CSE 3241 Project Checkpoint 02 – Relational Model and Relational Algebra
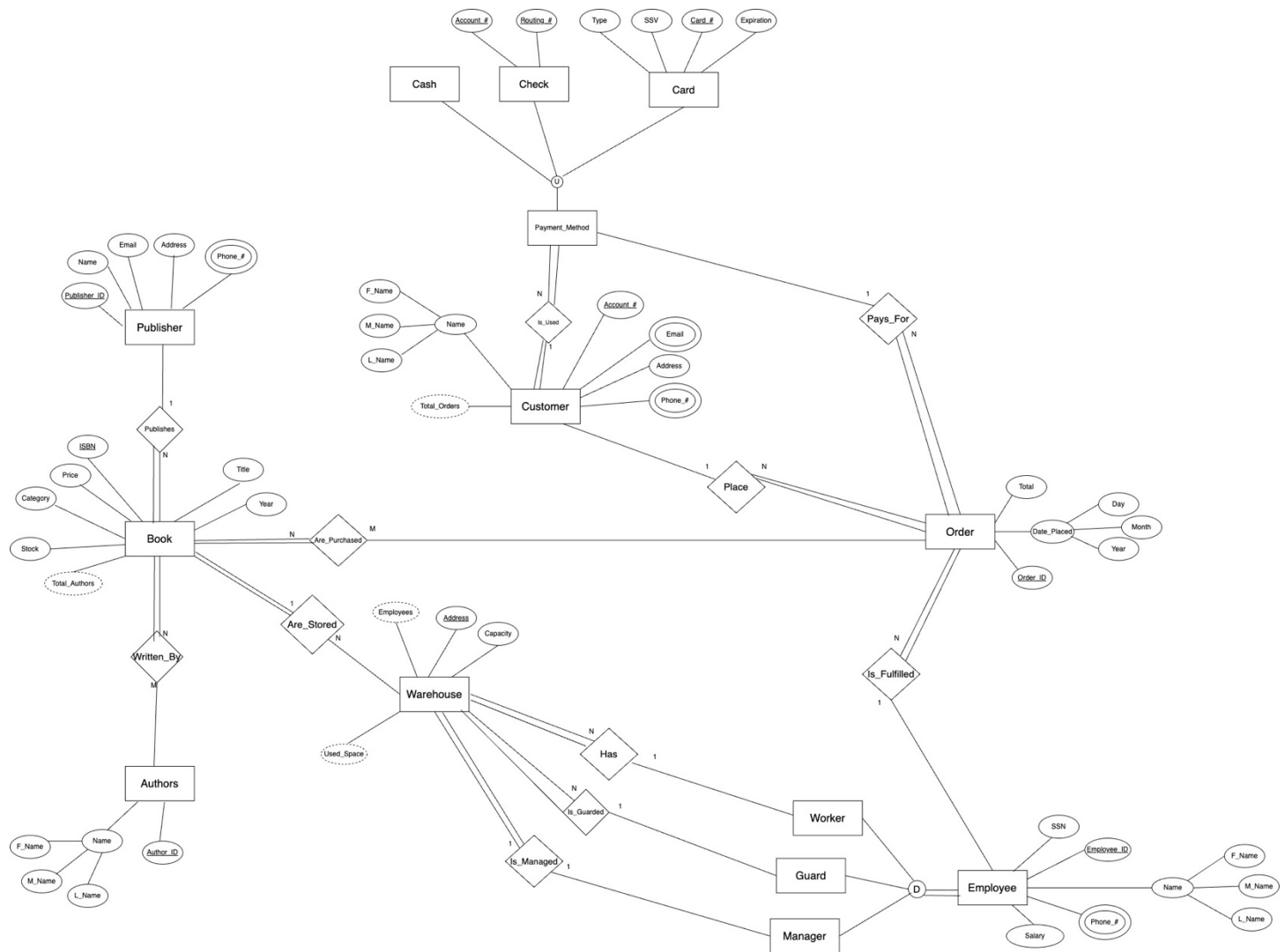
Names	Date 2/19/25
Massimo Adams, Charlie Cavallaro, Keenan Darkins, Samuel Ellerbrock	

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.
   Primary Keys Underlined

