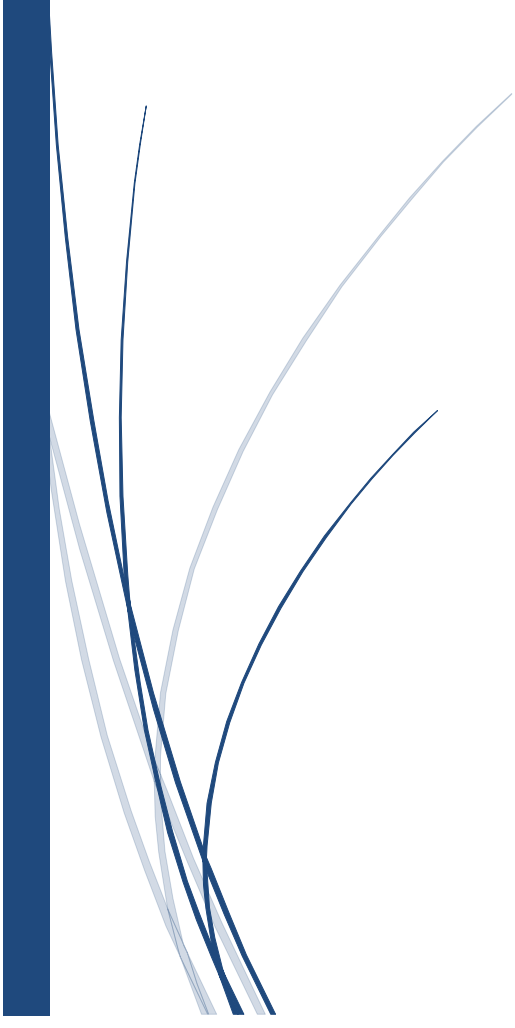
3/17/2022

INTRODUCTION TO DATABASES AND BIG DATA ASSIGNMENT



TOP TO DOWN APPROACH

After going through all the scripts, given entities were recognized.

1.Raw material **2.**Manufacturing_line **3.**Line_schedule **4.**Material_order_line **5.**Material_needed **6.**Model **7.**Test **8.**Test_type **9.**Material_order **10.**Supplier **11.**Tool **12.**Shipment **13.**Order_line **14.**Tool status **15.**Order **16.**Customer **17.**Problem_report **18.**Problem_type

After going through case study we can find there are 3 major part in which we can view the model. One is related with manufacturing of the raw materials, second portion is related with testing of the tools and their sales and third portion is related with results of testing i.e fault or problem reports.

This model allows to store the data for raw materials and also allows us to handle that which raw material will be required to create a specific of model of the tool. It gives information about the manufacturing date, status and production status of the model of the tools.

It gives us information about the suppliers and which material is being supplied by particular supplier along with dates and measurements of raw material supplied by the suppliers. It allows to know the status of the tools. The model handles the storage of the tests done on tools and type of the tests.

It gives information about the customers and their orders, and the order given by each customer separately. It also allows to handle the shipments and how much orders are contained in each shipment.

Assumptions:

1. A raw material can create many models of tools and a model of tool can be created by many raw materials
2. As it is a many to many relationship, so a link table named material_needed is introduced which contains foreign keys from both the entities
3. A model can have multiple line schedules, but a line schedule is for one and only one model
4. A manufacturing line can have multiple line schedules, but for a line schedule there is one and only one manufacturing line
5. For a material order, an order can contain multiple raw materials
6. For a raw material there can be multiple orders
7. As it is a many to many relationship, so we have introduced a bridge table named material_order_line which contains foreign keys from both the entities
8. A material_order_line is related with one and only one raw material and one and only one material order
9. A model of the tool can have many manufacturing lines
10. A manufacturing line can have multiple models of the tool
11. We have introduced a bridge table named line_schedule
12. A line schedule can have one and only one manufacturing line and one and only one model of tool
13. A model can have multiple tools of it’s type
14. But a tool will have one and only one model
15. A model can have multiple test types
16. Many test types can be done for one model

17. As it is many to many relationship between Model and Test type so we have introduced a link table named test which contains foreign keys from both tables

