3005 Project

By

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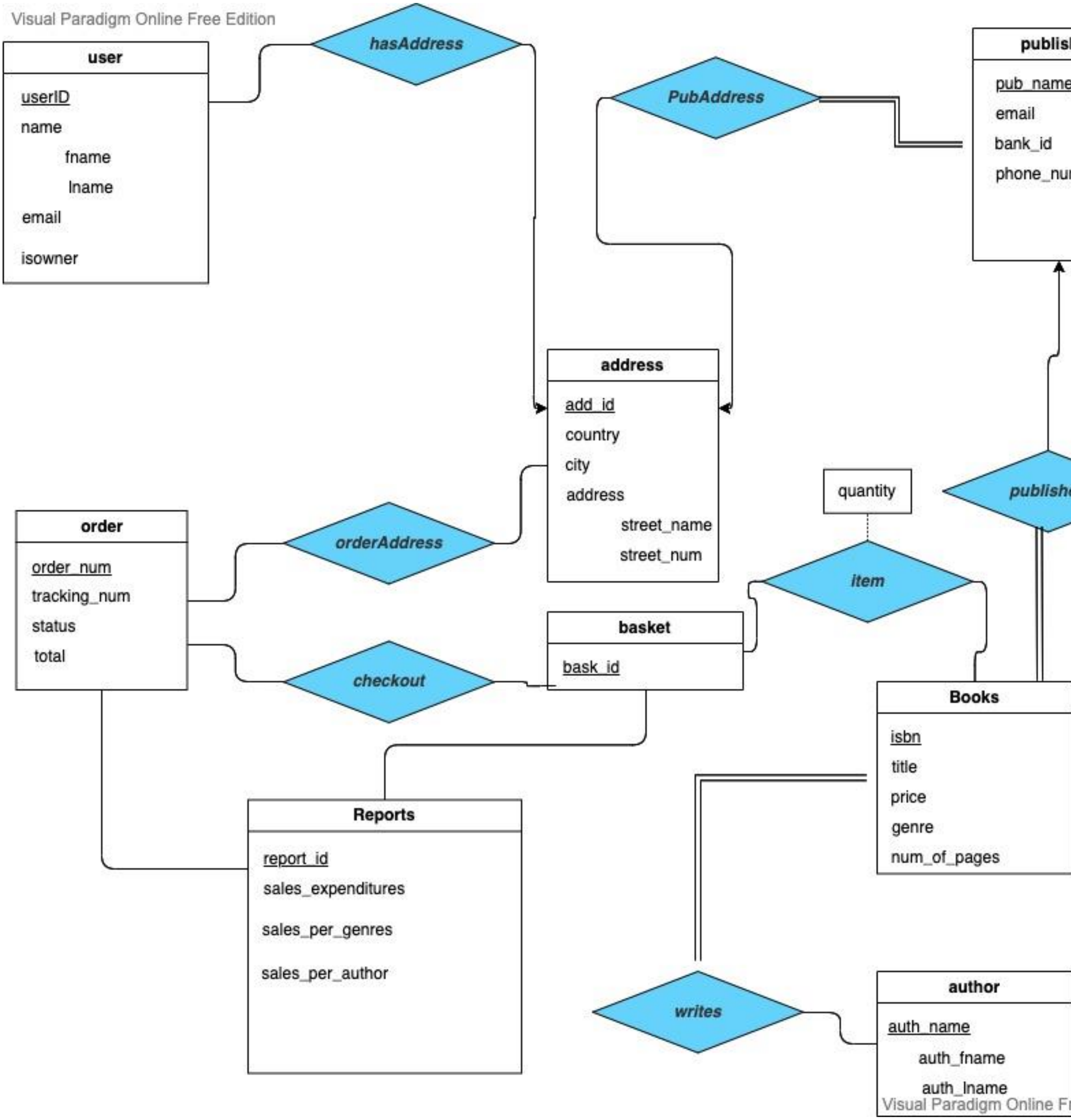
Conceptual Design

ER-Diagram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PubAddress
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item
basket
bask_id
checkout
Books
isbn
title
price
genre
num_of_pages
Reports
report_id
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sales_per_genres
sales_per_author
writes
author
auth_name
auth_fname
auth_lname
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Entities

- **User**
  The user entity represents a user of the bookstore. This entity contains 4 attributes, userID the primary key, fname, lname, and email. User_id uniquely identities a user.

- **Order**
  The order entity represents a users order at the bookstore. This entity contains 4 attributes, order_num the primary key, track_num, status, and total. Order_num uniquely identifies a user's order.

