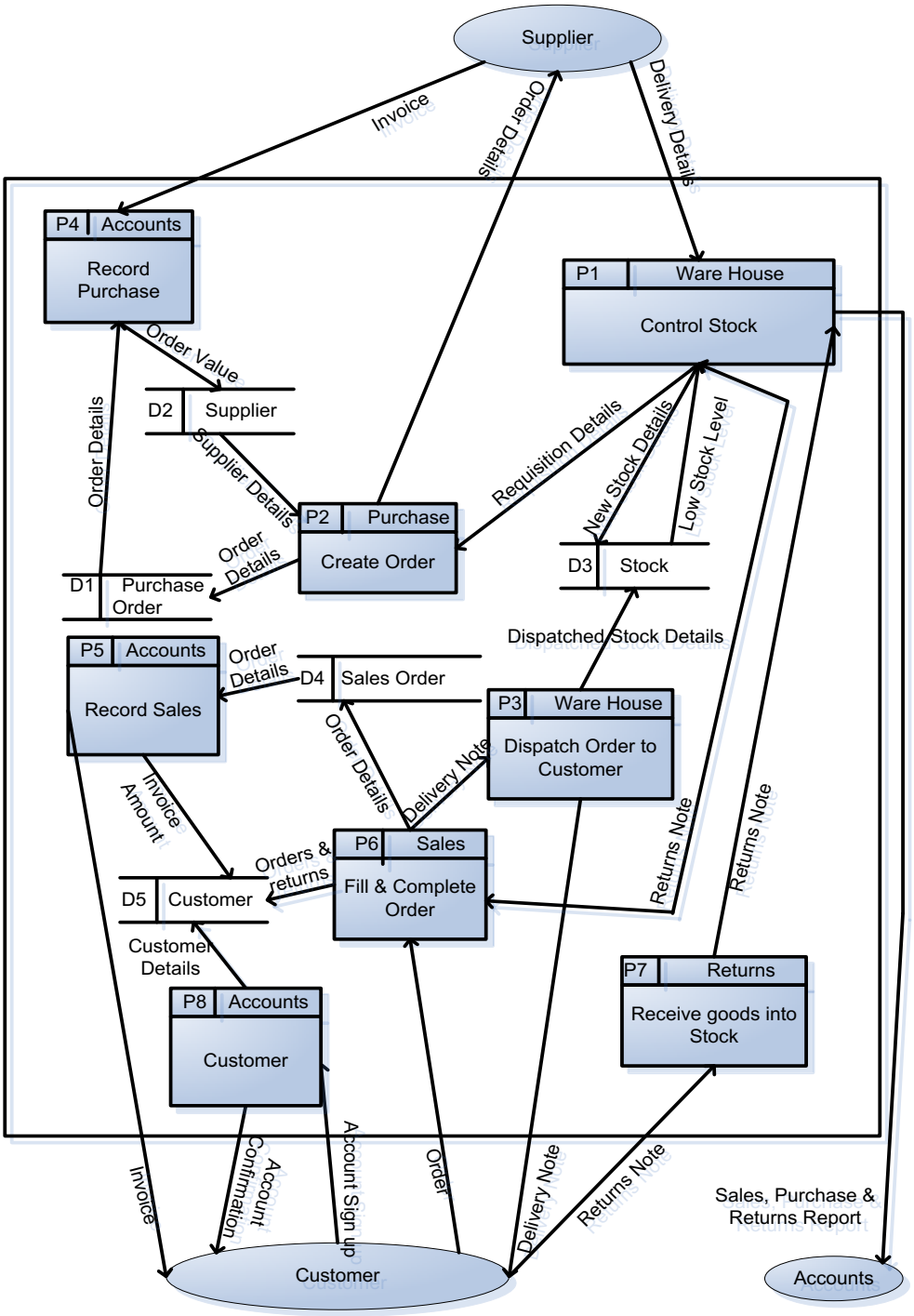

Figure 4: Level 1 DFD

Part c:

