数据挖掘作业1

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说明

- 选用`MySQL57(docker)`做数据库, 可视化部件为`pyecharts on Python3`.
- 原表结构`./NorthWindData/northwind.sql`经过`./NorthWindData/ripChineseColumnName.sql`修改, 将列名表名均更名为ASCII字符集内能够表示的字符.

作业1.1

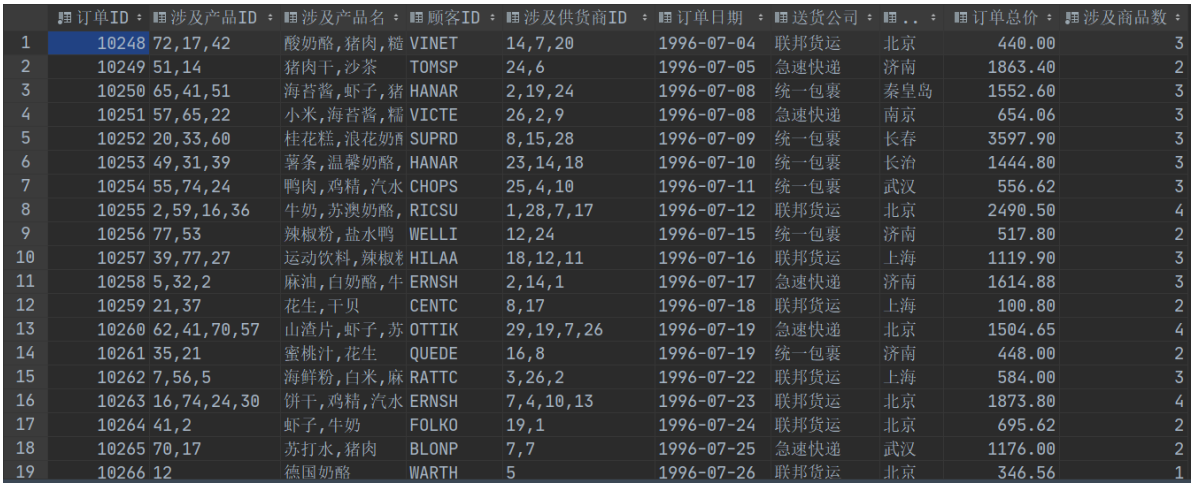
输出一张大表

> 所含信息有订单ID，产品ID，客户ID，雇员ID，供应商ID，时间ID，运货商，货主城市，单价高低（50一个等级），订单数，订单金额，商品数

SQL语句实现

```
USE northwind;
# TODO: 订单量为主键, 订单数为列不合理, ditched corresponding column
# 输出一张大表，所含信息有订单ID，产品ID，客户ID，雇员ID，供应商ID，时间ID，运货商，货主城市，
单价高低（50一个等级），订单数，订单金额，商品数
DROP VIEW IF EXISTS vOrderGlance;
CREATE VIEW vOrderGlance AS
SELECT tOrder.orderID     AS '订单ID',
       group_concat(tProduct.productID)  AS '涉及产品ID',
       group_concat(tProduct.pName)   AS '涉及产品名',
       tOrder.customerID      AS '顾客ID',
       group_concat(tProduct.supplierID)   AS '涉及供货商ID',
       date_format(tOrder.orderDate, '%Y-%m-%d')    AS '订单日期',
       tDeliveryCompany.dCompanyName      AS '送货公司',
       tOrder.ownerCity    AS '货主城市',
       cast(sum(tOrderDetail.productPrice * tOrderDetail.productCount
           * (1 - tOrderDetail.productDiscount)) AS DECIMAL(10, 2))
           AS '订单总价',
       count(tOrderDetail.productID)     AS '涉及商品数'
FROM tOrder,
     tOrderDetail,
     tProduct,
     tDeliveryCompany
WHERE tProduct.productID = tOrderDetail.productID
  AND tOrderDetail.orderID = tOrder.orderID
  AND tOrder.deliveryCompany = tDeliveryCompany.DeliveryCompanyID
GROUP BY tOrder.orderID;
```

