

# eCommerce Model

## Types

- Customer
  - ID
  - year of birth
  - gender
  - country
- Order
- Items
  - Type
  - Price

## ▼ Customer Generation

### Attributes

- *ID* → “customer1”, “customer2”, ...
- *Gender* → 50:50
- *YearOfBirth* → normal( $\mu$ : 30,  $\sigma$ : 10)
- ▼ *Country* → EU-Population distribution

EU Countries

Country	% of Population
Germany	18.81%
France	15.18%
Italy	13.12%
Spain	10.72%
Poland	8.20%
Romania	4.25%
Netherlands	3.97%

Country	% of Population
Belgium	2.62%
Czech Republic	2.41%
Sweden	2.35%
Portugal	2.33%
Greece	2.32%
Hungary	2.14%
Austria	2.03%
Bulgaria	1.44%
Denmark	1.32%
Finland	1.24%
Slovakia	1.21%
Ireland	1.16%
Croatia	0.86%
Lithuania	0.64%
Slovenia	0.47%
Latvia	0.42%
Estonia	0.30%
Cyprus	0.21%
Luxembourg	0.15%
Malta	0.13%

## Registration

**Assumption:** at the beginning, there are no customers, then the customer base grows exponentially

- *GLOBAL\_REGISTRATION\_DELAY\_LOWER\_DAYS*,  
*GLOBAL\_REGISTRATION\_DELAY\_UPPER\_DAYS*
  - upper and lower limit on how long to wait until a new customer registers itself
- *GROWTH\_COEFF*

- chance of which a newly registered customer will “recruit” a second one (to spark exponential growth)

## Login

- *LOCAL\_LOGIN\_DELAY\_LOWER\_DAYS*,  
*LOCAL\_LOGIN\_DELAY\_UPPER\_DAYS*
  - upper and lower limit on how long to wait until “the same” customer logs in again

## Order

If the customer is logged in, there is a chance of *CHANCE\_OF\_ORDER* that he will create an order

(Currently, a customer places at most one order per “session”, i.e., login-logout)

## ▼ Add Items

### ▼ Item list

We have 20 different items with different price ranges. Per Order, we add between 1-10 items.

Type	Price Range
Sunscreen	\$5 - \$20
Umbrella	\$10 - \$40
Laptop	\$300 - \$3,000
Smartphone	\$200 - \$1,500
T-shirt	\$10 - \$30
Swimwear	\$10 - \$50
Jeans	\$30 - \$80
Coffee maker	\$20 - \$200
Headphones	\$20 - \$300
Sneakers	\$30 - \$150
Camera	\$200 - \$2000
Camera Bag	\$5 - \$50
Tennis racket	\$20 - \$200
Pet food	\$10 - \$50
Jacket	\$70 - \$200

Type	Price Range
Car battery	\$50 - \$150
Multivitamin	\$5 - \$20
Necklace	\$20 - \$100
Printer	\$50 - \$300
Tent	\$50 - \$300

The probability of picking an item is **evenly distributed**, but there are the following **association rules**:

- Younger people (<25) → electronics
  - with a chance of 50%, draw out of: Laptop, Smartphone, Headphones, Printer
- Older people (>35) → old people stuff
  - with a chance of 50%, draw out of: multivitamin, pet food, coffee maker
- Sunny (Spain, Portugal, Greece, Cyprus, Malta)
  - with a chance of 50% draw out of: Sunscreen, Swimwear
- Rainy (Ireland, Belgium, Luxembourg, Netherlands, Denmark)
  - with a chance of 50%, draw out of: Umbrella, Jacket
- Also account for combinations: Young-Sunny, Young-Rainy, Old-Sunny, Old-Rainy

**Association rules** within an order:

When camera is picked, there is a chance of *ASSOCIATION\_STRENGTH*, that a camera bag is picked as well

Between adding Items to an order, there is a **random delay** between 0-10 min

## ▼ Orders and Delivery

User places the order (same length of delay as when adding an item, after adding the last one), he is logged out

## Payment

2 Cases:

- With a probability of *CHANCE\_PAY\_INSTANT*, the user pays online directly after placing the order, then the payment is confirmed, then the invoice is sent.
- Alternatively, the user “pays via invoice”: after the invoice is sent, the user takes 1-14 days to pay, only after confirming the payment.
  - During the first 7 days, there is a chance of *CHANCE\_CANCELATION* that the user cancels the order. Then, there are no further actions.

Only after confirming the payment, preparing the delivery is continued.

## Delivery

With a chance of *CHANCE\_CANCELATION*, the user selects a “fast delivery”, otherwise he chooses “normal delivery”. With an error of *CHANCE\_WRONG\_DELIVERY\_OPTION*, the package is shipped normally instead of fast (or vice versa)

### Distribution of Order to packages:

- An order is decomposed into a random amount of packages, the items are assigned to the packages in a random order
  - suppose there are *itemsLeftToPackage* items that still need to be packaged
  - pick a *packageSize* randomly from [1, itemsLeftToPackage]
  - form a package of *packageSize* items that are randomly chosen from the items that are not packaged yet and continue with its delivery
  - continue until there are no items left to package
- Then the packages are shipped individually (fast-if chosen “fast delivery”, slower - otherwise)
  - give to carrier (fast/normal)
  - carrier confirms (fast/normal)
  - delivery (fast/normal)
  - delivered

With a chance of *PACKAGE\_DEVIATION*, the package is packed wrongfully, then:

- With a chance of *CHANCE\_ITEM\_ADD*, another item (that was not ordered) is packed
- With a chance of  $1-CHANCE\_ITEM\_ADD$ , a random item of the order is missed

## ▼ Time Block

### Configuration:

- *STARTOFWORK*: Time of day that work starts
- *ENDOFWORK*: Time of day that work ends
- distribution of time on “target day” is variable and can be passed as a parameter
  - exemplary functions:
    - *drawTimeWeekdayEx()* - normally distributed with  $\mu=20:15h$ ,  $\sigma=2h$
    - *drawTimeWeekdayEx()* - normally distributed with two peaks:  $\mu_1=12h$ ,  $\sigma_1=3h$ ,  $\mu_2=18h$ ,  $\sigma_2=3h$

### Functions

- *delayByDays(days, drawTimeWeekday, drawTimeWeekend)*
  - time is delayed by *days* days, then a target time is randomly chosen according to *drawTimeWeekday* or *drawTimeWeekend* depending on whether the target day is on a weekend or not
- *delayByWeekdays(days, drawTime)*
  - time is delayed by *days* working days, then a target time is randomly chosen according to *drawTime*
- *delayByWorkingHours(hours)*
  - time is delayed by *hours* working hours (i.e., hours that are not on a weekend and within [*STARTOFWORK*,*ENDOFWORK*])

## ▼ Todos & Problems

### ▼ Todos

- ✓ ~~Separate Items from Association rules within order and customer item~~
  - ✓ ~~Buy Camera → Buy Camera Bag~~
- ✓ ~~Fix Long term dependency remaining tokens~~
- ✓ ~~Item packaging conformance issues~~
  - ✓ ~~add item~~
  - ✓ ~~remove items~~
- ✓ ~~Package fast/normal delivery conformance issues~~
- ☐ Logging