Select a process from (b) and draw a level 2 DFD

Answer

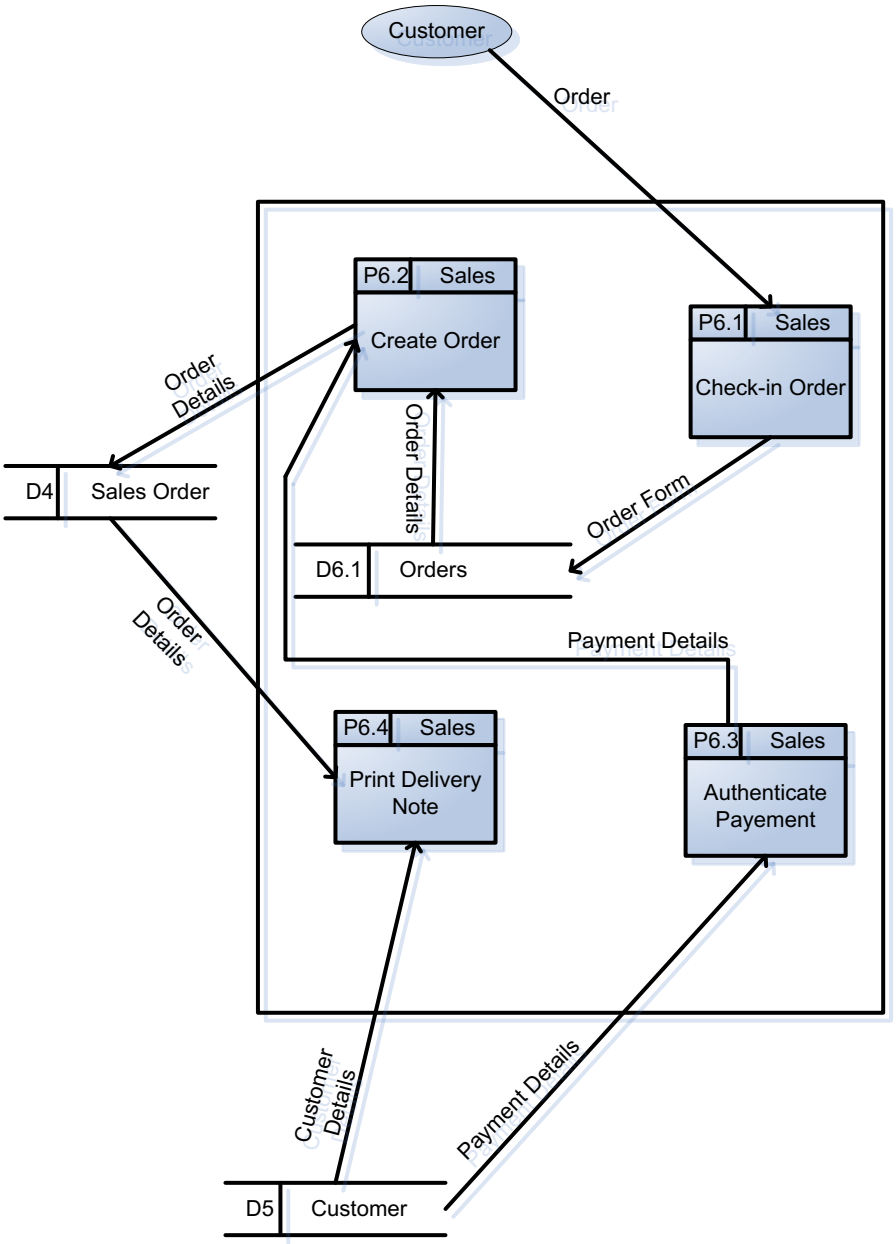

Figure 5: Level 2 DFD: Fill & Complete Order

Question 3:

Part a:

Select one of the processes from the level 1 DFD of question 2.b and draw a Jackson Process diagrams for this purpose.

