Assignment: Store XML in a Database

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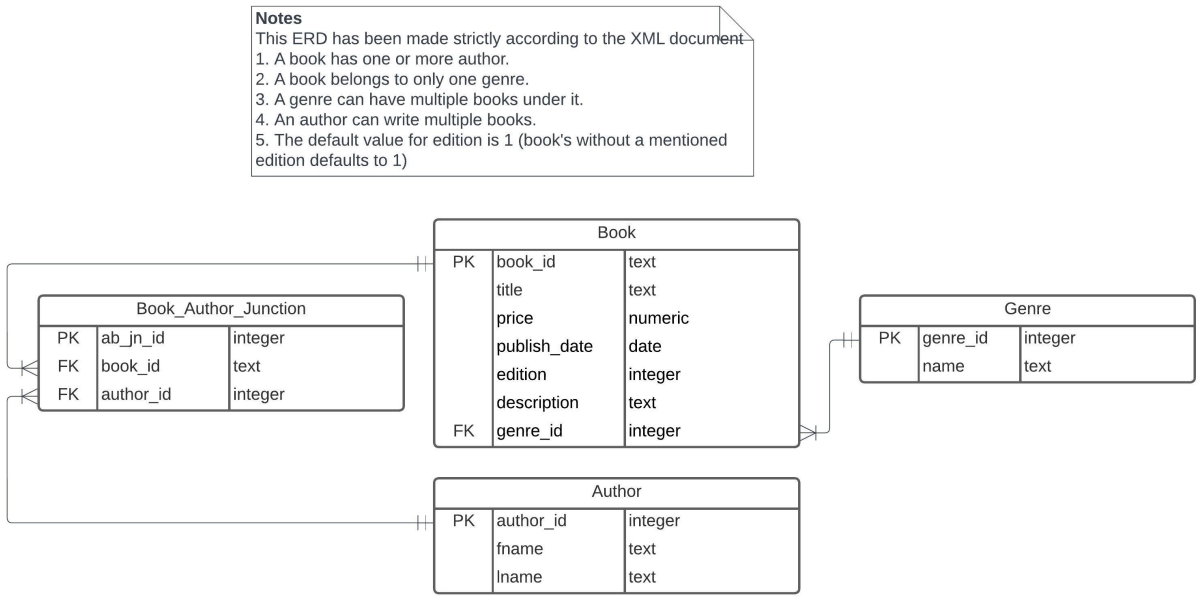
Loading required libraries

```
library(XML)
library(knitr)
library(RSQLite)
```

Question 1

Rendering the image of my ER Diagram

```
include_graphics('erd.jpeg')
```



Question 2

Connecting to the database

```
cwd <- getwd()
dbFile <- "book.db"
pathToDb <- paste0(cwd,  .Platform$file.sep, dbFile)
conn <-
  dbConnect(RSQLite::SQLite(), pathToDb)
```

Dropping tables before re-creating them

```
DROP TABLE IF EXISTS genre;
```

```
DROP TABLE IF EXISTS author;
```

```
DROP TABLE IF EXISTS book;
```

```
DROP TABLE IF EXISTS book_author_junction;
```

Creating table Genre

```
CREATE TABLE genre(
genre_id INTEGER PRIMARY KEY,
name TEXT NOT NULL
);
```

Creating table Author

```
CREATE TABLE author(
author_id INTEGER PRIMARY KEY,
fname TEXT NOT NULL,
lname TEXT NOT NULL
);
```

Creating table Book

```
CREATE TABLE book(
book_id TEXT PRIMARY KEY,
title TEXT NOT NULL,
price REAL NOT NULL,
publish_date DATE NOT NULL,
edition INTEGER DEFAULT 1,
description TEXT NOT NULL,
genre_id INTEGER NOT NULL,
CONSTRAINT fk_visit_genre_id FOREIGN KEY (genre_id)
REFERENCES genre(genre_id)
ON DELETE CASCADE
ON UPDATE CASCADE
);
```