- **Reports**
  The reports entity represents a report for the bookstore sales. This entity contains 4 attributes, report_id the primary key, sales_expenditures, sales_per_genres, and sales_per_author. Report_id uniquely identifies each report.

- **Address**
  The address entity represents an address in the database for the bookstore. This entity contains 5 attributes, add_id the primary key, country, city, street_name, street_num. Add_id uniquely identifies a users address

- **Basket**
  The basket entity represents a user's basket before purchase. This entity contains 1 attributes, bask_id the primary key, which uniquely identities a users basket.

- **Books**
  The books entity represents the books contained in the database. This entity contains 5 attributes, isbn the primary key, title, price, num_of_pages, and genre. ISBN uniqiely identifies a book.

- **Author**
  The author entity represents an authors name in the database. This entity contains 2 attributes, auth_fname and auth_lname the primary keys, which uniquely identity an author.

- **publisher**
  The publisher entity represents a publishers contact information in the database. This entity contains 4 attributes, pub_name the primary key, email, bank_id, and phone_number. Pub_name uniquely identifies a publisher.

Relations

- **HasAddress**
  The "HasAddress" relation relates to a user having an address. The attributes of this relation are userID, and add_id the primary key.

- **owner**
  The "IsOwner" relation relates to a user being an owner. The attributes of this relation are the primary keys of userID, and boolean isowner because only one user can be an owner.

- **PubAddress**
  The "PubAddress" relation relates to a publisher having an address. The attributes of this relation are the pub_name, and add_id primary key because each publisher only has one address.

- **Checkout**
  The "Checkout" relation relates to an order having a basket number. The attributes of this relation are the primary key bask_id and order_id.

- **Writes**
  The "Writes" relation relates to an author and a book The attributes of this relation are the primary keys of auth_name, and isbn.

- **Publishes**
  The "Publishes" relation relates to a user having an address. The attributes of this relation are the primary key isbn, and pub_name.

- **item**

The “item” relation relates to a book in a basket. This relation allows for an individual book to have its own quantity while in the basket or for checkout. The attributes of this relation are the primary keys of isbn, and basket_num.

- **orderAddress**
  The “orderAddress” relation relates to an order with an address. This relation allows for each order to have a specific address it’s delivered to.

Cardinalities & Participation Types

- **User to address**
  The cardinality is many to one, with many users having one address.

- **User to owner**
  The cardinality is one-to-one as there is only one owner of the library.

- **Publisher to address**
  The cardinality is many to one, with many publishers having one address.

- **Books to publisher**
  The cardinality is many to one, with many books having one publisher.

- **Order to address**
  The cardinality is many to many, with many orders having many addresses.

- **Order to reports**
  The cardinality is many to many, with many orders having many reports.

- **Order to basket**
  The cardinality is one to one, with one order having one basket.

- **Basket to book**
  The cardinality is many to many, with many baskets having many books.

- **Books to author**
  The cardinality is many to many, with many books having many authors.

Total Participation

- Order to reports
- Order to address
- Books to author
- Basket to book

Partial Participation

- The cardinalities that are not listed.

Reduction to Relation Schemas

- user(userID, fname, lname, email, isowner)
- books(isbn, title, price, num_of_pages, genre)
- publisher(pub_name, email, bank_id, phone_number)
- address(add_id**,** country, city, street_name, street_num)
- author(auth_fname, auth_lname)
- order(order_num, tracking_num, status, total)
- basket(bask_id)
- hasAddress(add_id, userID)
- reports(report_id,sales_expenditures, sales_per_genres, sales_per_author)
- orderAddress(order_num, add_id**)**
- pubAddress(add_id, pub_name)
- checkout(bask_id,order_num)
- writes(auth_fname, auth_lname, isbn)
- publishes(pub_name,isbn)
- item(isbn,bask_id,quantity)

Normalization of Relation Schemas

- *user(userID, fname, lname, email, isOwner)*

F={ userID fname, lname, email, isOwner
email userID
}

(userID+)

Result = userID
userID fname, lname, email, isOwner:
result =userID ,fname, lname, email, isOwner
userID uniquely determines all the relations.
Therefore, userID is a superkey and the relation is in BCNF.

- *book(isbn, title, num_of_pages, price, genre)*

F={*isbntitle*,num_of_pages, *price*, *genre*}

(*isbn*+)
Result = *isbn*
isbn title, num_of_pages,*price*, *genre*:
result =*isbn* ,*title*, num_of_pages,*price*, *genre*
isbn uniquely determines all the relations.
Therefore, *isbn* is a superkey and the relation is in BCNF.