18. A test is related with one and only one model and one and only one test_type.

19. A tool can have have one and only one tool status however a tool status can be related to multiple tools

20. An order can have multiple shipments

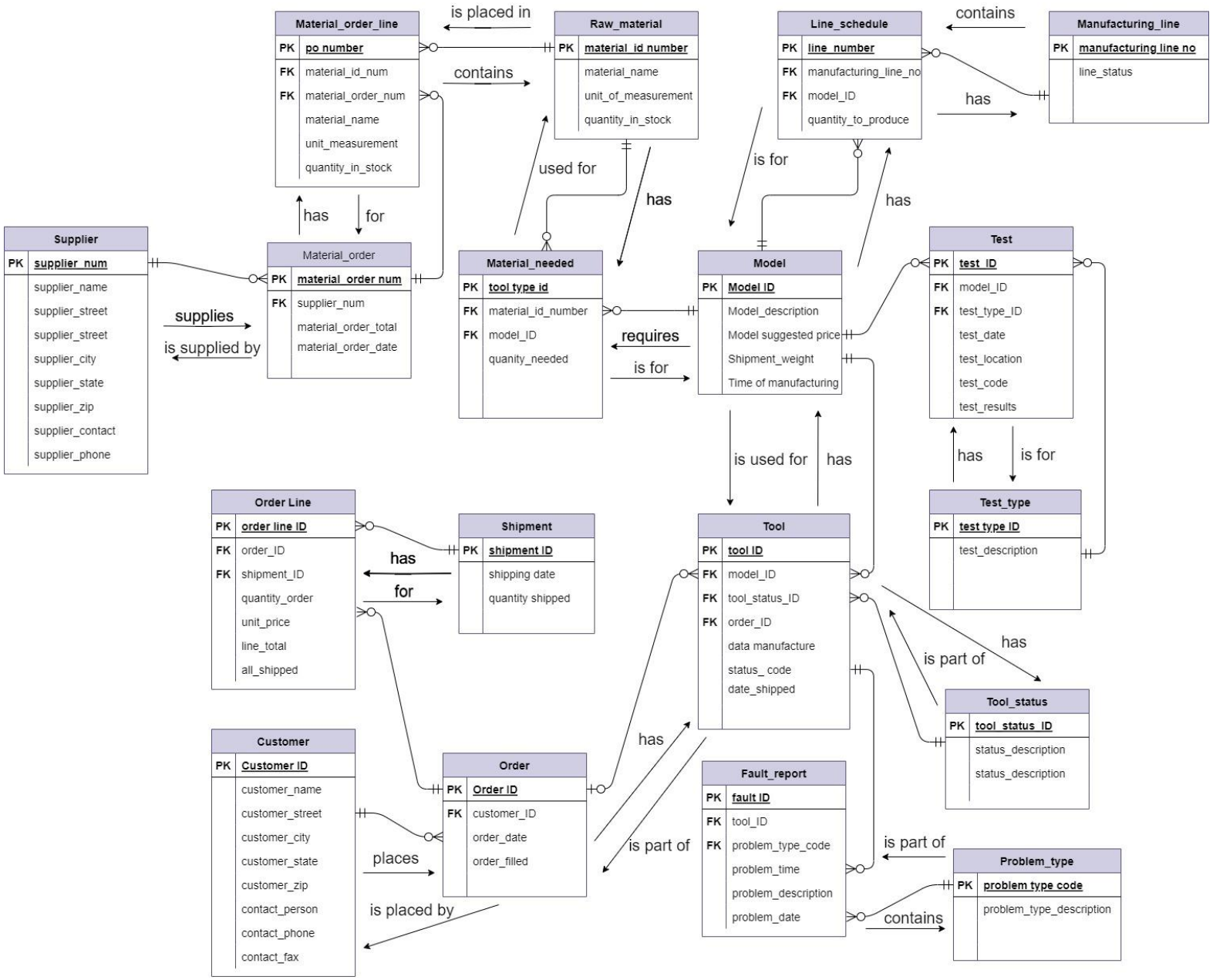
21. A shipment can contain multiple orders

22. There is a many to many relationship between both entities so we introduced a link table between both entities named as Order_Line

23. An order line can have one and only shipment and as well as one and only one order

24. A supplier can have multiple material_orders

25. A customer can do multiple orders, but an order will be related to one and only one customer



Bottom-up Modelling

Bottom-up modelling is used to examine forms presented by Merrill Hand Tools LTD to create determinacy diagrams, allowing us to use the process of normalisation which resulted in Entity-Relationship diagrams (Shown in appendix's A to K).

1.1. Order Form - Appendix A

We took surrogate keys for all entities to use as a substitute for a natural key. Within the order form, we introduced the order_id as a unique identifier to determine it's given attributes. Order_Id was taken as a foreign key in the item list. City was identified as a data redundancy. Therefore, City was identified as an entity and city_id was taken as primary key.

1.2. Order Manufacturing - Appendix B

We took surrogate keys for all entities to use as a substitute for a natural key. Manufacturing is done based on the model. So, we took model_id as a primary key in the Model entity.

