```
import pandas as pd
```

```
orders = pd.read_csv("/content/orders.csv")
order_products = pd.read_csv("/content/order_products__prior.csv")
products = pd.read_csv("/content/products.csv")
```

```
orders.head()
```

	order_id	user_id	eval_set	order_number	order_dow	order_hour_of_day	days_since_prior_order
0	2539329	1	prior	1	2	8	NaN
1	2398795	1	prior	2	3	7	15.0
2	473747	1	prior	3	3	12	21.0
3	2254736	1	prior	4	4	7	29.0
4	431534	1	prior	5	4	15	28.0

```
print(orders.shape)
print(order_products.shape)
print(products.shape)
```

```
(3421083, 7)
(32434489, 4)
(49688, 4)
```

```
merged = order_products.merge(products, on="product_id")
```

```
merged.head()
```

	order_id	product_id	add_to_cart_order	reordered	product_name	aisle_id	department_id
0	2	33120	1	1	Organic Egg Whites	86	16
1	2	28985	2	1	Michigan Organic Kale	83	4
2	2	9327	3	0	Garlic Powder	104	13
3	2	45918	4	1	Coconut Butter	19	13
4	2	30035	5	0	Natural Sweetener	17	13

```
top_products = (
    merged["product_name"]
    .value_counts()\
    .head(10)
)
top_products
```

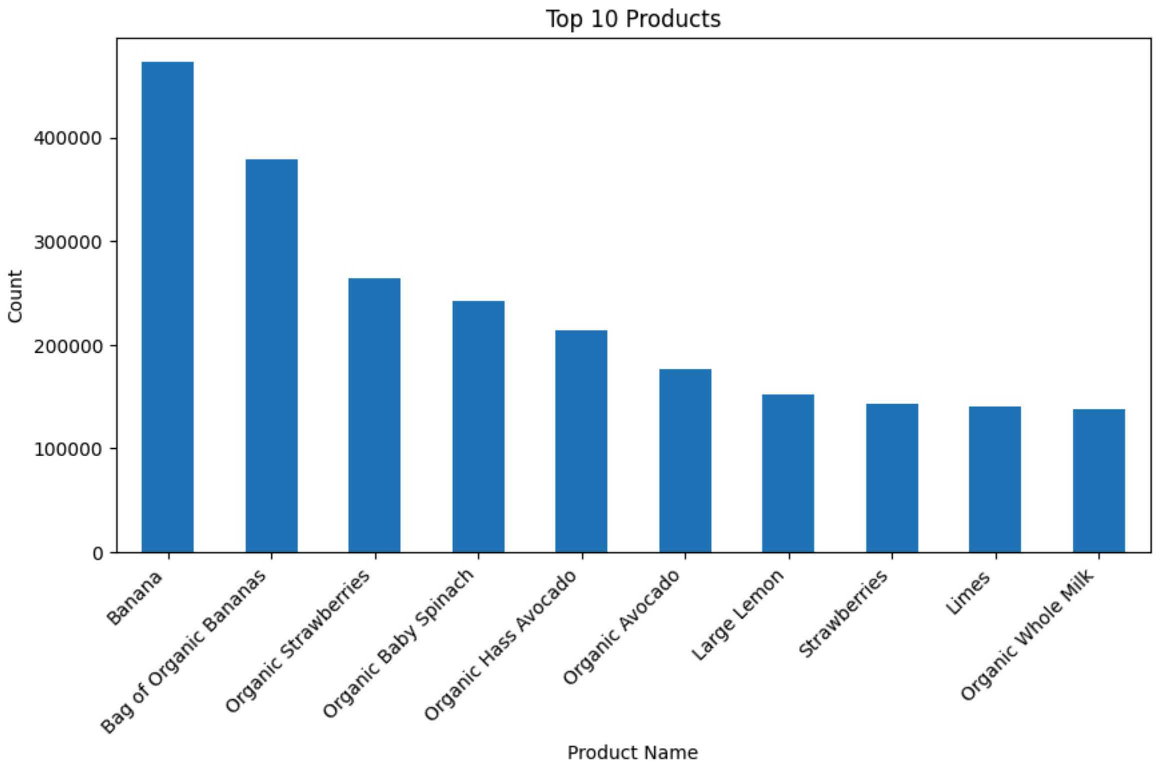
product_name	count
Banana	472565
Bag of Organic Bananas	379450
Organic Strawberries	264683
Organic Baby Spinach	241921
Organic Hass Avocado	213584
Organic Avocado	176815
Large Lemon	152657
Strawberries	142951
Limes	140627
Organic Whole Milk	137905