Glance



	订单ID	涉及产品ID	涉及产品名	顾客ID	涉及供货商ID	订单日期	送货公司	..	订单总价	涉及商品数
1	10248	72,17,42	酸奶酪,猪肉,糙	VINET	14,7,20	1996-07-04	联邦货运	北京	440.00	3
2	10249	51,14	猪肉干,沙茶	TOMSP	24,6	1996-07-05	急速快递	济南	1863.40	2
3	10250	65,41,51	海苔酱,虾子,猪	HANAR	2,19,24	1996-07-08	统一包裹	秦皇岛	1552.60	3
4	10251	57,65,22	小米,海苔酱,糙	VICTE	26,2,9	1996-07-08	急速快递	南京	654.06	3
5	10252	20,33,60	桂花糕,浪花奶酥	SUPRD	8,15,28	1996-07-09	统一包裹	长春	3597.90	3
6	10253	49,31,39	薯条,温馨奶酪,	HANAR	23,14,18	1996-07-10	统一包裹	长治	1444.80	3
7	10254	55,74,24	鸭肉,鸡精,汽水	CHOPS	25,4,10	1996-07-11	统一包裹	武汉	556.62	3
8	10255	2,59,16,36	牛奶,苏澳奶酪,	RICSU	1,28,7,17	1996-07-12	联邦货运	北京	2490.50	4
9	10256	77,53	辣椒粉,盐水鸭	WELLI	12,24	1996-07-15	统一包裹	济南	517.80	2
10	10257	39,77,27	运动饮料,辣椒粉	HILAA	18,12,11	1996-07-16	联邦货运	上海	1119.90	3
11	10258	5,32,2	麻油,白奶酪,牛	ERNSH	2,14,1	1996-07-17	急速快递	济南	1614.88	3
12	10259	21,37	花生,干贝	CENTC	8,17	1996-07-18	联邦货运	上海	100.80	2
13	10260	62,41,70,57	山渣片,虾子,苏	OTTIK	29,19,7,26	1996-07-19	急速快递	北京	1504.65	4
14	10261	35,21	蜜桃汁,花生	QUEDE	16,8	1996-07-19	统一包裹	济南	448.00	2
15	10262	7,56,5	海鲜粉,白米,麻	RATTC	3,26,2	1996-07-22	联邦货运	上海	584.00	3
16	10263	16,74,24,30	饼干,鸡精,汽水	ERNSH	7,4,10,13	1996-07-23	联邦货运	北京	1873.80	4
17	10264	41,2	虾子,牛奶	FOLKO	19,1	1996-07-24	联邦货运	北京	695.62	2
18	10265	70,17	苏打水,猪肉	BLONP	7,7	1996-07-25	急速快递	武汉	1176.00	2
19	10266	12	德国奶酪	WARTH	5	1996-07-26	联邦货运	北京	346.56	1

作业1.2

输出销售额前十大客户的基本信息

SQL语句实现

```
SELECT tCustomer.customerID            AS '顾客ID',
       tCustomer.cCompanyName          AS '顾客名',
       cast(sum(tOrderDetail.productCount * tOrderDetail.productPrice
           * (1 - tOrderDetail.productDiscount)) AS DECIMAL(14, 2))
           AS '总流水'
FROM tCustomer,
     tOrder,
     tOrderDetail
WHERE tCustomer.customerID = tOrder.customerID
  AND tOrder.orderID = tOrderDetail.orderID
GROUP BY tCustomer.customerID
ORDER BY 总流水 DESC
LIMIT 10;
```

Glance

> Using PyCharm/DataGrip -> Database -> Export to -> Markdown
>
> Pycharm/DataGrip -> 数据库 -> 导出至 -> Markdown

顾客ID	顾客名	总流水
QUICK	高上补习班	110277.30
ERNSH	正人资源	104874.98
SAVEA	大钰贸易	104361.95
RATTC	学仁贸易	51097.80
HUNGO	师大贸易	49979.90
HANAR	实翼	32841.37
KOENE	永业房屋	30908.38
FOLKO	五洲信托	29567.56
MEREP	华科	28872.19
WHITC	椅天文化事业	27363.60

输出平均订单单价最高（总额/订单数）客户的基本信息；

SQL语句实现

```
SELECT tCustomer.customerID
                        AS '顾客ID',
       tCustomer.cCompanyName
                        AS '顾客名',
       sum(tOrderDetail.productCount * tOrderDetail.productPrice * (1 -
tOrderDetail.productDiscount)) AS '总流水',
       count(tOrder.customerID)
                        AS '单量',
       sum(tOrderDetail.productCount * tOrderDetail.productPrice * (1 -
tOrderDetail.productDiscount)) /
       count(tOrder.customerID)
                        AS '平均价'
FROM tCustomer,
     tOrder,
     tOrderDetail
WHERE tCustomer.customerID = tOrder.customerID
  AND tOrder.orderID = tOrderDetail.orderID
GROUP BY tCustomer.customerID
ORDER BY 平均价 DESC
LIMIT 10;
```