Creating table Book_Author_Junction

```
CREATE TABLE book_author_junction(
ab_jn_id INTEGER PRIMARY KEY,
book_id INTEGER NOT NULL,
author_id INTEGER NOT NULL,
CONSTRAINT fk_visit_book_id FOREIGN KEY (book_id)
REFERENCES book(book_id)
ON DELETE CASCADE
ON UPDATE CASCADE,
CONSTRAINT fk_visit_author_id FOREIGN KEY (author_id)
REFERENCES author(author_id)
ON DELETE CASCADE
ON UPDATE CASCADE
);
```

Question 3

```
# Reading the XML file
xmlFile <- "Books-v4.xml"
pathToFile <- paste0(cwd, .Platform$file.sep, xmlFile)
parsedXML <- xmlParse(pathToFile, trim = T)
root <- xmlRoot(parsedXML)
sizeOfXML <- xmlSize(root)

# --- Author
# Processing authors
# The idea was to add all the authors into a vector, as a book may have multiple authors
# I then find the distinct values in this vector and then split their name into first
# and last name
firstNames <- c()
lastNames <- c()
authorXPath <- "//author"
author <- xpathSApply(root, authorXPath, xmlValue)
nauthor <- length(author)

for (i in 1:nauthor) {
   splitAuthorName <- strsplit(author[i], ', ')
   firstNames <- c(firstNames, splitAuthorName[[1]][[2]])
   lastNames <- c(lastNames, splitAuthorName[[1]][[1]])
}

firstNames <- unique(firstNames)
lastNames <- unique(lastNames)
noOfUniqueAuthors <- length(firstNames)

authorDf <- data.frame (author_id =  integer(noOfUniqueAuthors),
                        fname = character(noOfUniqueAuthors),
                        lname = character(noOfUniqueAuthors),
                        stringsAsFactors = F)

authorDf$author_id <- 1:noOfUniqueAuthors
authorDf$fname = firstNames
authorDf$lname = lastNames
# --- Author


# --- Genre
# The idea with genre was the same as authors, push all genres into a vector and then remove duplicates
genre = c()
authorXPath <- "//genre"
genres <- xpathSApply(root, authorXPath, xmlValue)
ngenres <- length(genres)

for (i in 1:ngenres) {
   genre <- c(genre, genres[i])
}

genre <- unique(genre)
noOfUniqueGenres <- length(genre)
```

```r
genreDf <- data.frame (genre_id =  integer(noOfUniqueGenres),
                       name = character(noOfUniqueGenres),
                       stringsAsFactors = F)

genreDf$genre_id <- 1:noOfUniqueGenres
genreDf$name = genre
# --- Genre

# --- Book
# To book dataframe is populated by a mix of xPath expressions and R
# The idea was to extract the book_id for every book
# then target a book by its book_id and then extract every other elemet from it
# the elements being publish_date, author, edition, price, etc
bookDf <- data.frame (book_id =  integer(sizeOfXML),
                       title = character(sizeOfXML),
                     price = double(sizeOfXML),
                     publish_date = character(sizeOfXML),
                     edition = integer(sizeOfXML),
                     description = character(sizeOfXML),
                     genre_id = integer(sizeOfXML),
                       stringsAsFactors = F)


bookIds = c()
authorIds = c()
populateAuthors <- function(bookId, authors, bookIds, authorIds) {
  nAuthors = length(authors)
  for (i in 1:nAuthors) {
    bookIds <- c(bookIds, bookId)
    splitAuthorName <- strsplit(authors[i], ", ")[[1]]
    locatedAuthor <- which(authorDf$fname == splitAuthorName[2]
                           & authorDf$lname == splitAuthorName[1])
    authorIds <- c(authorIds, locatedAuthor)
  }

  return(list(bookIds = bookIds, authorIds = authorIds))
}

for (i in 1:sizeOfXML) {
  bid <- xmlAttrs(root[[i]])
  commonXpath = sprintf("/catalog/book[@id='%s']/", bid)
  bookDf$book_id[i] <- bid

  authorXPath <- paste0(commonXpath, 'author')
  authors <- xpathSApply(root[[i]], authorXPath, xmlValue)
  result <- populateAuthors(bid, authors, bookIds, authorIds)
  bookIds <- result$bookIds
  authorIds <- result$authorIds

  titleXPath = paste0(commonXpath, 'title')
  title = xpathSApply(root[[i]], titleXPath, xmlValue)
  bookDf$title[i] <- title
```

```
  genreXpath = paste0(commonXpath, 'genre')
  genre = xpathSApply(root[[i]], genreXpath, xmlValue)
  bookDf$genre_id[i] <- which(genreDf$name == genre)


  priceXPath = paste0(commonXpath, 'price')
  price = xpathSApply(root[[i]], priceXPath, xmlValue)
  bookDf$price[i] <- as.double(price)

  pDateXPath = paste0(commonXpath, 'publish_date')
  pDate = xpathSApply(root[[i]], pDateXPath, xmlValue)
  bookDf$publish_date[i] <- pDate

  editionXPath = paste0(commonXpath, 'edition')
  edition = xpathSApply(root[[i]], editionXPath, xmlValue)
  if (length(edition) > 0) {
    bookDf$edition[i] <- edition
  } else {
     bookDf$edition[i] <- 1
  }

  descriptionXPath = paste0(commonXpath, 'description')
  description = xpathSApply(root[[i]], descriptionXPath, xmlValue)
  bookDf$description[i] <- description
}
nAuthorIds <- length(authorIds)
# --- Book

# --- Book_Author_Junction
# Here I map book_id to author_id
bookAuthorJnDf <- data.frame (ab_jn_id =  integer(nAuthorIds),
                          book_id = integer(nAuthorIds),
                        author_id = integer(nAuthorIds),
                          stringsAsFactors = F)
bookAuthorJnDf$book_id <- bookIds
bookAuthorJnDf$author_id <- authorIds
bookAuthorJnDf$ab_jn_id <- 1:nAuthorIds
# --- Book_Author_Junction
```

