CS 317: Project Deliverable 1 Revision

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Warehouse Management System

Your company has several warehouses, and each warehouse is designated by a unique 4-letter string (lowercase or capital letters). Each warehouse has several bins that are identified uniquely across all warehouses by a bin identification string, which can consist of lowercase letters, capital letters, and unsigned integers. Each bin has a particular capacity. Each warehouse bin stores parts. Each part is designated by a unique part identification string (a five-character sequence of digits and letters).

Several parts together can form a distinct other part called an "assembly". The warehouses store only the constituent parts (parts stored separately), and the system should record the assembly to which the part belongs, if any. A part can be a constituent part in at most one assembly. Each assembly type has a specific assembly type identification string, consisting of 4 characters beginning with an uppercase “A”. Each instance of an assembly has a unique assembly instance identification string (a five-character sequence of digits and letters). For example, Parts P1111 and P1112 can together comprise assembly type A999. Further, each particular instance of assembly A999 has a unique assembly instance identifier, such as Ai222. Assemblies cannot be parts of other assemblies.

Parts arrive in batches, and each batch consists of only one part type. Each batch for a particular part has a unique batch identification string (a six-character sequence of digits and letters) and arrives on a particular date. Each batch has a size (the number of items in the batch). All items from the same batch are stored together in the same bin, and no batch is stored in more than one bin. Each item in a batch has a batch item number. Each item across all bins and warehouses has a unique item identification string (a five-character sequence of digits and numbers), which corresponds to a given batch identification string and batch item number. Additionally, if a specific item is a component part of an assembly instance, the associated assembly instance identification string should be recorded. However, an item does not have to belong to an assembly instance. When a particular manager checks a batch’s arrival, it is recorded that the batch has been checked in along with the manager’s identification string.

When a shipment out of the warehouse is made, its date-out is recorded together with the identification string of the employee who checked its shipping, the identification string of the customer, and the item identification numbers of the items shipped. While assembly instances can be shipped, their shipment will be recorded by their associated items.

Some parts may be backordered. Each backorder is assigned a specific backorder identification number and corresponds to only one part type. A part can be backordered only by a manager. The manager, the date of the backorder, and the quantity backordered are all recorded. When a backorder shipment arrives, the remaining quantity for that backorder is updated (e.g. the number of items arrived is subtracted from the remaining quantity), and if it is less or equal to 0, the backorder status is updated to “closed”. When this happens, the date is recorded and stored. There may be only a single active backorder for a particular part. Assemblies cannot be backordered — only their constituent parts.

A customer has a unique customer number (six digits), zero or more phone number(s) (consisting of a 3-digit area code and a 7-digit number), name(s) (it consists of an up to 20 characters first name, an up to 20 character middle name, and an up to 20 character last name), and one or more address(es) (street number, street name. city name, abbreviated state, zip code).

An employee has a unique employee number (six digits), zero or more phone number(s) (consisting of a 3-digit area code and a 7-digit number), name(s) (it consists of an up to 20 characters first name, an up to 20 character middle name, and an up to 20 character last name), and one or more address(es) (street number, street name. city name, abbreviated state, zip code). Some of the employees are managers. Every employee who is not a manager works under supervision of a single manager. Managers do not work under other managers.

**Field List**

* **Key**:
  + **Bold:** Entity
  + Underline: Primary Key
  + (FK): Foreign Key
  + (o): Optional
* **Warehouse** -- warehouseID char(4), warehouseName varchar(12)
* **Bin** -- binID char(6), binCapacity numeric, warehouseID char(4) (FK)
* **Part** -- partID char(5), partName varChar (10), assemblyTypeID char(4) (o) (FK)
* **Assembly** -- assemblyTypeID char(4), assemblyName varchar(10)
* **AssemblyInstance** -- assemblyInstanceID char(5), assemblyTypeID char(4)
* **Batch –** (of similar parts) batchID char(6), orderID (o), backorderID (o) batchArrivalDate date, partID (FK), batchSize numeric (# of items in batch), checkInManagerID (o) (FK), checkedInBool boolean, binID numeric (FK)
* **Item** -- itemID char(10), batchID char(6) (FK), batchItemNo numeric, AssemblyInstanceID char(4) (o)
* **Backorders** --backorderID numeric**,** backorderManagerNo numeric (FK), backorderDate date, backorderPartID (FK) char(5), backorderQuantity numeric, backorderStatus varchar(6), backorderRemainingQuantity numeric, backOrderFufillmentDate date (o)
* **Employee** -- employeeNo char(6), employeePhoneNumber char(10) (o), employeeFirstName varChar(20), employeeMiddleName varChar(20), employeeLastName varChar(20), employeeStreetNumber numeric, employeeStreetName varChar (20), employeeCityName varChar (16), employeeStateAbbreviation char(2), employeeZipCode char(5), isManager boolean, employeeManagerNo char(6) (o) (FK)
* **Customer** -- customerNo char(6), customerPhoneNumber char(10) (o), customerFirstName varChar(20), customerMiddleName varChar(20), customerLastName varChar(20), customerStreetNumber numeric, customerStreetName varChar (20), customerCityName varChar (16), customerStateAbbreviation char(2), customerZipCode char(5)
* **ShipmentOut** -- shipmentID char(6), shipmentDateOut date, employeeID numeric (FK), itemID char(10) multi (FK), customerNo char(6)(FK), custOrderNo (FK)
* **CustOrder –** custOrderNo, customerID (FK), shipOutDate (o)
* **Order –** orderID, employeeID, supplierID, orderDate, fulfilled (bool)