Glance

	顾客ID	顾客名	总流水	单量	平均价
1	QUICK	高上补习班	110277.30488350891	86	1282.294242831499
2	SIMOB	百达电子	16817.097494864836	15	1121.1398329909891
3	ERNSH	正人资源	104874.97835350106	102	1028.1860622892261
4	HANAR	实翼	32841.36997813582	32	1026.2928118167445
5	PICCO	顶上系统	23128.859954281896	23	1005.6026067079085
6	HUNGO	师大贸易	49979.90494634077	55	908.7255444789231
7	MEREP	华科	28872.189950353655	32	902.2559359485517
8	SAVEA	大钰贸易	104361.94986812412	116	899.6719816217596
9	GREAL	仪和贸易	18507.44997683935	22	841.2477262199704
10	KOENE	永业房屋	30908.383968844264	39	792.5226658678016

输出库存不足三天销售的预警商品；

SQL语句实现

```
# @-> Session-Wide Variable
SET @DAYSDIFF = 0;
SELECT to_days(max(tOrder.orderDate)) - to_days(min(tOrder.orderDate))
FROM tOrder
INTO @DAYSDIFF;
SELECT tProduct.productID,
       tProduct.pName    AS '商品名',
       tProduct.pStorage  AS '库存量',
       sum(tOrderDetail.productCount) / @DAYSDIFF  AS '日销量',
       sum(tOrderDetail.productCount) / @DAYSDIFF * 3 > tProduct.pStorage
       AS '库存告急'
FROM tProduct,
     tOrderDetail
WHERE tOrderDetail.productID = tProduct.productID
GROUP BY tProduct.productID
ORDER BY 库存告急 DESC
LIMIT 100;
```

Glance

> Export using Method Mentioned Above

productID	商品名	库存量	日销量	库存告急
17	猪肉	0	1.4754	1
31	温馨奶酪	0	2.0820	1
53	盐水鸭	0	1.0760	1
29	鸭肉	0	1.1118	1
21	花生	3	1.5142	1
5	麻油	0	0.4441	1

输出订单最多的优秀雇员信息；

SQL语句实现

```
SELECT tEmployee.employeeID                          AS '员工号',
       concat(tEmployee.eSurname, tEmployee.eName) AS '员工姓名',
       count(tOrder.orderID)                         AS '总单量'
FROM tEmployee,
     tOrder
WHERE tOrder.employeeID = tEmployee.employeeID
GROUP BY tOrder.employeeID
ORDER BY 总单量 DESC;
```

Glance

员工号	员工姓名	总单量
4	郑建杰	154
3	李芳	127
1	张颖	124
8	刘英玫	104
2	王伟	96
7	金士鹏	72
6	孙林	67
9	张雪眉	44
5	赵军	42

输出订单总金额的随时间变化图；

SQL语句实现

```
SELECT year(tOrder.orderDate)  AS '年份',
       month(tOrder.orderDate) AS '月份',
       sum(tOrderDetail.productCount * tOrderDetail.productPrice * (1 -
tOrderDetail.productDiscount))
       AS '销量'
FROM tOrder,
     tOrderDetail
WHERE tOrderDetail.orderID = tOrder.orderID
GROUP BY 年份, 月份
ORDER BY年份 ASC;
```

```
xDate = []
ySellAmount = []
ySellAmountSum = []
with open('queryResult/SELECT_year_tOrder_orderDate_.csv', 'r', encoding='utf-
8') as f:
    f.readline() # 跳表头
```

```
    for row in csv.reader(f):
        xDate.append('{}-{}'.format(row[0], row[1]))
        ySellAmount.append(round(float(row[2]), 0))

ySellAmountSum.append(ySellAmount[0])
for index in range(1, len(ySellAmount)):

 ySellAmountSum.append(ySellAmountSum[len(ySellAmountSum)-1]+ySellAmount[index])

graph1 = (
    Line(init_opts=opts.InitOpts(width="1600px", height="800px"))
    .add_xaxis(xDate)
    .add_yaxis("总销量", ySellAmountSum, is_smooth=True)
    .set_global_opts(title_opts=opts.TitleOpts(title="销量总金额"))
)

graph2 = (
    Bar(
        init_opts=opts.InitOpts(
            animation_opts=opts.AnimationOpts(
                animation_delay=1000, animation_easing="elasticOut"
            ), width="1600px", height="800px"
        )
    )
    .add_xaxis(xDate)
    .add_yaxis("每月销售量", ySellAmount)
    .set_global_opts(title_opts=opts.TitleOpts(title="每月销售金额"))
)
```