Answer

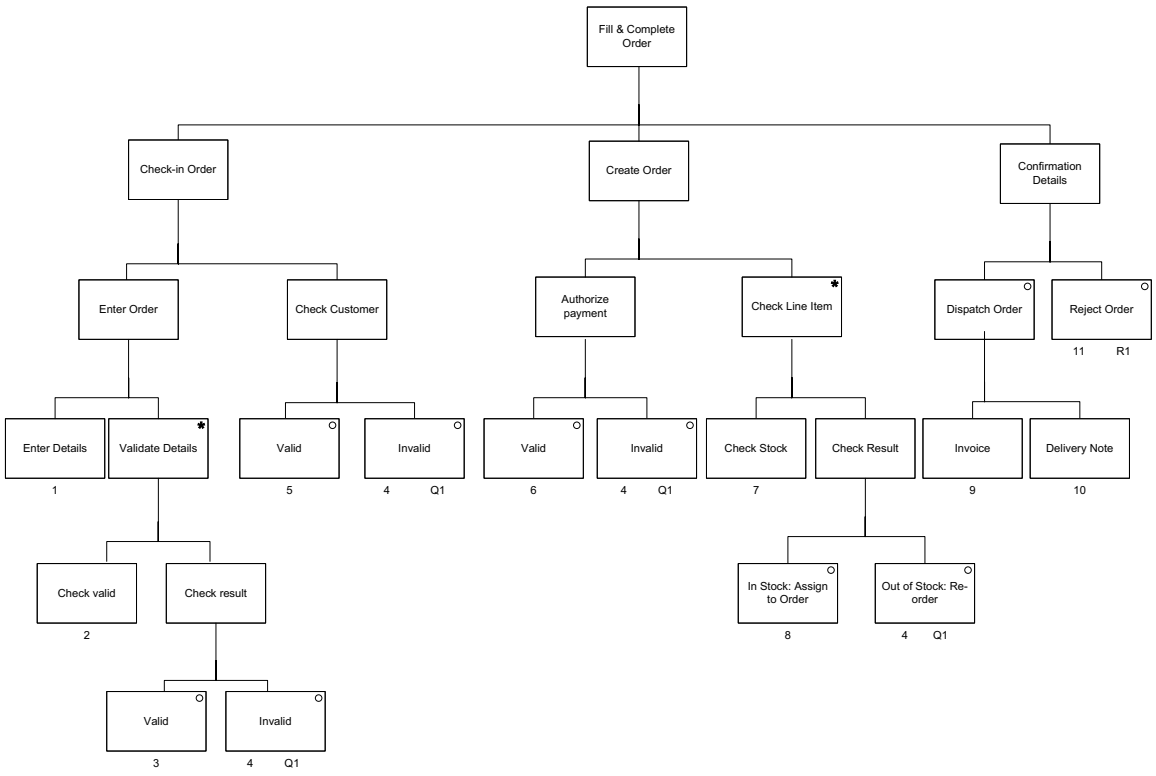

Figure 6: Jackson Structure Diagram for Fill & Complete Order process

The above Jackson Structure Diagram is for the Fill & Complete Order process, which is process # 6 is Level 1 DFD.

Following table shows the Fill and Complete Order operations.

Operation #	Operation details
1	Save the order to a temporary file
2	Check all the mandatory and optional fields in order form
3	Set valid flag for order details

4	Set invalid flag
5	Set valid flag for customer
4	Set invalid flag
6	Set valid flag for payment
4	Set Invalid flag
7	Check stock for quantity of the ordered items
8	Set valid flag for assign to order
4	Set invalid flag
9	Call invoice function
10	Call print delivery note function
11	Delete temporary file

Part b:

Pick an entity from the system and draw an Entity Life Histories model for the process

Answer

The entity Order has been chosen from the system for Entity Life Histories Model.

Following are the possible states for an occurrence of order:

- - order has not yet placed
- 1 order placed
- 2 order is valid
- 3 order is cancelled
- 4 order is delivered
- - order is deleted from the system

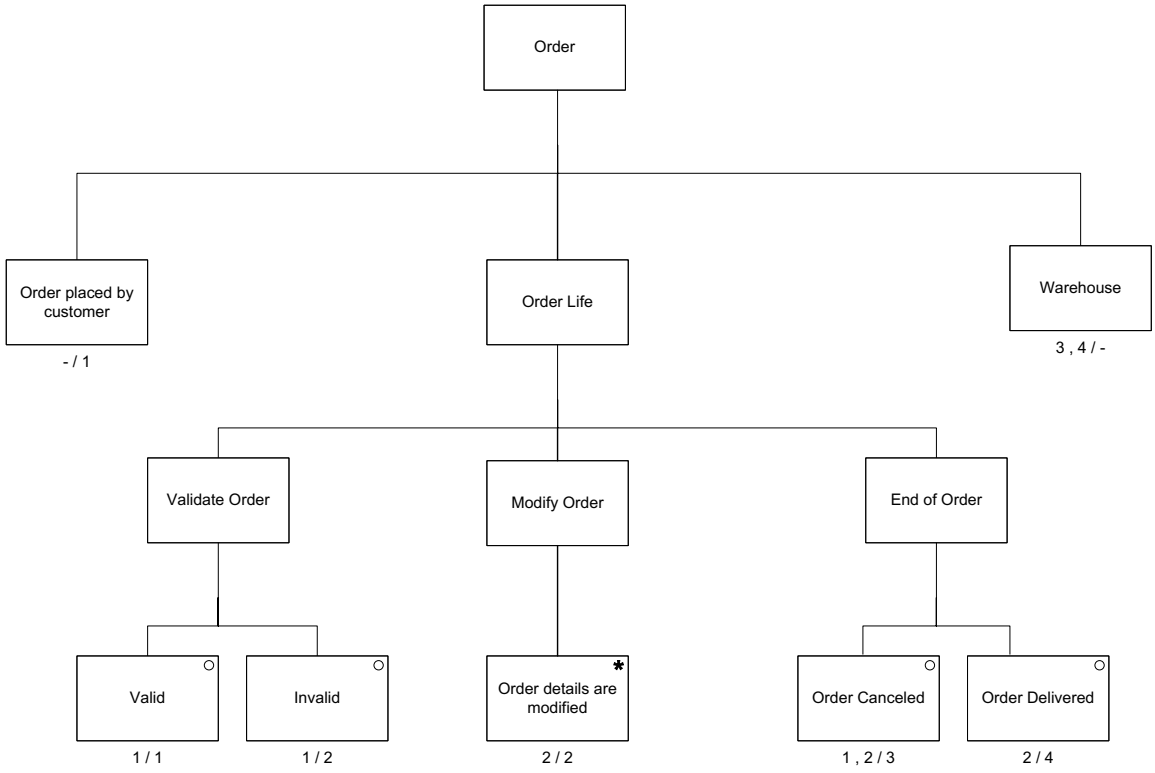

Figure 7: Entity Life Histories Model for Order

Following is the detail about the states and status indicators shown in the figure above for order.