1.3. Order Shipping - Appendix C

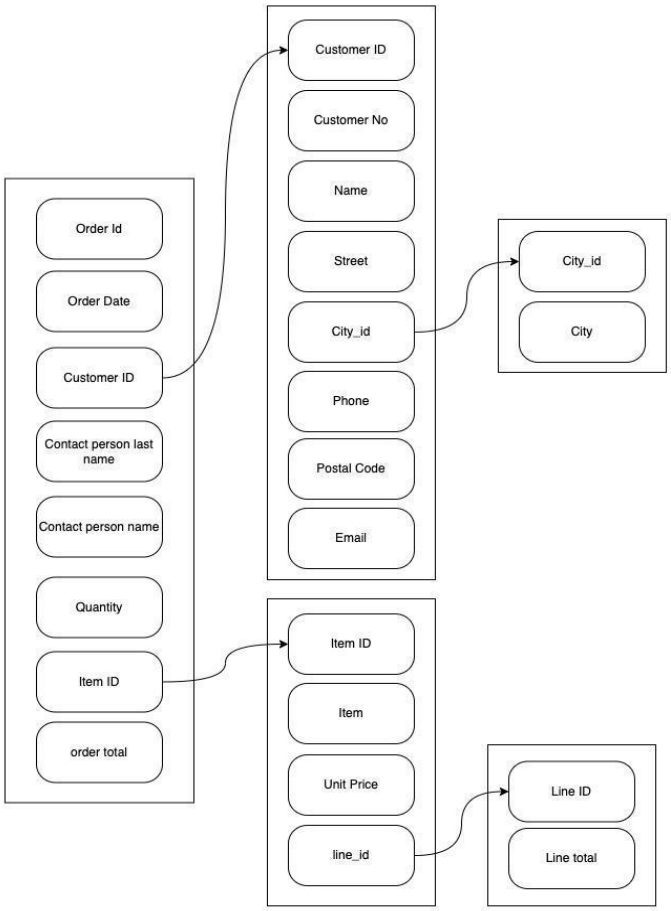
We took surrogate keys for all entities to use as a substitute for a natural key. Shipment_id was taken as the primary key in shipping entity. Parcel Delivery Company was added as an entity since it is required to update the inventory. Pdc_id was chosen for primary key and item_id had be a foreign key for the item entity.

1.4. Order Testing - Appendix D

We took surrogate keys for all entities to use as a substitute for a natural key. Within the Test report, we introduced the test_id as a unique identifier to determine it's given attributes. Fault_id was set as a primary key of the Fault entity and it can be used for identify the faults in relevant product

Order Form

Order - Determinacy diagram



Order - Normalization

1 NF

PK	OrderId
	Customer No
	Street
	City
	Phone
	Postal Code
	Email
	Contact persona Name
	Contact person last Name
	Item
	Quantity
	Line total
	Order Total
	Unit Price
	Order Date

2 NF

PK	OrderId
FK	Customer ID
	Contact person Name
	Order Date
	Order Total
	Line total
	Contact person last Name

PK	Order_ID
	Item_ID
	Quantity

PK	Customer ID
	Customer No
	Street
	City
	Phone
	Postal Code
	Email

PK	Item ID
	Item Name
	Price

3 NF

Order

PK	OrderId
FK	Customer ID
	Contact person Name
	Order Date
	Order Total
	Quantity
	Contact person last Name

