E-Commerce Transaction Data:

An Online Gift Shop Retailer Case

DATA607 Project 3 Presentation

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Who Presents What

DH Kim: Data Acquisition from Web

- Motivation, Gift shop business, How to import Excel data from web, Data structure

Cassie Boylan: Revenue Analysis from Invoices Data

- An Online gift shop retailer, Pre-processing data, Top 10 and bottom 10 gift items sold, Results of analysis

Alexis Mekueko: Data Management with Database

- Why database?: securing data, Theoretical E-R diagram, Normalizing: The customer table

Data Acquisition from Web

Motivation

Recent crisis of retail stores

Linking business-related activities to real-world data

*Virtually every aspect of business is now open to data collection and often instrumented for data collection: operations, manufacturing, **supply-chain management**, customer behaviour, market campaign performance, workflow procedures, and so on (page 1, Data Science for Business)*

Gift Shop Business and Transaction Data

An Online Retailer

- This is an UK-based online gift shop retailer selling gift goods to customers (mainly wholesalers) across countries.
- Main items sold include Assorted Color Bird Wind Ornaments, Pink Cheery Lights, Floral Elephant Soft Toy, and so on.

E-Commerce Invoice Data

- Information on which items are sold, how many, and how much, who buys them, and when and what time are they ordered.
- Data covering from 12/1/2009 to 12/9/2011, which is stored in an Excel file with two separate sheets.

Importing Excel Data from the Web

Source: The Website of UCI Machine Learning Repo

Packages needed:

```
library(readxl)
library(httr)
```

The GET() and read_excel() functions

```
retailURL <-
    "http://archive.ics.uci.edu//ml//machine-learning-databases//00502//online_retail_II.xlsx"
```

```
GET(retailURL, write_disk(tempFileName <- tempfile(fileext = ".xlsx")))
```

```
retail_sheet_2009 <- read_excel(tempFileName, sheet = "Year 2009-2010")
retail_sheet_2010 <- read_excel(tempFileName, sheet = "Year 2010-2011")
retaildf <- rbind(retail_sheet_2009, retail_sheet_2010)
```

Description of Data

Invoices Data

```
library(tidyverse)
glimpse(retaildf)
```

```
## Rows: 1,067,371
## Columns: 8
## $ Invoice       <chr> "489434", "489434", "489434", "489434", "489434", "48...
## $ StockCode     <chr> "85048", "79323P", "79323W", "22041", "21232", "22064...
## $ Description   <chr> "15CM CHRISTMAS GLASS BALL 20 LIGHTS", "PINK CHERRY L...
## $ Quantity      <dbl> 12, 12, 12, 48, 24, 24, 24, 10, 12, 12, 24, 12, 10, 1...
## $ InvoiceDate   <dttm> 2009-12-01 07:45:00, 2009-12-01 07:45:00, 2009-12-01...
## $ Price         <dbl> 6.95, 6.75, 6.75, 2.10, 1.25, 1.65, 1.25, 5.95, 2.55,...
## $ `Customer ID` <dbl> 13085, 13085, 13085, 13085, 13085, 13085, 13085, 1308...
## $ Country       <chr> "United Kingdom", "United Kingdom", "United Kingdom",...
```

Summary of Revenue and Transaction by Year

```
library(stringr)
library(kableExtra)
retaildf$Date <- str_sub(retaildf$InvoiceDate, start=1, end=10)
retaildf$Year <- str_extract(retaildf$InvoiceDate, "\\d{4}")

summaReTr <- retaildf %>%
  filter(!is.na(Description)&!is.na(`Customer ID`)&Quantity > 0&Price > 0) %>%
  mutate(Revenue = round(Quantity*Price, digit = 2)) %>%
  group_by(Year) %>%
  summarise(Revenue = sum(Revenue),
            n_transactions = n_distinct(Invoice),
            n_obs = n(),
            First_Date = min(Date),
            Last_Date = max(Date))
kbl(summaReTr, booktabs = T)
```

Year	Revenue	n_transactions	n_obs	First_Date	Last_Date
2009	686654.2	1512	30754	2009-12-01	2009-12-23
2010	8718063.0	18325	403067	2010-01-04	2010-12-23
2011	8338712.0	17132	371728	2011-01-04	2011-12-09

Revenue Analysis from Invoices Data

An Online Retailer Case

- This is Online Gift Shop Retailer
- Data from 12/1/2009 to 12/9/2011 daily including time information
- The number of annual transactions is about 18,000 (Year 2010)
- The annual revenue is about 8 millions (Year 2010)

