

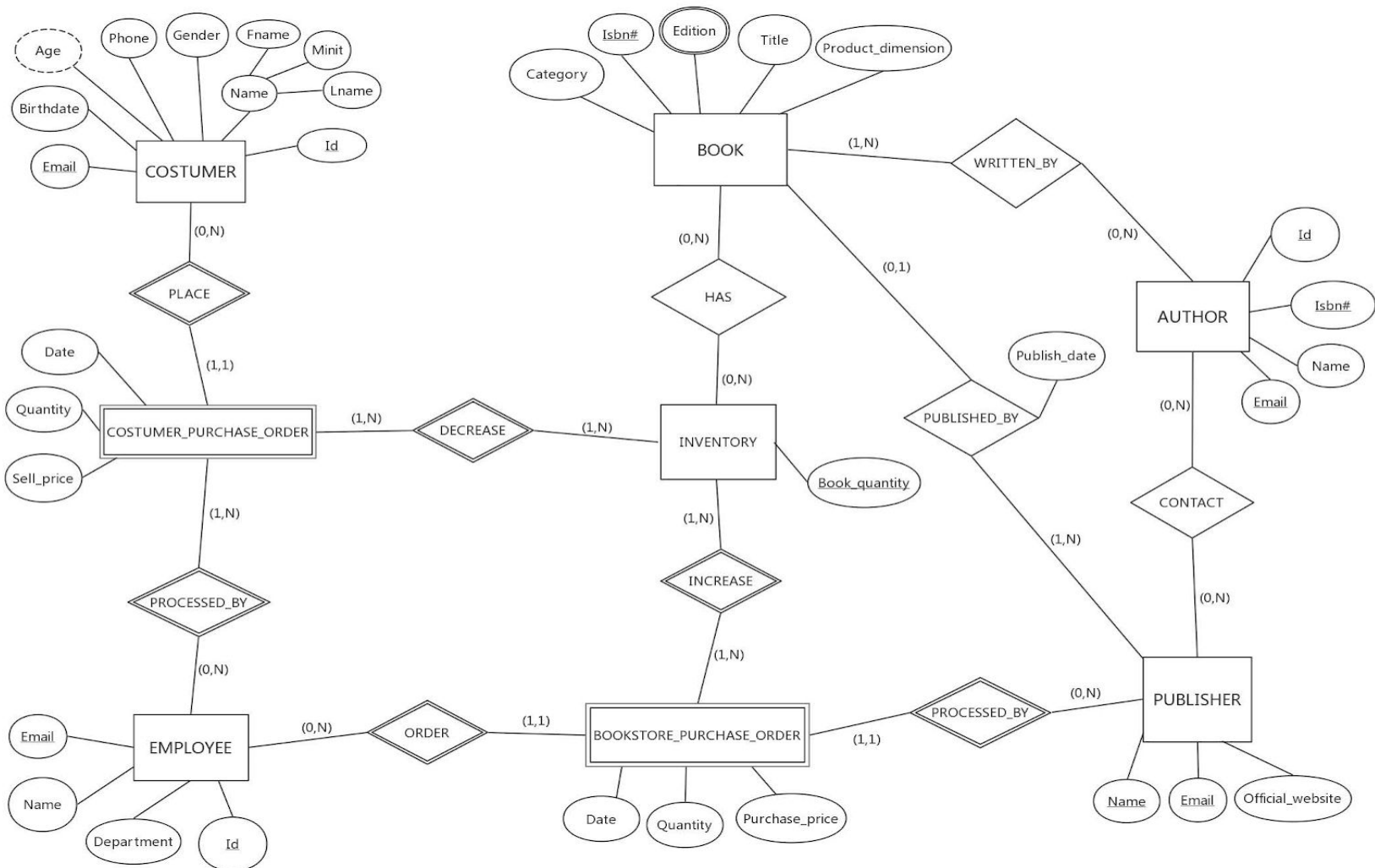
CSE 3241 Project Checkpoint 02 – Relational Model and Relational Algebra