- publisher(pub_name, email, bank_id, phone_numbers)

F={ pub_name→ email,phone_numbers, bank_id
email pub_name
phone_numbers pub_name
bank_id pub_name}

(pub_name+)
Result =pub_name
pub_name *email*, phone_numbers, bank_id:
result =pub_name,bank_id,*email,* phone_numbers
Therefore, pub_name, email,phone_numbers, bank_id are all candidate keys and are in BCNF .

- author(auth_fname, auth_lname)

F={ auth_fnameauth_lname
auth_lname auth_fname
}

(auth_fname+)
Result = *auth_fname+*
auth_fnameauth_lname:

result =auth_fname, auth_lname

(auth_lname+)
Result = *auth_lname+*
auth_lnameauth_fname:
result =auth_lname, auth_fname
Therefore, auth_fname and auth_lname are both candidate keys and are in BCNF.

- address(add_id**,** country, city, street_name, street_num)

F={add_idcountry, city,street_name, street_num}

(add_id+)
Result = add_id
add_id country, city,street_name, street_num:
result =add_id, country, city,street_name, street_num
add_id uniquely determines all the relations.
Therefore, add_id is a superkey and the relation is in BCNF.

- order(order_num, tracking_num, status, total)

F={ order_numtracking_num, status, total
tracking_num order_num,status
}

(order_num+)
Result = order_num+
order_numtracking_num, status, total :
result =order_num,tracking_num, status, total

(tracking_num+)
Result = tracking_num+
tracking_numorder_num, status, total :
result =tracking_num,order_num, status, total
Therefore, auth_fname and auth_lname are both candidate keys and are in BCNF.

- basket(bask_id)

F={bask_idbask_id}

(bask_id+)
Result = bask_id
bask_id bask_id:
result =bask_id:
bask_id uniquely determines all the relations.
Therefore, bask_id is a superkey and is trivial. The relation is in BCNF.

- hasAddress(add_id, userID)
  F={ userIDadd_id
  add_id userID
  }
  (userID+)
  Result =userID
  userID add_id: result =userID, add_id

  (add_id+)
  Result = add_id
  add_id userID: result =add_id, userID
  Therefore, userID and add_id are both candidate keys and are in BCNF.

- reports(report_id,sales_expenditures, sales_per_genres, sales_per_author)
  F={   report_id→ sales_expenditures, sales_per_genres,sales_per_author }

  (report_id+)
  Result =report_id
  report_id sales_expenditures, sales_per_genres,sales_per_author:
  result =report_id,sales_expenditures,
  sales_per_genres,sales_per_author

  Therefore, report_id is a superkey and the relation is in BCNF.

- orderAddress(order_num, add_id)
  F={ order_num, add_idadd_id, order_num}

  (order_num,add_id+)

Result =order_num, add_id

order_num, add_id add_id, order_num : result =order_num, add_id

(order_num+)

Result = order_num

add_id, order_num add_id, order_num: result =add_id, userID

(add_id+)

Result = add_id

add_id, order_num add_id, order_num: result =add_id, userID

Therefore, order_num and add_id are both candidate keys and are in BCNF .

- pubAddress(add_id, pub_name)
  F={ add_id→ pub_name}

  (add_id+)
  Result =add_id
  add_id pub_name:
  result =

  Therefore, report_id is a superkey and the relation is in BCNF.

- checkout(bask_id,order_id)

  F={ bask_idorder_id
  order_id bask_id
  }
  (bask_id+)
  Result =bask_id
  bask_id order_id: result =bask_id, order_id

  (order_id+)
  Result = order_id
  order_id bask_id: result =order_id, bask_id
  Therefore, bask_id and order_id are both candidate keys and are in BCNF. .

- writes(auth_fname, auth_lname, isbn)
  F={ isbn auth_fname, auth_lname}
  (isbn+)

Result =isbn
isbn auth_fname, auth_lname : result =isbn, auth_fname, auth_lname
Therefore, isbn is a superkey and is in BCNF.