**Business Requirements**

* For the Warehouse Management System, there are *Warehouses, Bins, Parts, Batches, Backorders, Assembly Types, Assembly Instances, Employees, Managers,* and *Shipments*.
* Each warehouse has a unique warehouse identifier and a warehouse name.
* Each warehouse can have one or many bins.
* Each bin has an identifier that is unique across all warehouses and a bin capacity. A bin is housed in only one warehouse.
* Each part has a unique part identifier, a part name, and an optional identifier to indicate the assembly type to which it belongs, if any. Each part belongs to at most one assembly.
* An assembly type is comprised of at least two parts, and each assembly type has a unique assembly identifier and an assembly name.
* Each specific instance of an assembly type has a unique assembly instance identifier.
* Each assembly instance must correspond to one assembly type. An assembly type may have 0 or many assembly instances corresponding to it.
* Parts arrive to warehouses in batches. Each batch consists of exactly one part type.
* Each batch is stored in exactly one bin. A bin can consist of zero or many batches.
* The database should track the arrival date of a batch and whether or not it has been checked in. A batch may only be checked in by a manager, and his/her identifier must be recorded. A manager can check in zero or many batches.
* Each item has an item identifier that is unique across all warehouses.
* Each item corresponds to exactly one batch, and a batch is composed of one or many items. Each item within a batch is also given a batch item number, which is unique within a single batch, but not across all batches.
* Each item belongs to at most one assembly instance, but it does not have to belong to any. Each assembly instance consists of at least two items, and may contain many.
* Items may be shipped out of the warehouse. Each shipment has a unique shipment identifier. When a shipment is made, its date out, the employee number of the employee who verified the shipment, and the identifier of the customer to whom the items are being shipped must be recorded.
* Shipments can include one or many items, but a specific item can only be included in one shipment, if any.
* Assembly instances may be shipped, but their shipment will be recorded via their associated items.
* Each customer has a unique customer identification number, zero or more phone number(s), a name (broken up by first, middle, and last), and one or more address(es) including street number, street name, city name, state abbreviation, and zip code.
* Some parts can be on backorder.
* Only a manager may backorder a part. A manager can backorder zero or many parts.
* Each backorder has a unique backorder identification number and corresponds to only one part type.
* Each backorder tracks the date of when the backorder was made, the manager who made the backorder, and the quantity of the part on backorder.
* The arrival date of the backorder is noted upon arrival of the shipment.
* Each time a backorder arrives, the quantity of the part contained in the backorder is subtracted from the quantity of the part currently listed as being on backorder.
* Each backorder can be “open” or “closed”. If the quantity on backorder is > 0, it is “open”. Otherwise, it is “closed”. When the status changes to “closed”, the fulfillment date of the backorder is recorded.
* Each employee has a unique employee number, zero or more phone number(s), a name (broken up by first, middle, and last), and one or more address(es) including street number, street name, city name, state abbreviation, and zip code.
* Some employees are managers.
* Every employee who is not a manager works under the supervision of only one manager. A manager can manage one or many employees.
* Managers do not work under other managers.

**Queries:**

1. List all employee numbers for all the workers that work under a manager with either the first name Tony or the last name Tony with no middle name.
2. List all the names and employee numbers for all workers. The names should be listed in alphabetical order (by last, then by first, then by middle)
3. List all the phones and employee numbers for all managers.
4. List all parts that are assemblies.
5. For each manager, list all current backorders entered by the manager.
6. For each manager, list all current and old backorders entered by the manager. For each backorder, list the part number, backorder date, and fulfilled date. For current backorders, list a fulfilled date of '2019-01-01'.
7. For each warehouse bin, list the remaining capacity of the bin.
8. List employee number and number of workers managed for top 5 managers with the largest number of workers managed.
9. List all the details for batches arriving in a given week. Sort by date.
10. Display a count of items shipped out by each employee along with the employee name and number. Sort by count (in descending order).
11. Display the maximum number of assembly instances that can be made of a given assembly type given the quantity of its component parts throughout all warehouses.
12. Display all shipments to a given customer in descending order of quantity of items shipped.