Pre-processing 1

```
library(dplyr)
library(ggplot2)
library(lubridate)
library(tidyverse)
library(scales)
library(janitor)
library(epiDisplay)
```

```
retaildf_2009 <- retaildf %>%
    filter(as.Date.POSIXct(InvoiceDate)=='2009-12-01') %>%
    filter(!is.na(Description) &!is.na(`Customer ID`) & Quantity > 0) %>%
    mutate(Dollar_Total = Quantity * Price) %>%
    group_by(StockCode, Description) %>%
    summarise(Total_Earned = sum(Dollar_Total),
              Total_Sold = sum(Quantity)) %>%
    arrange(desc(Total_Earned)) %>%
    ungroup() %>%
    mutate(Proportion_of_Revenue = scales::percent( Total_Earned/sum(Total_Earned)))
```

Top 10 Gift Items Sold

```
top10 <- retaildf_2009 %>%
    filter(Total_Earned> 0) %>%
    slice_max(Total_Earned, n=10)
top10$StockCode <- NULL
kbl(top10, booktabs = T) %>%
kable_styling(latex_options = "striped")
```

Description	Total_Earned	Total_Sold	Proportion_of_Revenue
ASSORTED COLOUR BIRD ORNAMENT	1919.28	1272	4%
PAPER CHAIN KIT 50'S CHRISTMAS	998.40	368	2%
PAPER CHAIN KIT RETRO SPOT	729.95	277	2%
RETRO SPOT TEA SET CERAMIC 11 PC	727.80	164	2%
WHITE HANGING HEART T-LIGHT HOLDER	681.35	257	2%
PINK CHERRY LIGHTS	601.65	103	1%
SCOTTIE DOG HOT WATER BOTTLE	583.20	128	1%
WHITE CHERRY LIGHTS	558.60	92	1%
POSTAGE	505.00	15	1%
FLORAL ELEPHANT SOFT TOY	398.25	105	1%

Bottom 10 Gift Items Sold

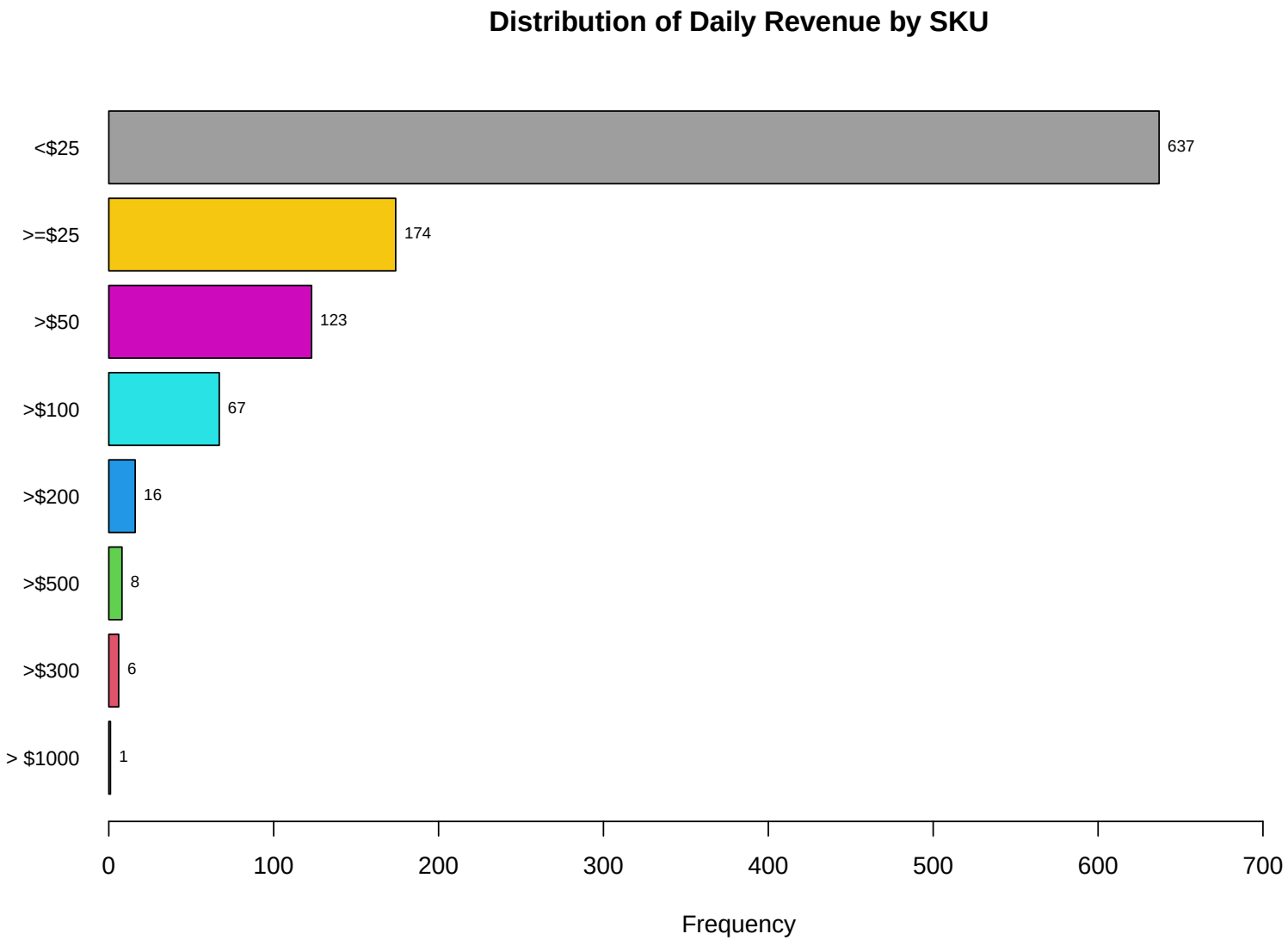
```
bottom10 <- retaildf_2009 %>%
    filter(Total_Earned > 0) %>%
    slice_min(Total_Earned, n=10)
bottom10$StockCode <- NULL
kbl(bottom10, booktabs = T) %>%
kable_styling(latex_options = "striped")
```