Item_list

PK	Item_list_Id
FK	Item_ID
FK	order_Id
	Quantity

Customer

PK	Customer ID
	Customer No
	Street
FK	City_id
	Phone
	Postal Code
	Email
	Name

City

PK	city ID
	city

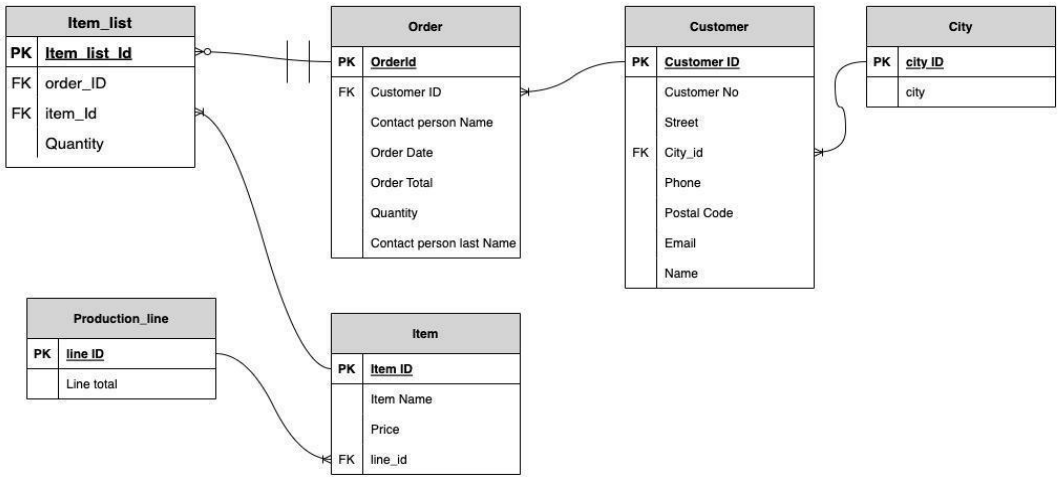
Item

PK	Item ID
	Item Name
	Price
FK	line_id

Production_line

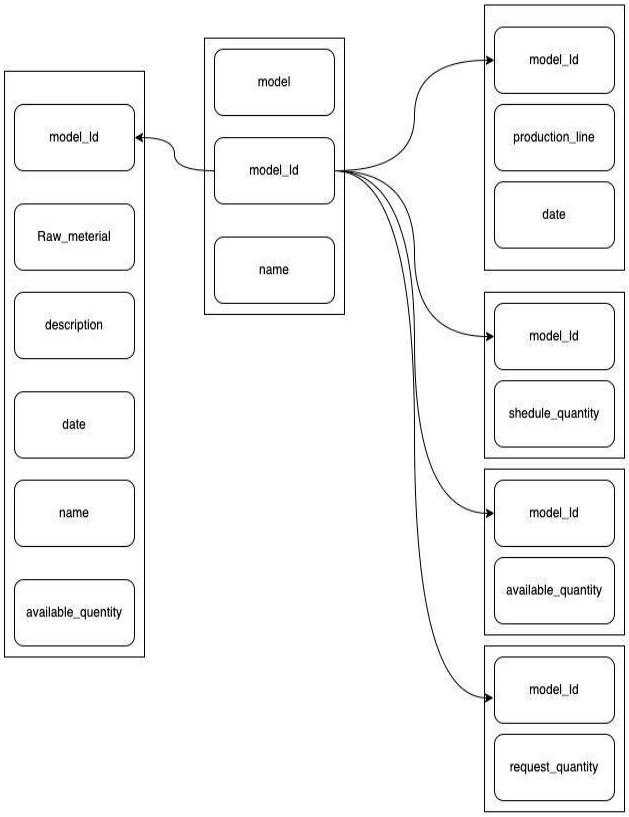
PK	line ID
	Line total

Order ERD



Manufacturing

Production Determinacy diagram



1 NF

PK	line_id
	date
	shedule_quantity
	available_quantity
	request_quantity
	model
	name

PK	material_Id
	Raw_meterial
	description
	date
	name
	model
	name

2 NF

PK	model_id
	name
	name

PK	line_Id
	shedule_quantity
	available_quantity
	request_quantity
	date
FK	model_id

