Here the primary key is bold and is underlined and the foreign key is bold with an asterisk(\*).

UNF –

**users(user\_id**, username, password, email, registration\_date, last\_login\_date, {log\_id, activity\_type, timestamp, details},{wishlist\_id, date\_added, {product\_id, name, description, price,inventory\_id, current\_stock, safety\_stock\_level, reorder\_point, discount\_id, discount\_type, discount\_value, start\_date, end\_date, {image\_id, image\_url, description, upload\_date}, vendor\_id, vendor\_name, contact\_information, address, registration\_date, {analytics\_id, date, total\_sales, total\_orders, popular\_products},{category\_id, name, description},{data\_id, interaction\_type, interaction\_date},{review\_id, rating, comment, review\_date}, {order\_detail\_id, quantity, price, order\_id, order\_date, total\_amount, status}}})

1NF –

Here we separate the repeating groups. We then get the following tables:

**users-1(user\_id,** username, password, email, registration\_date, last\_login)

**user\_activity-1(log\_id,** activity\_type, timestamp, details, **user\_id\***)

**wishlist-1(wishlist\_id**, date\_added, **user\_id\***)

**product-1(product\_id,** name, description, price, inventory\_id, current\_stock, safety\_stock\_level, reorder\_point, discount\_id, discount\_type, discount\_value, start\_date, end\_date, vendor\_id, vendor\_name, contact\_information, address, registration\_date **wishlist\_id\*, user\_id\*)**

**product\_images-1(image\_id,** image\_url, description, upload\_date, **product\_id\*, wishlist\_id\*, user\_id\*)**

**sales\_analytics-1(analytics\_id**, date, total\_sales, total\_orders, popular\_products, **product\_id\*, wishlist\_id\*, user\_id\*)**

**categories-1(category\_id,** name, description, **product\_id\*, wishlist\_id\*, user\_id\*)**

**recommendation\_engine\_data-1(data\_id**, interaction\_type, interaction\_date, **product\_id\*, wishlist\_id\*, user\_id\*)**

**product\_review-1(review\_id,** rating, comment, review\_date, **product\_id\*, wishlist\_id\*, user\_id\*)**

**order\_detail-1(order\_detail\_id**, quantity, price, order\_id, order\_date, total\_amount, status, **product\_id\*, wishlist\_id\*, user\_id\*)**

**2NF –**

We remove the partial dependencies here(no indepth explanation at the moment):

**users-2(user\_id,** username, password, email, registration\_date, last\_login)

**user\_activity-2(log\_id,** activity\_type, timestamp, details)

**user\_activity\_users-2(user\_id\*, log\_id\*)**

**wishlist-2(wishlist\_id**, date\_added)

**product-2(product\_id,** name, description, price, inventory\_id, current\_stock, safety\_stock\_level, reorder\_point, discount\_id, discount\_type, discount\_value, start\_date, end\_date, vendor\_id, vendor\_name, contact\_information, address, registration\_date)

**product\_images-2(image\_id,** image\_url, description, upload\_date)

**sales\_analytics-2(analytics\_id**, date, total\_sales, total\_orders, popular\_products)

**categories-2(category\_id,** name, description)

**recommendation\_engine\_data-2(data\_id**, interaction\_type, interaction\_date)

**product\_review-2(review\_id,** rating, comment, review\_date)

**order\_detail-2(order\_detail\_id**, quantity, price, order\_id, order\_date, total\_amount, status)

**order\_detail\_product\_wish\_user-2(order\_detail\_id\* product\_id\*, wishlist\_id\*, user\_id\*)**

**product\_review\_product\_wish\_user-2(review\_id\*, product\_id\*, wishlist\_id\*, user\_id\*)**

**recommendation\_engine\_data\_product\_wish\_user-2(data\_id\*, product\_id\*, wishlist\_id\*, user\_id\*)**

**categories\_product\_wish\_user-2(category\_id\*, product\_id\*, wishlist\_id\*, user\_id\*)**

**sales\_analytics\_product\_wish\_user-2(analytics\_id\*, product\_id\*, wishlist\_id\*, user\_id\*)**

**product\_image\_wish\_user-2(image\_id\*, product\_id\*, wishlist\_id\*, user\_id\*)**

**3NF-**

Here we remove transitive dependencies:

Users is the same

User\_activity is the same

User\_activity\_users is the same

Wishlist is the same

**Product-3**(**product\_id,** name, description, price, **inventory\_id\*, discount\_id\*, vendor\_id\*)**

**Inventory-3(inventory\_id,** current\_stock, safety\_stock\_level, reorder\_point)

**Discount-3(discount\_id**, discount\_type, discount\_value, start\_date, end\_date)

**Vendor-3(vendor\_id,** vendor\_name, contact\_information, address, registration\_date)

Product\_image is the same

Sales\_analytics is the same

Categories is the same

Recommendation\_engine is the same

Product\_review is the same

**Order\_detail-3(order\_detail\_id,** quantity, price, **order\_id\*)**

**Order-3(order\_id,** order\_date, total\_amount, status)

Others are the same too.

Denormalizing:

In the case of our various junction tables, we can denormalize them to make them more efficient and cause no abnormalities to appear in the table.

**users-3(user\_id,** username, password, email, registration\_date, last\_login)

**user\_activity-3(log\_id,** activity\_type, timestamp, details, **user\_id**\*)

**wishlist-3(wishlist\_id**, date\_added, **user\_id\***)

**product\_wish-3(wishlist\_id\*, product\_id\*)**

**Product-3**(**product\_id,** name, description, price, **inventory\_id\*, discount\_id\*, vendor\_id\*)**

**Inventory-3(inventory\_id,** current\_stock, safety\_stock\_level, reorder\_point)

**Discount-3(discount\_id**, discount\_type, discount\_value, start\_date, end\_date)

**Vendor-3(vendor\_id,** vendor\_name, contact\_information, address, registration\_date)

**product\_images-3(image\_id,** image\_url, description, upload\_date, **product\_id\***)

**sales\_analytics-3(analytics\_id**, date, total\_sales, total\_orders, popular\_products, **vendor\_id\***)

**categories-3(category\_id,** name, description)

**product\_category-3(category\_id\*, product\_id\*)**

**recommendation\_engine\_data-2(data\_id**, interaction\_type, interaction\_date, **user\_id\***)

**product\_recommendation(product\_id\*, data\_id\*)**

**product\_review-2(review\_id,** rating, comment, review\_date, **user\_id\*)**

**Order\_detail-3(order\_detail\_id,** quantity, price, **order\_id\*, product\_id\*)**

**Order-3(order\_id,** order\_date, total\_amount, status, **user\_id\***)