- -/1 order is placed
- 1/1 order placed but invalid
- 1/2 order is valid
- 2/2 order modified but there is no change of state
- 1,2/3 valid or invalid, the order is cancelled
- 2/4 valid order is delivered
- 3,4/- cancelled or delivered order is deleted

Question 4:

Part a:

Draw a simple activity diagram for the task of purchasing textbooks

Answer:

There are two separate activity diagrams in my view for the task of purchasing textbook by a customer. The reason is, according to university shop requirements the customer can purchase a textbook via web, phone or at store. So, for the task of purchasing textbook via web, the customer needs to login to his account and then proceed with the process. He then selects a book and enters the order form details. After the payment is authenticated the customer is shown confirmation details like invoice and delivery note. In case of any delay in delivery due to low stock level, the customer is notified about it. In case of order via phone or store, the university sales person might use student ID card or some other detail to identify the customer as genuine. This depends on the business rules of the university shop.

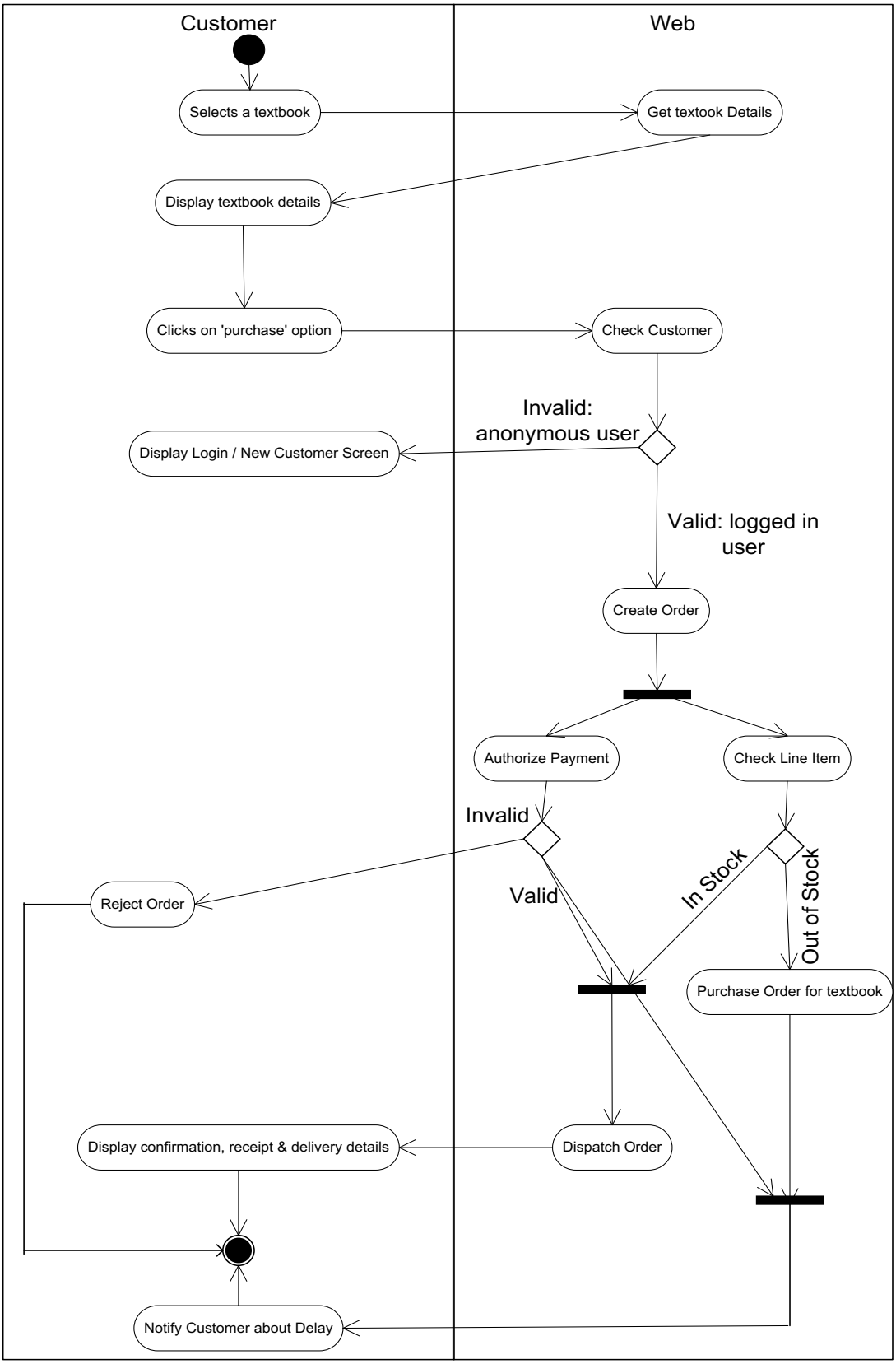

Figure 8: Activity Diagram, purchasing textbook via Web

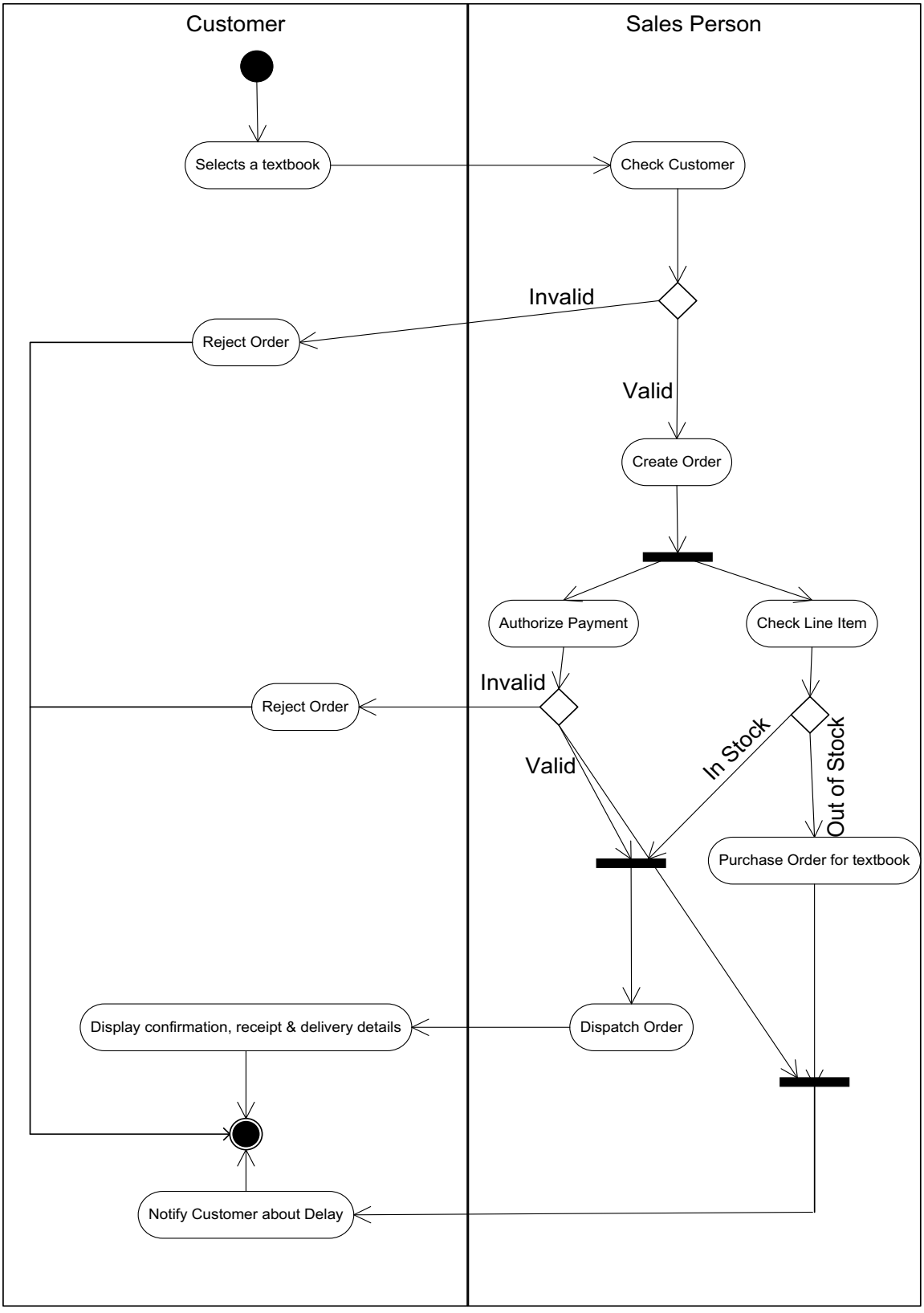

Figure 9: Activity Diagram, purchasing textbook via phone/ at store

Part b:

Based on 4.a produce a dialog structure diagram

Answer

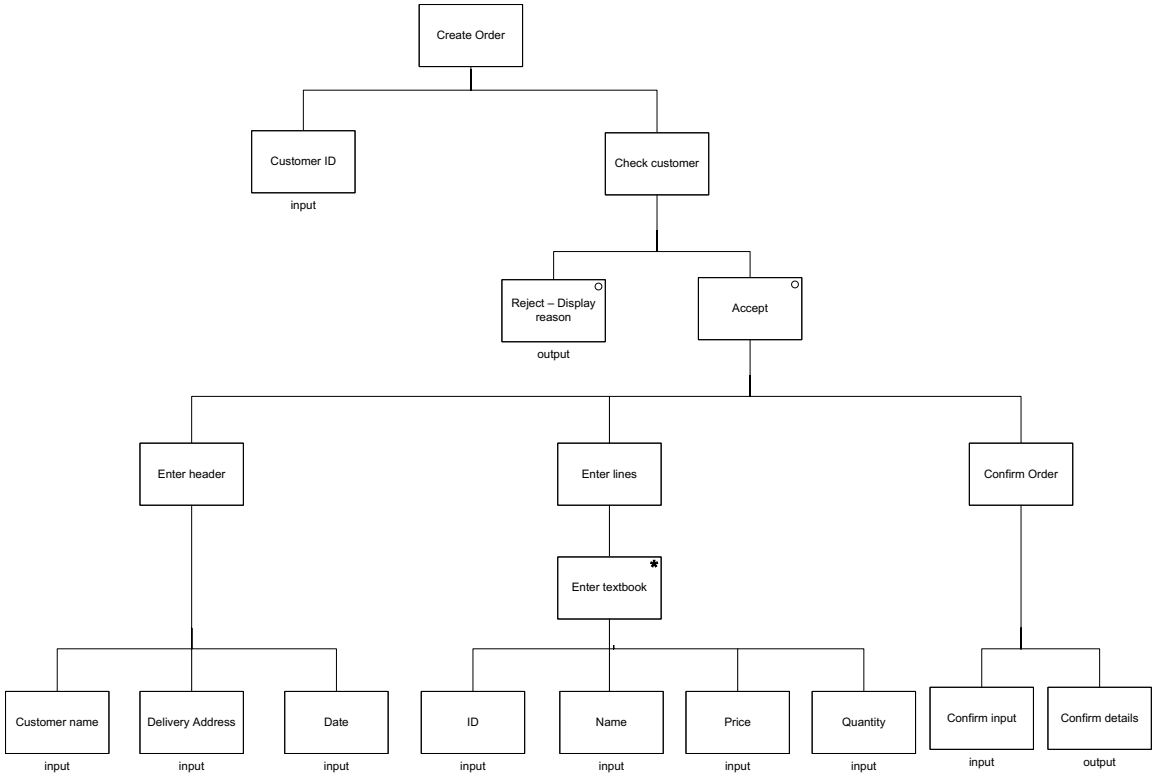

Figure 10: Dialog Structure for purchasing textbooks

The above dialog structure is for the creating order process when the customer orders a textbook.

Part c:

Produce 2 wireframes from diagram of 4.b

Answer

The following are two wireframe screens for order form. The first one is for the sales person at the university shop and the second one is for the customer himself at web.

