# 2.1 – Conceptual Design

**Assumptions:**

“Every publisher has published at least one book.” – Since this is from the bookstore’s perspective, every known publisher has published at least one book in the bookstore. This causes the cardinality of the relation between Publisher and Book (Published) to be one to many, and the publisher entity is in total participation, while the book entity is in partial participation.

“Billing Information can be used in multiple purchases.” – Since the billing information is saved, it can be used multiple times. The relation between BillingInfo and Purchase (billing) is of cardinality type one to many. Every order has exactly one BillingInfo, while BillingInfo can be used in zero to many Purchases. This means that BillingInfo is in partial participation, while Purchase is in total participation.

“ContactInfo does not have total participation with User” – The program creates tuples in ContactInfo for the destination, and in BillingInfo for the billing information. These are stored and associated with the user. These tuples are in participation with the ContactInfo to User relation (contactInfoUser). The rest of the tuples are created at checkout when the destination and/or billing information is different from those that are stored already. This causes ContactInfo to be in partial participation with User. It also should be clear that this is the same reason why ContactInfo is in partial participation with Purchase and BillingInfo is in partial participation with Purchase.

# 2.2 – Reduction to Relation Schemas

contact\_info(id, street, city, zip, phone, first\_name, last\_name)

billing\_info(id, street, city, zip, phone, first\_name, last\_name, card\_number, cvv, expiry)

user(user\_name, password, superuser, contact\_info\_id)

user\_purchase(username, purchase\_number)

purchase(purchase\_number, status, total, destination\_id, billing\_id)

purchase\_book(purchase\_number, isbn, royalties\_paid, revenue, quantity)

book(isbn, book\_name, author, genre, price, stock, royalty, pages, publisher)

publisher(publisher\_name, street, city, zip email, phone

# 2.3 – Normalization of Relation Schemas

**contact\_info:**

Assuming phone number can be of any type.

Therefore id is a superkey, and this relation is in BCNF.

**billing\_info:**

Assuming phone number can be of any type.

Therefore id is a superkey, and this relation is in BCNF.

**purchase:**

Therefore purchase\_number is a superkey, and this relation is in BCNF.

**user:**

Therefore user\_name is a superkey, and this relation is in BCNF.

**user\_purchase:**

Therefore purchase\_number is a superkey, and this relation is in BCNF.

**purchase\_book**:

Therefore (purchase\_key)(isbn) is a superkey, and this relation is in BCNF.

**book:**

Assuming there might be multiple authors per book.

Therefore isbn is a superkey, and this relation is in BCNF.

**publisher:**

Therefore publisher\_name is a superkey, and this relation is in BCNF.