Description	Total_Earned	Total_Sold	Proportion_of_Revenue
PAPER POCKET TRAVELING FAN	0.28	2	0%
LOVE POTION MASALA INCENSE	0.42	2	0%
HAPPY ANNIVERSARY CANDLE LETTERS	0.42	1	0%
KITCHEN METAL SIGN	0.55	1	0%
TOILET METAL SIGN	0.55	1	0%
HEART DECORATION PAINTED ZINC	0.65	1	0%
DOVE DECORATION PAINTED ZINC	0.65	1	0%
STAR DECORATION PAINTED ZINC	0.65	1	0%
RAIN HAT WITH RED SPOTS	0.84	2	0%
POP ART PEN CASE & PENS	0.85	1	0%
12 PENCILS TALL TUBE WOODLAND	0.85	1	0%
BIRD BOX CHRISTMAS TREE DECORATION	0.85	1	0%
SET/20 POSIES PAPER NAPKINS	0.85	1	0%
PANDA AND BUNNIES STICKER SHEET	0.85	1	0%
PACK 20 ENGLISH ROSE PAPER NAPKINS	0.85	1	0%

Pre-processing 2

```
proportion_totals <- retaildf_2009 %>%
    mutate(daily_revenue = case_when(
        between(Total_Earned, 1001, max(Total_Earned)) ~ "> $1000",
        between(Total_Earned, 500, 1000) ~ ">$500",
        between(Total_Earned, 301, 500) ~ ">$300",
        between(Total_Earned, 201, 300) ~">$200",
        between(Total_Earned, 101, 200) ~">$100",
        between(Total_Earned, 51, 100) ~">$50",
        between(Total_Earned, 25, 50) ~">=$25",
        between(Total_Earned, 0, 24) ~"<$25",
        TRUE ~ "loss")) %>%
    filter(daily_revenue!="loss")
```