Names: Cenglin Bao, Wen Fang, Patrick Flanagan, Kai Li

Date 2/25/2020

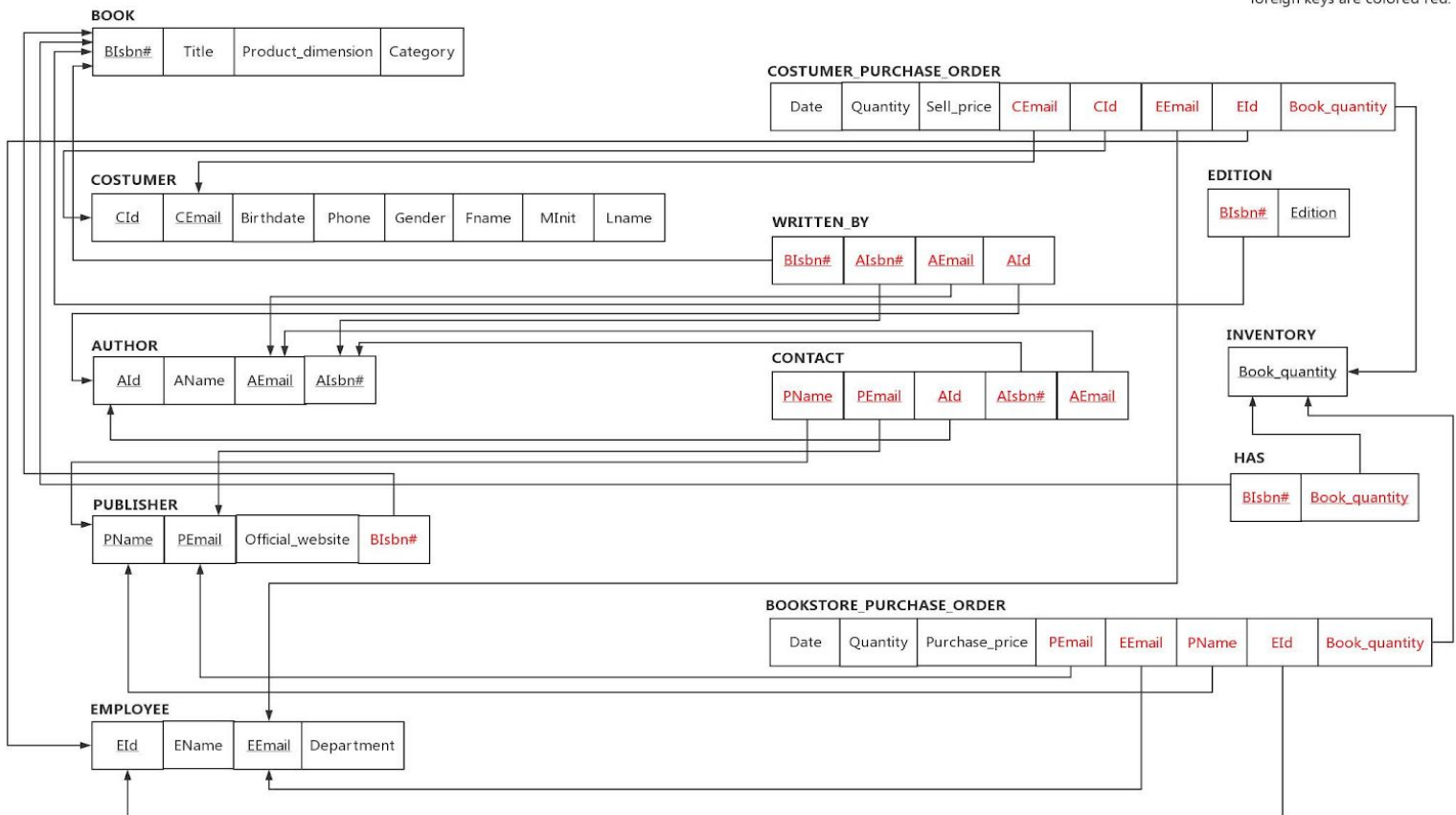
In a **NEATLY TYPED** document, provide the following:

1. Provide a current version of your ER Model as per Project Checkpoint 01. If you were instructed to change the model for Project Checkpoint 01, make sure you use the revised version of your ER Model.



2. Map your ER model to a relational schema. Indicate all primary and foreign keys.

Note: Primary keys are underlined, foreign keys are colored red.



3. Given your relational schema, provide the relational algebra to perform the following queries. If your schema cannot provide answers to these queries, revise your ER Model and your relational schema to contain the appropriate information for these queries: (π σ ρ \bowtie)

- a. Find the titles of all books by Pratchett that cost less than \$10

PratchettBooksPrices $\leftarrow (\sigma_{\text{Author_Name} = \text{Pratchett}}(\text{Book})) \bowtie_{\text{ISBN\#} = \text{ISBN\#}} (\text{Inventory})$
 Result $\leftarrow \pi_{\text{Title}}(\sigma_{\text{Sell_Price} < 10}(\text{PratchettBooksPrices}))$

- b. Give all the titles and their dates of purchase made by a single customer (you choose how to designate the customer)