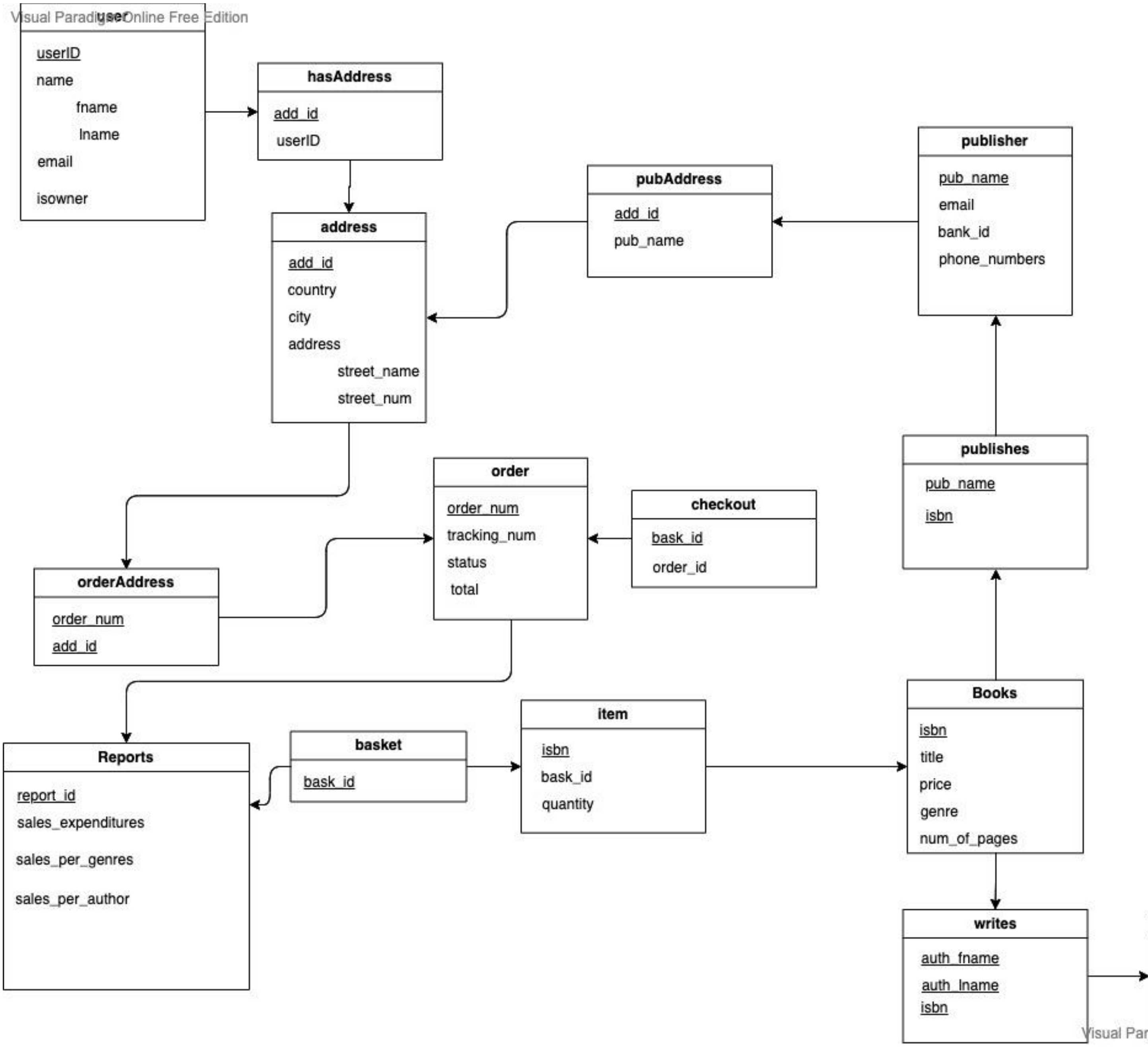
- publishes(pub_name,isbn)
  F={ pub_nameisbn
  isbn pub_name
  }
  (pub_name+)
  Result =pub_name
  pub_name isbn: result =pub_name, isbn

  (isbn+)
  Result = isbn
  isbn pub_name: result =isbn, pub_name
  Therefore, pub_name and isbn are both candidate keys and are in BCNF.

- item(isbn, bask_id,quantity)
  F={   isbn→ bask_id, quantity}

  (isbn+)
  Result =isbn
  isbn bask_id,quantity: result =isbn,bask_id,quantity
  result =isbn,bask_id,quantity
  Therefore, isbn is a superkey and the relation is in BCNF.

Database Schema Diagram


user
userID
name
fname
lname
email
isowner
hasAddress
add_id
userID
address
add_id
country
city
address
street_name
street_num
pubAddress
add_id
pub_name
publisher
pub_name
email
bank_id
phone_numbers
publishes
pub_name
isbn
order
order_num
tracking_num
status
total
checkout
bask_id
order_id
orderAddress
order_num
add_id
Reports
report_id
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sales_per_genres
sales_per_author
basket
bask_id
item
isbn
bask_id
quantity
Books
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auth_lname
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