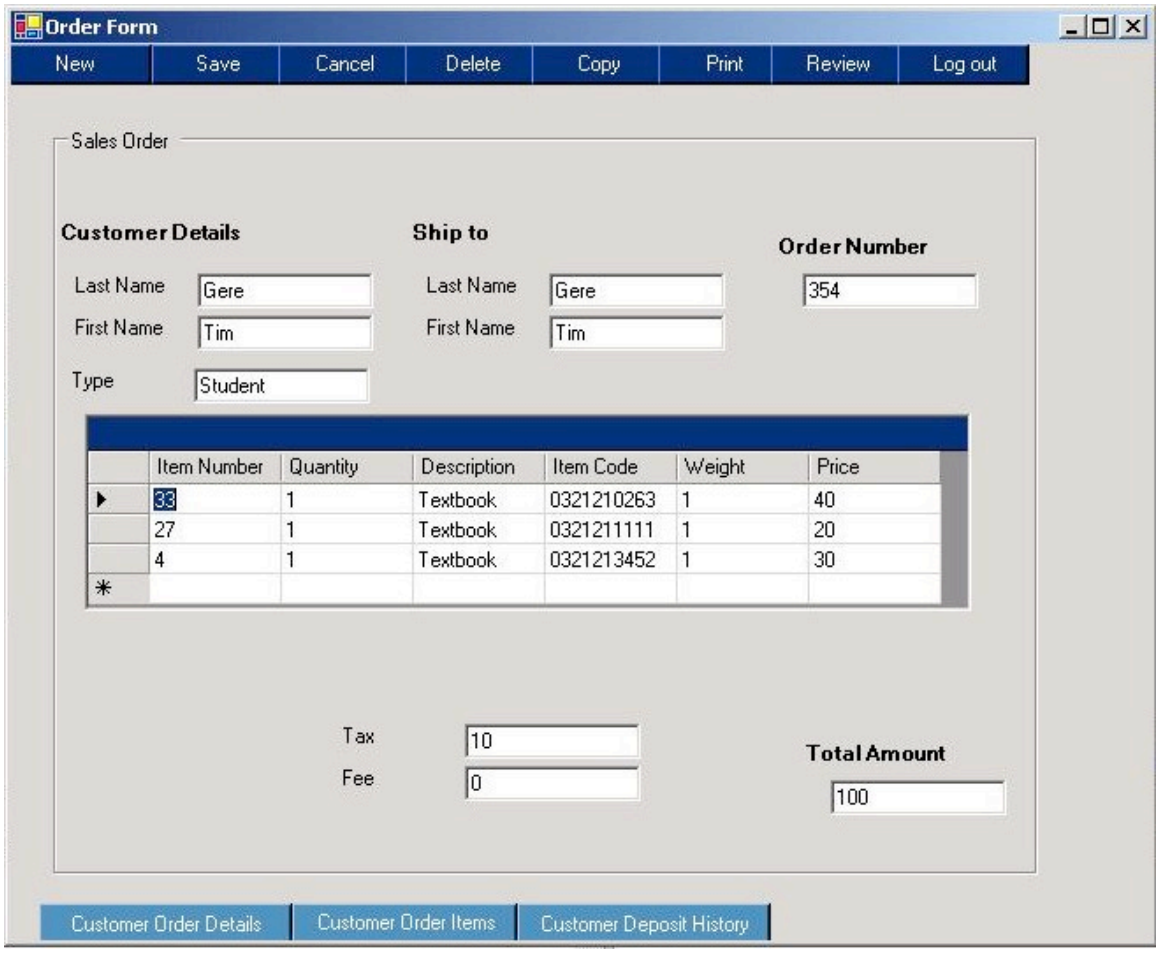

Figure 11: WireFrame - Order form at Shop

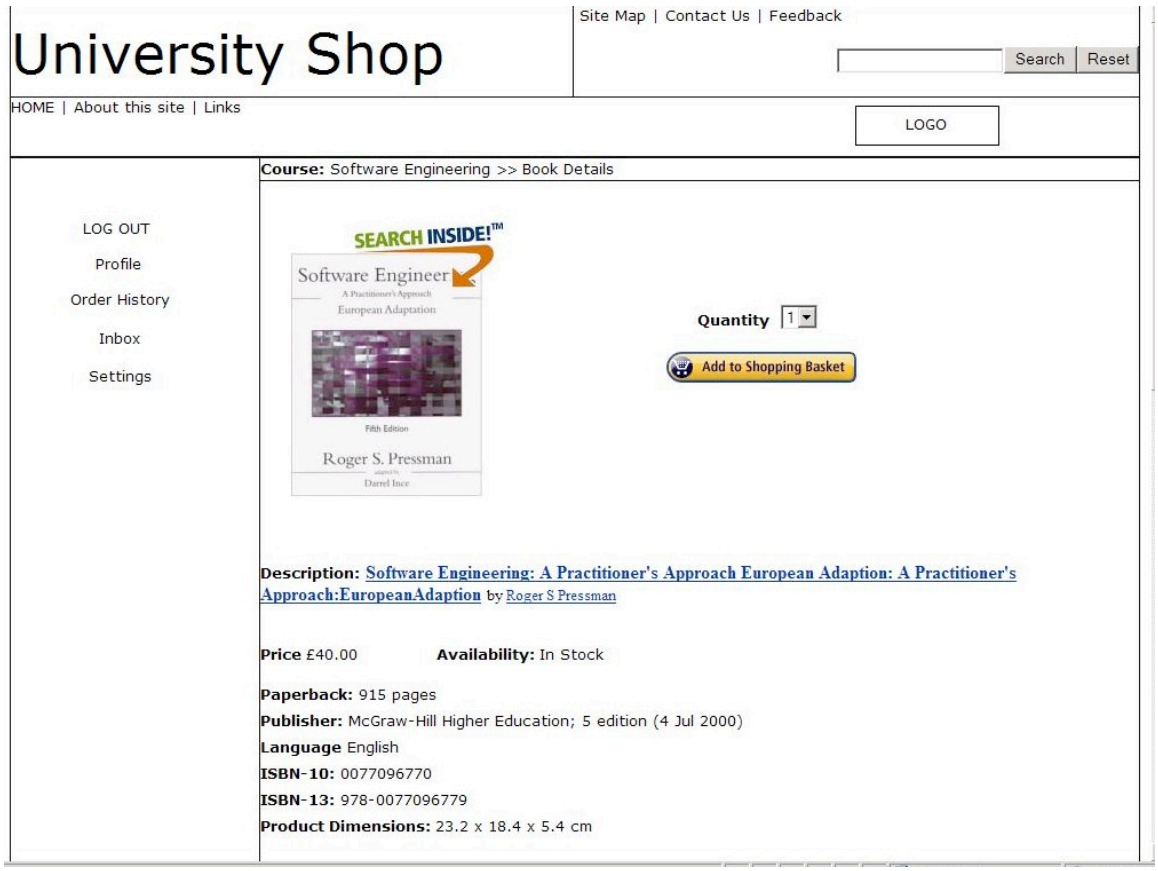

Figure 12: WireFrame – Selecting & Viewing Book at Web

Here the additional attributes like product dimensions, author, language etc can be traced using ISBN # from the university's internal database; where the ISBN # is the item code in shop's