Glance

见后

输出商品销量的特征；即什么商品畅销，什么商品滞销;

SQL语句实现

```
SELECT tProduct.productID,
       tProduct.pName                                AS '商品名',
       sum(tOrderDetail.productCount) / @DAYSDIFF AS '日销量'
FROM tProduct,
     tOrderDetail
WHERE tOrderDetail.productID = tProduct.productID
GROUP BY tProduct.productID
ORDER BY 日销量 DESC
LIMIT 30;

# 输出商品销量的特征
SELECT tCategory.categoryName AS '类目', count(tOrderDetail.productID) AS '销量'
FROM tCategory,
     tOrderDetail,
     tProduct
WHERE tOrderDetail.productID = tProduct.productID
  AND tProduct.categoryID = tCategory.categoryID
GROUP BY categoryName
ORDER BY 销量 DESC ;
```

Glance

productID	商品名	日销量
60	花奶酪	2.3502
59	苏澳奶酪	2.2295
31	温馨奶酪	2.0820
56	白米	1.8838
16	饼干	1.7258
...	...	...

类目	销量
饮料	405
日用品	365
点心	336
海鲜	330
调味品	214
谷类/麦片	197
肉/家禽	174
特制品	136

货主城市分析特征;

SQL语句实现

```
SELECT tOrder.ownerRegion AS '地区', count(tOrder.ownerName) AS '频数'
FROM tOrder
GROUP BY ownerRegion
ORDER BY 频数 DESC ;

# 货主城市分析特征;
SELECT tOrder.ownerCity AS '城市', count(tOrder.ownerCity) AS '频数'
FROM tOrder
GROUP BY ownerCity
ORDER BY 频数 DESC ;
```

```
xCity = []
yCityCount = []
with open('queryResult/SELECT_tOrder_ownerCity_AS_count_t.csv', 'r',
encoding='utf-8') as f:
    f.readline()
    for row in csv.reader(f):
        xCity.append(row[0])
        yCityCount.append(int(row[1]))
```

```
graph3 = (
    Geo(init_opts=opts.InitOpts(width="1600px", height="800px"))
        .add_schema(maptype="china")
        .add(
        "geo",
        [list(z) for z in zip(xCity, yCityCount)],
        type_=ChartType.HEATMAP,
    )
        .set_series_opts(label_opts=opts.LabelOpts(is_show=True))
        .set_global_opts(
        visualmap_opts=opts.VisualMapOpts(),
        title_opts=opts.TitleOpts(title="货主位置热力图"),
    )
)
```