Question 4

Using dbWriteTable to write all the dataframes to the tables

```
dbWriteTable(conn, "author", authorDf, append = T, row.names = F)
dbWriteTable(conn, "genre", genreDf, append = T, row.names = F)
dbWriteTable(conn, "book", bookDf, append = T, row.names = F)
dbWriteTable(conn, "book_author_junction", bookAuthorJnDf, append = T, row.names = F)
```

Question 5.A

```
SELECT COUNT(*) AS no_of_genres
FROM (
    SELECT COUNT(*)
```

```
    FROM genre g
    JOIN book b ON b.genre_id = g.genre_id
    GROUP BY g.genre_id
    HAVING COUNT(*) >= 3
);
```

Table 1: 1 records

no_of_genres
2

Question 5.B

```
SELECT strftime('%Y', MIN(publish_date)) AS oldest_year
FROM book;
```

Table 2: 1 records

oldest_year
2000

Question 5.C

```
SELECT g.name, COUNT(g.genre_id) as no_of_books, AVG(b.price) as avg_price
FROM genre g
JOIN book b on b.genre_id = g.genre_id
GROUP BY g.genre_id;
```

Table 3: 5 records

name	no_of_books	avg_price
Computer	8	46.0875
Fantasy	5	6.3500
Romance	2	4.9500
Horror	1	4.9500
Science Fiction	1	6.9500

Question 5.D

```
SELECT b.title, COUNT(bajn.author_id)
FROM book_author_junction bajn
JOIN book b ON b.book_id = bajn.book_id
GROUP BY bajn.book_id
HAVING COUNT(bajn.author_id) > 1;
```

Table 4: 3 records

title	COUNT(bajn.author_id)
MSXML3: A Comprehensive Guide	2
Designing Ontologies with XML	2
Visual Basic for Beginners	3

Question 5.E

```
SELECT b.title, a.fname || ' ' || a.lname AS author
FROM book b
JOIN book_author_junction bajn ON b.book_id = bajn.book_id
JOIN author a ON bajn.author_id = a.author_id
WHERE b.price < 0.8 * (SELECT AVG(price) FROM book)
   OR b.price > 1.2 * (SELECT AVG(price) FROM book);
```

Table 5: Displaying records 1 - 10

title	author
XML Developer's Guide	Matthew Gambardella
Midnight Rain	Kim Ralls
Maeve Ascendant	Eva Corets
Oberon's Legacy	Eva Corets
The Sundered Grail	Eva Corets
Lover Birds	Cynthia Randall
Visual Studio	Mike Galos
Splish Splash	Paula Thurman
Creepy Crawlies	Stefan Knorr
Paradox Lost	Peter Kress

Disconnect from database

```
dbDisconnect(conn)
```