database. The student can view book details and then add to cart / purchase it.

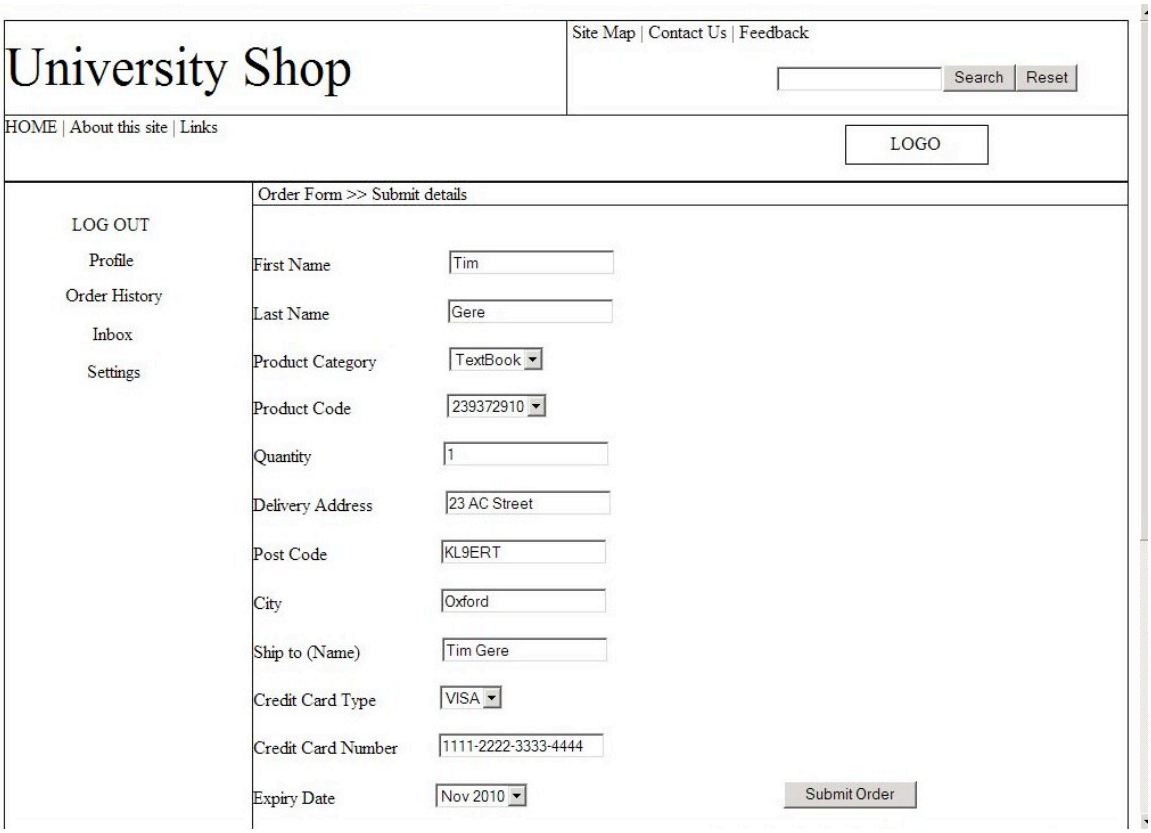

Figure 13: Wireframe - Order Form at Web

References

[Trinty, 2001]
University of Dublin, Trinty College. “Mapping an ER Model to the Relational Model”. [17/1/2001] Available on World Wide Web at: <https://www.cs.tcd.ie/courses/baict/baim/jf-im/6ERtoRel.pdf>