PK	material_Id
	Raw_meterial
	description
	date
	name
FK	model_Id

3 NF

Model

PK	model_id
	name
	name

Production_line

PK	line_Id
	shedule_quantity
	date
FK	model_id

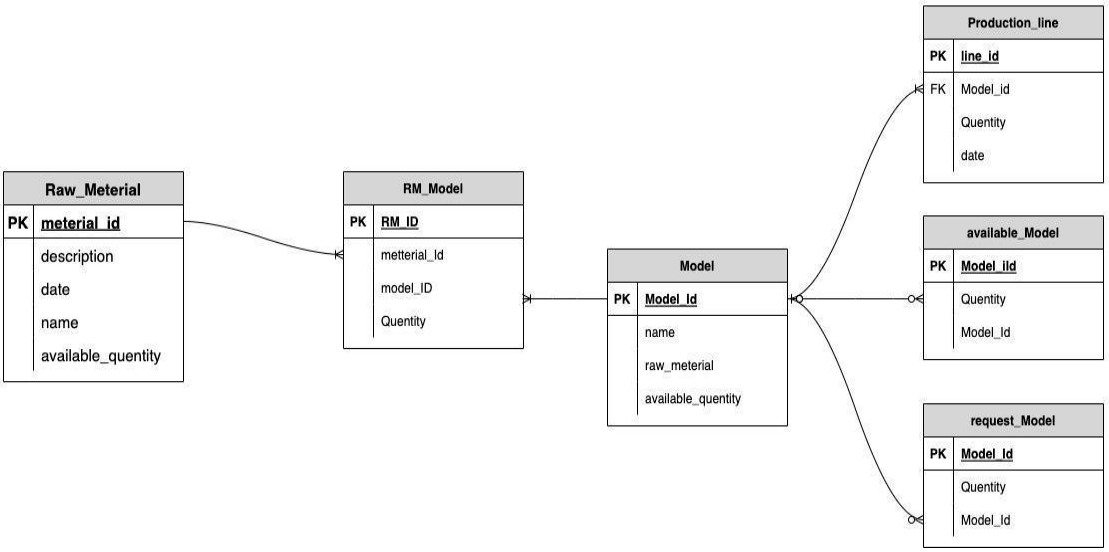
available_model

PK	line_Id
	available_quantity
	date
FK	model_id

request_model

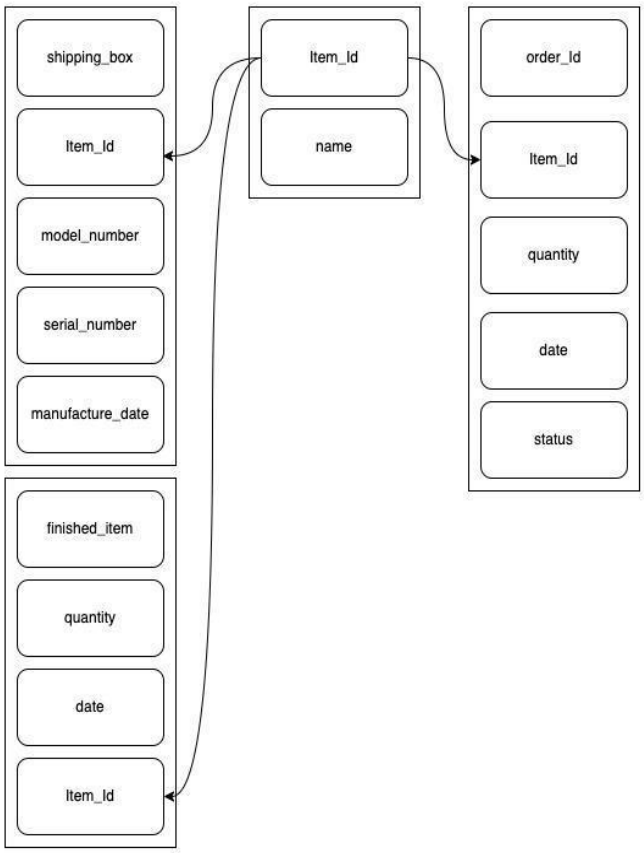
PK	line_Id
	request_quantity
	date
FK	model_id

Production ERD



Shipping

Determinacy Diagram



1 NF

PK	shipment_Id
	Order
	Model_number
	Serial_Number
	manufacture_date
	Item
	date
	status