dtype: int64

```
import matplotlib.pyplot as plt
```

```
plt.figure(figsize=(10, 5))
top_products.plot(kind="bar")
plt.title("Top 10 Products")
plt.xlabel("Product Name")
plt.ylabel("Count")
plt.xticks(rotation=45, ha="right")
```

```
(array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9]),
 [Text(0, 0, 'Banana'),
  Text(1, 0, 'Bag of Organic Bananas'),
  Text(2, 0, 'Organic Strawberries'),
  Text(3, 0, 'Organic Baby Spinach'),
  Text(4, 0, 'Organic Hass Avocado'),
  Text(5, 0, 'Organic Avocado'),
  Text(6, 0, 'Large Lemon'),
  Text(7, 0, 'Strawberries'),
  Text(8, 0, 'Limes'),
  Text(9, 0, 'Organic Whole Milk')])
```



```
test_user = 1
```

```
merged_user = merged.merge(
    orders[["order_id", "user_id"]],
    on="order_id"
)
```

```
merged_user.head()
```

	order_id	product_id	add_to_cart_order	reordered	product_name	aisle_id	department_id	user_id
0	2	33120	1	1	Organic Egg Whites	86	16	202279
1	2	28985	2	1	Michigan Organic Kale	83	4	202279
2	2	9327	3	0	Garlic Powder	104	13	202279
3	2	45918	4	1	Coconut Butter	19	13	202279
4	2	30035	5	0	Natural Sweetener	17	13	202279

```
print(merged_user.shape)
merged_user.head()
```

```
(32434489, 8)
```

	order_id	product_id	add_to_cart_order	reordered	product_name	aisle_id	department_id	user_id
0	2	33120	1	1	Organic Egg Whites	86	16	202279
1	2	28985	2	1	Michigan Organic Kale	83	4	202279
2	2	9327	3	0	Garlic Powder	104	13	202279
3	2	45918	4	1	Coconut Butter	19	13	202279
4	2	30035	5	0	Natural Sweetener	17	13	202279

```
cart_products = (
    merged
    .groupby("order_id")["product_name"]
    .apply(list)
)
```

```
def hybrid_recommender(
    user_id,
    merged_user,
    cart_products,
    top_products,
    top_n=5
):
    # Products user already bought
    user_products = set(
        merged_user[merged_user["user_id"] == user_id]["product_name"]
    )

    recommendations = []

    # 1 Similar users
    similar_users = merged_user[
        merged_user["product_name"].isin(user_products)
    ]["user_id"].unique()

    similar_users = [u for u in similar_users if u != user_id]

    similar_products = (
        merged_user[merged_user["user_id"].isin(similar_users)]
        ["product_name"]
        .value_counts()
    )

    for product in similar_products.index:
        if product not in user_products:
            recommendations.append(product)
        if len(recommendations) >= top_n:
            return recommendations

    # 2 Bought together
    for product in user_products:
        if product in cart_products.values:
            related = recommend_frequently_bought(
                product, cart_products, top_n
            )
            for item, _ in related:
                if item not in user_products and item not in recommendations:
                    recommendations.append(item)
                if len(recommendations) >= top_n:
                    return recommendations

    # 3 Popular fallback
    for product in top_products.index:
        if product not in user_products:
            recommendations.append(product)
        if len(recommendations) >= top_n:
            break

    return recommendations
```

```
hybrid_recommender(
    user_id=1,
    merged_user=merged_user,
    cart_products=cart_products,
    top_products=top_products,
    top_n=5
)
```

```
['Banana',
 'Organic Strawberries',
 'Organic Baby Spinach',
 'Organic Hass Avocado',
 'Organic Avocado']
```