CustomerPurchases $\leftarrow [(\text{Customer}) \bowtie_{\text{CID} = 12345} (\text{CustomerPurchaseOrder})]$
 CustomerBookPurchases $\leftarrow \text{CustomerPurchases} \bowtie_{\text{ISBN\#} = \text{ISBN\#}} (\text{Inventory})$
 Result $\leftarrow \pi_{\text{Title, Purchase_Date}} [(\text{CustomerBookPurchases}) \bowtie_{\text{ISBN\#} = \text{ISBN\#}} (\text{Book})]$

- c. Find the titles and ISBNs for all books with less than 5 copies in stock

LessThanFive $\leftarrow \sigma_{\text{Qty} < 5} (\text{Inventory})$
 Result $\leftarrow \pi_{\text{Title, ISBN\#}} [(\text{LessThanFive}) \bowtie_{\text{ISBN\#} = \text{ISBN\#}} (\text{Book})]$

- d. Give all the customers who purchased a book by Pratchett and the titles of Pratchett books they purchased

$$\begin{aligned} \text{PratchettBooks} &\leftarrow \sigma_{\text{Author_Name} = \text{Pratchett}}(\text{Book}) \\ \text{PratchettBookPurchases} &\leftarrow [(\text{PratchettBooks}) \bowtie_{\text{ISBN\#} = \text{ISBN\#}} (\text{CustomerPurchaseOrder})] \\ \text{CustomersPurchasingPratchett} &\leftarrow \text{Customer} \bowtie_{\text{CID} = \text{CID}} (\text{PratchettBookPurchases}) \\ \text{Result} &\leftarrow \pi_{\text{Fname, Lname, Title}} (\text{CustomersPurchasingPratchett}) \end{aligned}$$

- e. Find the total number of books purchased by a single customer (you choose how to designate the customer)

$$\begin{aligned} \text{CustomerPurchases} &\leftarrow [(\text{Customer}) \bowtie_{\text{CID} = 12345} (\text{CustomerPurchaseOrder})] \\ \text{Result} &\leftarrow \pi_{\text{Qty}} [\rho_{\text{COUNT}(\text{ISBN\#})} (\text{CustomerPurchases})] \end{aligned}$$

- f. Find the customer who has purchased the most books and the total number of books they have purchased

$$\begin{aligned} \text{CustomerPurchases} &\leftarrow [(\text{Customer}) \bowtie_{\text{CID} = \text{CID}} (\text{CustomerPurchaseOrder})] \\ \text{TotalForEachCustomer} &\leftarrow \rho_{(\text{TotalQty})} [\rho_{\text{COUNT}(\text{ISBN\#})} (\text{CustomerPurchases})] \\ \text{Result} &\leftarrow \pi_{\text{Fname, Lname, TotalQty}} [\rho_{\text{MAX}(\text{TotalQty})} (\text{TotalForEachCustomer})] \end{aligned}$$

4. Come up with three additional interesting queries that your database can provide. Give what the queries are supposed to retrieve in plain English and then as relational algebra. Your queries should include joins and at least one should include an aggregate function. At least one of your queries should use “extra” entities you added to your model in Checkpoint 01.

a) Top Salesperson: Find the salesperson who sold the most books

$$\begin{aligned} \text{EmployeeSales} &\leftarrow [(\text{Employee}) \bowtie_{\text{EID} = \text{EID}} (\text{CustomerPurchaseOrder})] \\ \text{TotalForEachSalesperson} &\leftarrow \rho_{(\text{TotalSales})} [\rho_{\text{COUNT}(\text{ISBN\#})} (\text{EmployeeSales})] \\ \text{Result} &\leftarrow \pi_{\text{Fname, Lname, TotalSales}} [\rho_{\text{MAX}(\text{TotalSales})} (\text{TotalForEachSalesperson})] \end{aligned}$$

b) Total Sales Revenue: Find the total amount of revenue earned from selling inventory (at this point just books)

$$\text{Result} \leftarrow \pi_{\text{TotalRevenue}} \{ (\rho_{(\text{TotalSales})} [(\rho_{\text{SUM}(\text{Sell_Price})} (\text{CustomerPurchaseOrder}))]) \}$$

c) Total Cost of Inventory Purchased: Find the total amount of expense on inventory (at this point just books)

$$\text{Result} \leftarrow \pi_{\text{TotalExpenses}} \{ (\rho_{(\text{TotalExpenses})} [(\rho_{\text{SUM}(\text{Purchase_Price})} (\text{BookstorePurchaseOrder}))]) \}$$