PK	model_Id
	item
	quantity
	date

2 NF

PK	shipment_Id
	Order
FK	Item_Id
	quantity
	date
	status

PK	finished_Id
FK	Item_Id
	quantity
	date

PK	model_Id
FK	Item_Id
	model_number
	serial_number
	manufacture_date

PK	Item_Id
	name

3 NF

Shipment

PK	shipment_Id
	Order
FK	Item_Id
	quantity
	date
	status

Finished_Inventory

PK	finished_Id
FK	Item_Id
	quantity
	date

Model

PK	model_Id
FK	Item_Id
	model_number
	serial_number
	manufacture_date

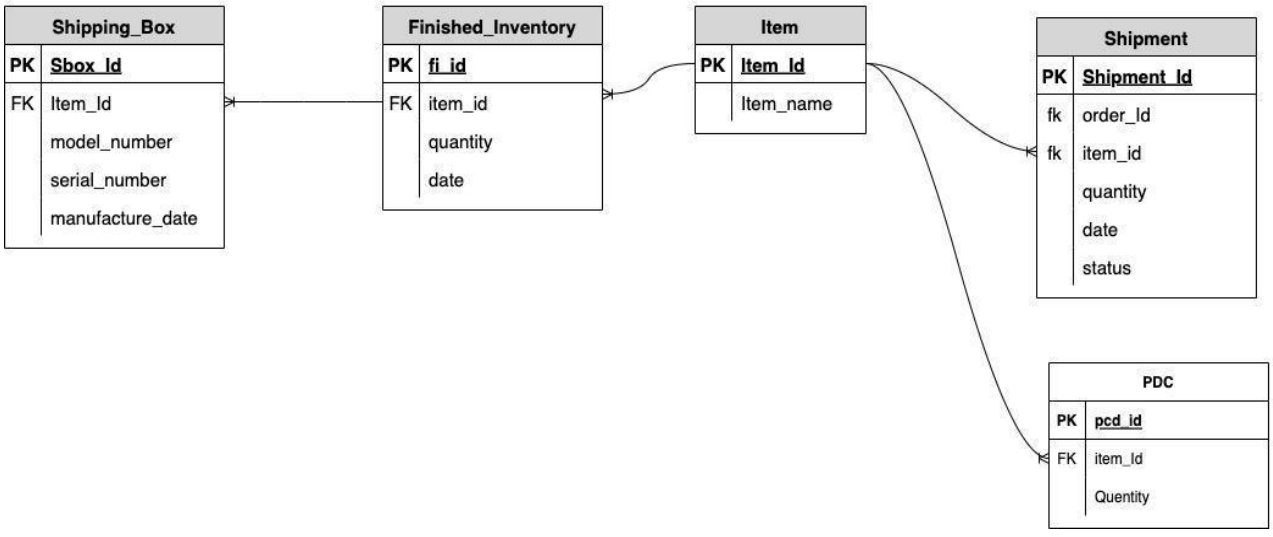
Item

PK	Item_Id
	name

PDC

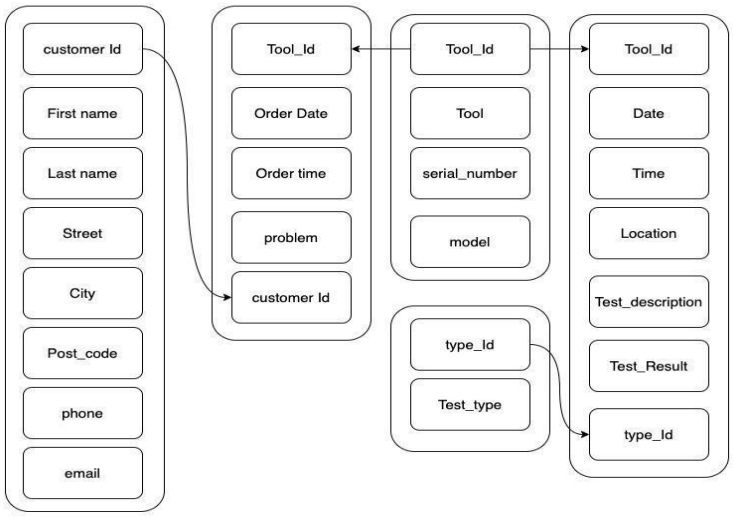
PK	pcd_id
FK	item_Id
	Quentity

Shipment ERD



Testing

Test - Determinacy diagram



Test - Normalisation

1 NF

PK	test_id
	tool
	model
	serial number
	date
	ttime
	location
	test_type
	test_description
	test_result

PK	fault_id
	tool
	model
	serial number
	date
	ttime
	First name
	Last name
	Street
	City
	Post_code
	phone
	email
	problem

2 NF

PK	test_id
FK	product_id
	date
	ttime
	location
	test_type
	test_description
	test_result

PK	product_id
	tool
	model
	serial number

PK	fault_id
FK	product_id
FK	customer_id
	date
	ttime
	problem

PK	customer_id
	First name
	Last name
	Street
	City
	Post_code
	phone
	email

3 NF

test

PK	test_id
FK	product_id
	date
	ttime
	location
	test_type
	test_description
	test_result