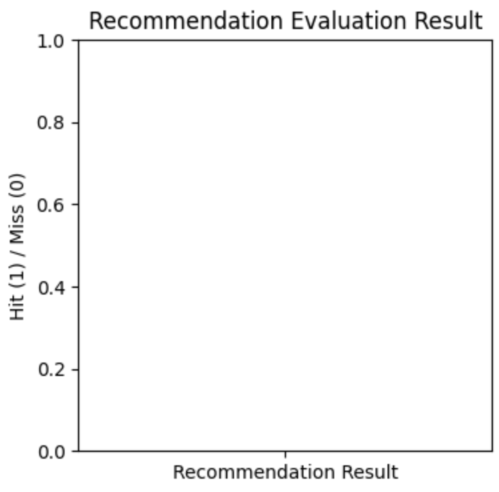
```
hybrid_recommender(
    user_id=1,
    merged_user=merged_user,
    cart_products=cart_products,
    top_products=top_products,
    top_n=5
)
```

```
['Banana',
 'Organic Strawberries',
 'Organic Baby Spinach',
 'Organic Hass Avocado',
 'Organic Avocado']
```

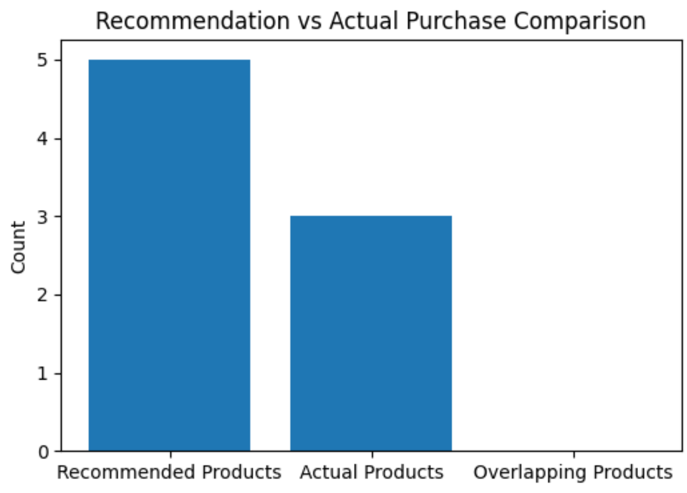
```
test_user = merged_user["user_id"].value_counts().index[0]

def get_last_order_products(user_id, merged_user):
    user_data = merged_user[merged_user["user_id"] == user_id]

    if user_data.empty:
        return set()

    last_order_id = user_data["order_id"].iloc[-1]

    return set(
        user_data[user_data["order_id"] == last_order_id]["product_name"]
    )

recommended = hybrid_recommender(
    user_id=test_user,
    merged_user=merged_user,
    cart_products=cart_products,
    top_products=top_products,
    top_n=5
)


actual = get_last_order_products(test_user, merged_user)

hit = any(item in recommended for item in actual)

print("Test User:", test_user)
print("Recommended Products:", recommended)
print("Actual Last Order Products:", actual)
print("Hit:", hit)
```

```
Test User: 201268
Recommended Products: ['Organic Avocado', 'Organic Whole Milk', 'Organic Yellow Onion', 'Organic Garlic', 'Organic Zucc
Actual Last Order Products: {'Vanilla Bean Tea Bags', 'Roasted & Salted Almonds', 'Organic Large Brown Grade AA Cage Fr
Hit: False
```

```
import matplotlib.pyplot as plt

# Convert hit to numeric
hit_value = 1 if hit else 0

plt.figure(figsize=(4, 4))
plt.bar(["Recommendation Result"], [hit_value])
plt.ylim(0, 1)
plt.ylabel("Hit (1) / Miss (0)")
plt.title("Recommendation Evaluation Result")

plt.show()
```



```
overlap_count = len(set(recommended).intersection(actual))

plt.figure(figsize=(6, 4))
plt.bar(
    ["Recommended Products", "Actual Products", "Overlapping Products"],
    [len(recommended), len(actual), overlap_count]
)

plt.ylabel("Count")
plt.title("Recommendation vs Actual Purchase Comparison")
plt.show()
```


Recommendation vs Actual Purchase Comparison
Count
Recommended Products
Actual Products
Overlapping Products