Results: Distribution of Revenue by SKU



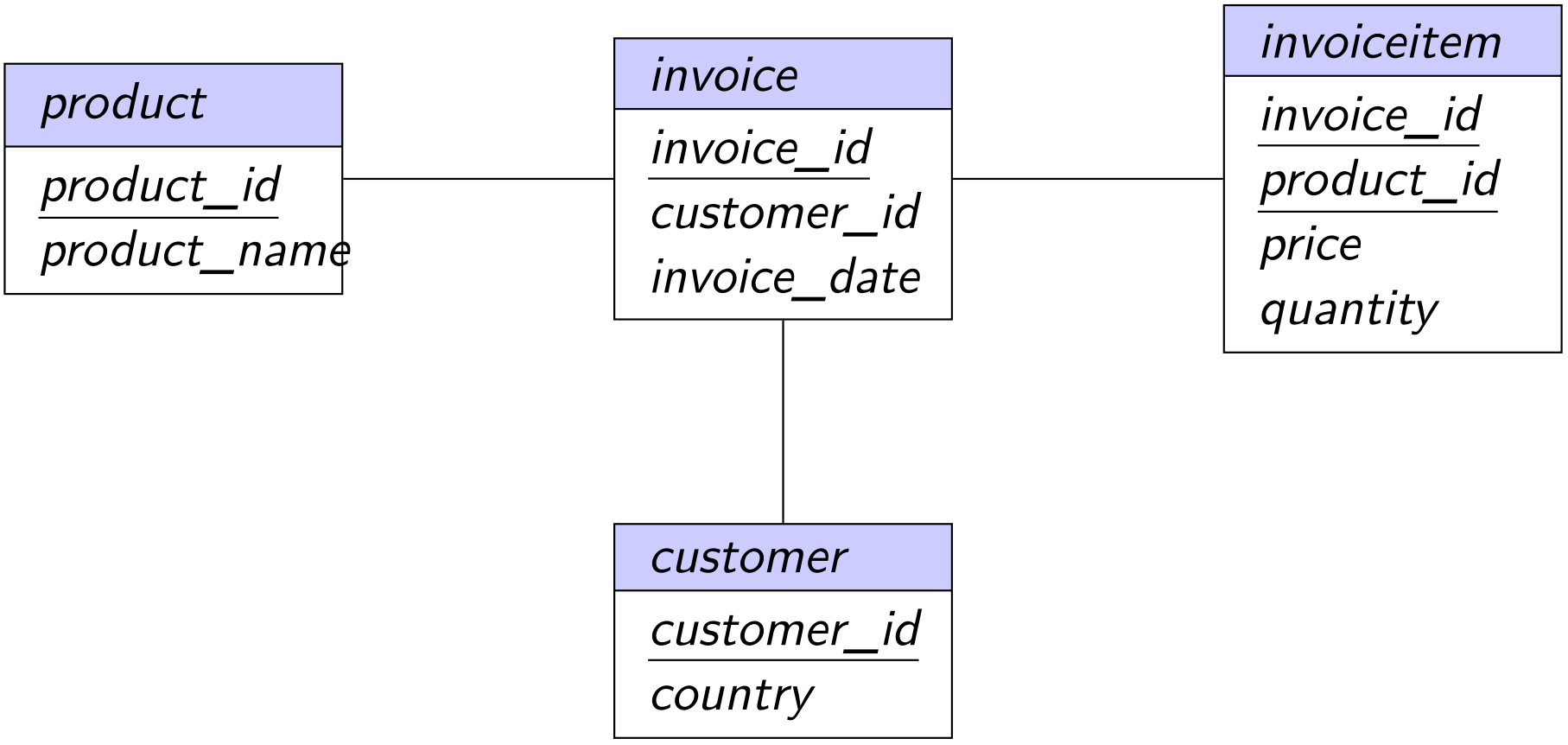
Data Management with Database

Why Database: An Example of Securing Data

```
# establishing the connectioon to SQL server to access db
con <- dbConnect(odbc(),
  # server type
  Driver = "SQL Server",
  #server name
  Server = "ATM\\ATMSERVER",
  # this is one of the db I want to import
  Database = "Data607_Project3_db",
  UID = "Alex",
  # password required
  PWD = rstudioapi::askForPassword("Database password"),
  ort = 1433)
}
```

PWD = rstudioapi::askForPassword("Database password")

E-R Diagram


product
product_id
product_name
invoice
invoice_id
customer_id
invoice_date
invoiceitem
invoice_id
product_id
price
quantity
customer
customer_id
country

Normalizing

A set of normalized tables

Customer, product, invoice, and invoiceitem tables

An efficient way to storing data

Easy for data maintenance and upgrade

A secured way to access data

Control access to data with password

An Example: The customer table

```
varKeep <- c("Customer ID", "Country")
customerTable <-
  retaildf[unique(retaildf$`Customer ID`), varKeep]
names(customerTable) <- c("CustomerID", "Country")
customerTable <- customerTable %>%
  drop_na(CustomerID) %>%
  arrange(desc(CustomerID))
```

A Sample Code for DB

```
Script for SelectTopNRows command from SSMS
SELECT TOP (1000000) [NoName]
      ,[Invoice]
      ,[StockCode]
      ,[Description]
      ,[Quantity]
      ,[InvoiceDate]
      ,[Price]
      ,[CustomerID]
      ,[Country]
  FROM [Data607_Project3_db].[dbo].[retail_sheet_2009]

SELECT * FROM [Data607_Project3_db].[dbo].[retail_sheet_2009];

delete from dbo.retail_sheet_2009
  where isnull([dbo].[retail_sheet_2009].[InvoiceDate],'')='';
--use this case to check all the column since there aren't many
delete from dbo.retail_sheet_2009 where Country is null or
Description is null or StockCode is null or Invoice is null or
Quantity is null or InvoiceDate is null or Price is null;
```

A Sample Code for DB (continued)

```
ALTER TABLE dbo.retail_sheet_2009
  DROP COLUMN NoName;

CREATE TABLE InvoiceDetail (
    InvoiceNumber varchar(50),
    StockNumber varchar(50),
    ItemPrice float,
    Quantity float
    );

INSERT INTO InvoiceDetail (InvoiceNumber, StockNumber, Quantity, ItemPrice)
SELECT DISTINCT Invoice, StockCode, Quantity, Price
FROM    retail_sheet_2009;
```