Test_type

PK	type_id
	test_type

product

PK	product_id
	tool
	model
	serial number

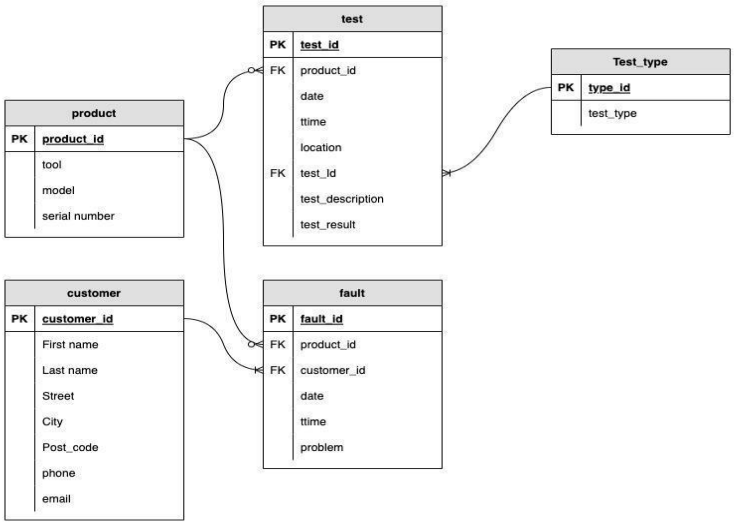
fault

PK	fault_id
FK	product_id
FK	customer_id
	date
	ttime
	problem

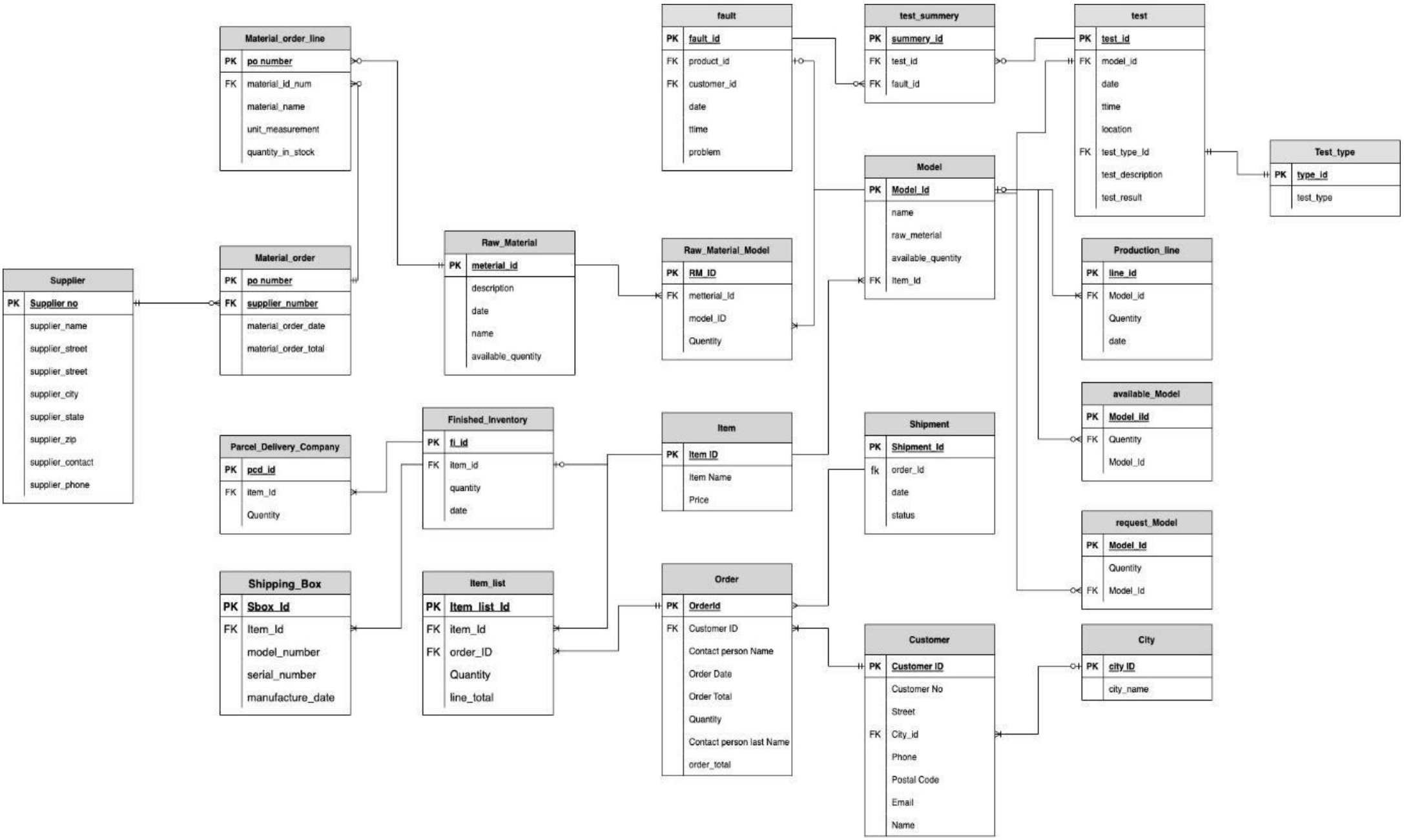
customer

PK	customer_id
	First name
	Last name
	Street
	City
	Post_code
	phone
	email

Test ERD



Final ER Diagram - Bottom to Up

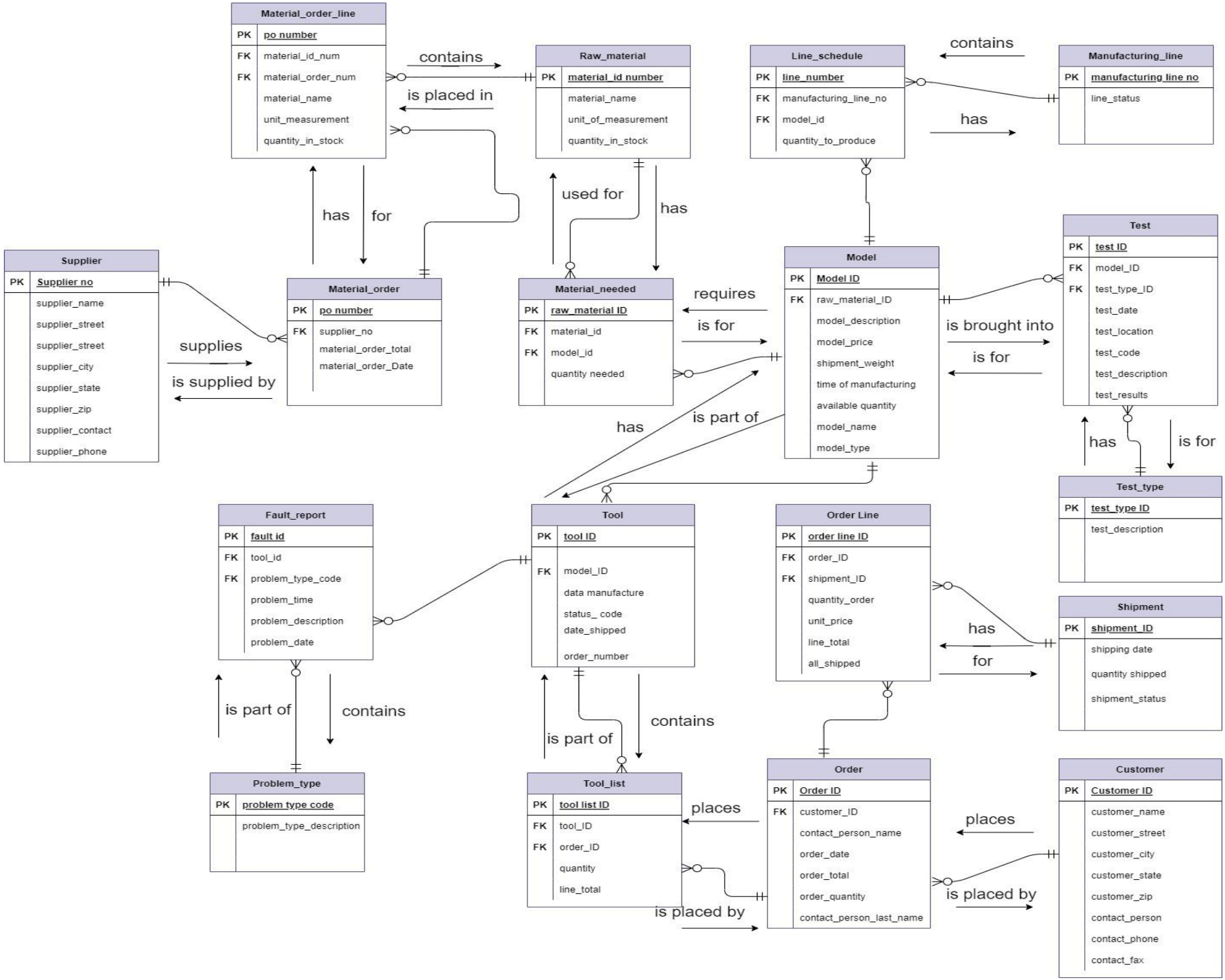


KEY POINTS TO NOTICE WHILE MERGING THE TWO DIAGRAMS:

In bottom up approach attributes were picked up and the tables were created and finally normalized so it resulted in many entities which were extra, and after discussion we

- In bottom up approach RAW_MATERIAL_MODEL was identified as a COMPOSITE ENTITY serving as bridge table between the Model and Raw material, so we agreed on having on keeping it's name as MATERIAL_NEEDED entity
- Test_summary, Parcel_delivery_company, Finished_Inventory entities were removed as they did not fulfil the requirements of an entity
- In bottom up, Production_Line entity was recognized which was same as the Manufacturing_line recognized in top to bottom, the relationship was not correctly
- established between model and manufacturing_line which was modified in Finalized diagram
- Available model and request model entities were dropped from bottom up approach and became attributes of the Model entity
- Shipping Box entity was removed from bottom up approach as its all attributes were part of the bridge table order_line in top to down approach
- A new entity tool_list was added in final digram which acts as composite entity between tools and order entity

BELOW GIVEN IS THE FINAL ENTITY RELATIONSHIP DIAGRAM


Material_order_line
PK po number
FK material_id_num
FK material_order_num
material_name
unit_measurement
quantity_in_stock