Publisher

Name	Email	Address	Phone_#	Publisher_ID

Book – Foreign Key Publisher_ID references Publisher

Title	Year	Stock	Category	Price	ISBN	Publisher_ID

Author

F_Name	M_Name	L_Name	Author_ID

Warehouse - Foreign Key Employee_ID references Employee and Foreign Key ISBN references Book

Capacity	Address	Employee_ID	ISBN

Order - Foreign Key Account_# references Customer and Foreign Key Employee_ID references Employee

Total	Day	Month	Year	Order_ID	Account_#	Employee_ID

Customer

F_Name	M_Name	L_Name	Phone_#	Address	Email	Account_#

Employee

SSN	Salary	Phone_#	F_Name	M_Name	L_Name	Employee_ID	Job_Type

Are_Purchased - Foreign Key ISBN references Book and Foreign Key Order_ID references Order

ISBN	Order_ID

Written_By - Foreign Key ISBN references Book and Foreign Key Author_ID references Author

Author_ID	ISBN

Payment_Method

Payment_ID

Cash – Foreign Key Payment_ID references Payment_Method

Payment_ID

Check - Foreign Key Payment_ID references Payment_Method

Routing_#	Checking_#	Payment_ID

Card - Foreign Key Payment_ID references Payment_Method

Type	SSV	Expiration	Card_#	Payment_ID

Customer_Phone - Foreign Key Account_# references Customer

Account_#	C_Phone

Customer_Email - Foreign Key Account_# references Customer

Account_#	C_Email

Publisher_Phone - Foreign Key Publisher_ID references Publisher

Publisher_ID	P_Phone

Employee_Phone - Foreign Key Employee_ID references Employee

Employee_ID	E_Phone

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:

σ Π

    a. Find the titles of all books by Pratchett that cost less than $10
        R1A <-- σ(Price<10)(Book)

R2A <-- Written_By ⋈(ISBN=ISBN)R1A

R3A <-- σ(Author_Id = Pratchett's ID)

ResultA <-- Π (Title)(R2A⋈(Author_ID=Author_ID)R3A)

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

R1B <-- σ(Account_# = CustomerOfChoice)(Customer)

R2B <-- R1B⋈(Account_#= Account_#)Order

R3B <-- R2B ⋈(Order_ID=Order_ID)Purchased

R4B <-- R3B ⋈Book

ResultB <-- Π(Title,Day,Month,Year,Fname,Lname,Account_#)R4B

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

R1C <-- σ(Stock<5)(Book)

ResultC <-- Π(Title,ISBN)(R1C)

d. Give all the customers who purchased a book by Pratchett and the titles of Pratchett books they purchased
R1D <-- Written_By ⋈(ISBN=ISBN)Book
R2D <-- σ(Author_Id = Pratchett's ID)
R3D <-- R2D ⋈(ISBN= ISBN)Purchased
R4D <-- R3D ⋈ (Order_Id=Order_Id) Order
R5D <-- R4D ⋈ (Account_# = Account_#) Customer
ResultD <-- Π(Title,Total,Fname,Lname)R5D

e. Find the total number of books purchased by a single customer (you choose how to designate the customer)
R1E <-- σ(Account_# = CustomerOfChoice)(Customer)

R2E <-- R1E⋈(Account_#= Account_#)Order

ResultE <-- Π(Count(Order_ID), Fname, Lname, Account_#)(R2E)

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

R1F <-- Customer⋈(Account_#= Account_#)Order

R2F <-- σ(ℑMax(Sum(Total)))R1F

ResultF <-- Π(Fname,Lname,Account_#)R2F

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.

Get the amount of orders fulfilled by a given employee:

R1G <-- σ(Employee_ID=Given Employee)(Employee)

R2G <-- R1G⋈Is_Fulfilled

ResultG <-- R2G ℑ Count(Order_ID)

Get the most often payment type:

R1H <-- Order ⋈(Order_ID = Order_ID) Payment_Method

R2H <-- R1H ℑ (Count(Payment_ID) → PaymentCount) (Payment_ID)

R3H <-- σ(PaymentCount = Max(PaymentCount)) (R2H)

ResultH <-- Π(Payment_ID, PaymentCount) R3H

Get the cost of books that are stocked the highest:

R1K <-- σ(Stock > Book ℑ Average(Stock))Book

ResultK <-- Π(Title, Price, Stock)R1K