contains
is placed in
Raw_material
PK material_id number
material_name
unit_of_measurement
quantity_in_stock
Line_schedule
PK line_number
FK manufacturing_line_no
FK model_id
quantity_to_produce
contains
has
Manufacturing_line
PK manufacturing line no
line_status
has
for
used for
has
Supplier
PK Supplier no
supplier_name
supplier_street
supplier_street
supplier_city
supplier_state
supplier_zip
supplier_contact
supplier_phone
supplies
is supplied by
Material_order
PK po number
FK supplier_no
material_order_total
material_order_Date
Material_needed
PK raw_material ID
FK material_id
FK model_id
quantity needed
requires
is for
Model
PK Model ID
FK raw_material_ID
model_description
model_price
shipment_weight
time of manufacturing
available quantity
model_name
model_type
is brought into
is for
Test
PK test ID
FK model_ID
FK test_type_ID
test_date
test_location
test_code
test_description
test_results
has
is for
has
is part of
Test_type
PK test_type ID
test_description
Fault_report
PK fault id
FK tool_id
FK problem_type_code
problem_time
problem_description
problem_date
Tool
PK tool ID
FK model_ID
data manufacture
status_ code
date_shipped
order_number
Order Line
PK order line ID
FK order_ID
FK shipment_ID
quantity_order
unit_price
line_total
all_shipped
has
for
Shipment
PK shipment_ID
shipping date
quantity shipped
shipment_status
is part of
contains
is part of
contains
Problem_type
PK problem type code
problem_type_description
Tool_list
PK tool list ID
FK tool_ID
FK order_ID
quantity
line_total
places
is placed by
Order
PK Order ID
FK customer_ID
contact_person_name
order_date
order_total
order_quantity
contact_person_last_name
places
is placed by
Customer
PK Customer ID
customer_name
customer_street
customer_city
customer_state
customer_zip
contact_person
contact_phone
contact_fax