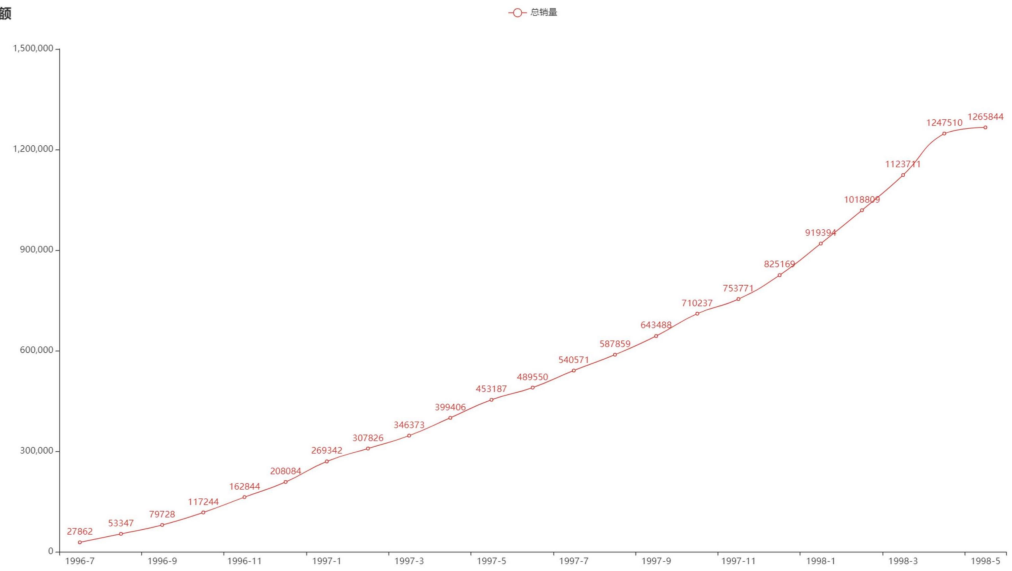
Glance

地区	频数
华北	355
华东	236
华南	85
西南	81
东北	65
…	…

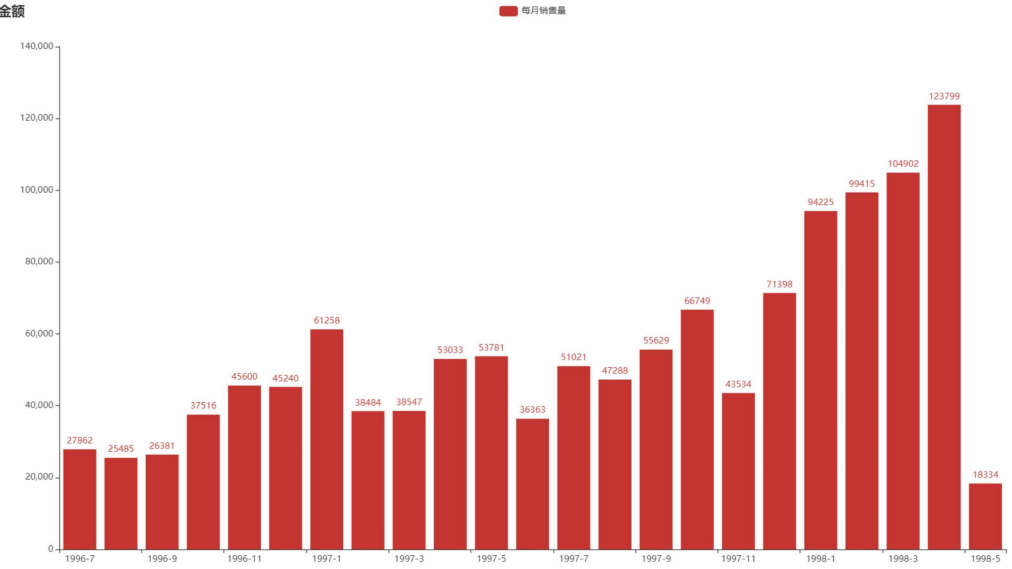
城市	频数
天津	207
南京	85
北京	52
重庆	46
石家庄	40
…	…

可视化详见`./NorthWindData/Visualization.py`与`可视化.html`

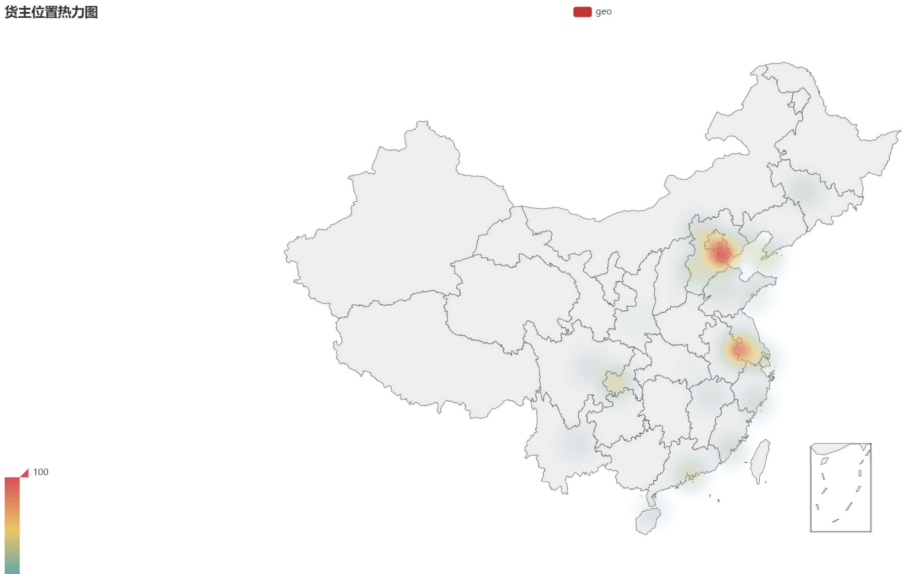
销量总金额



每月销售金额



货主位置热力图



全库数据导出SQL文件位于 `NorthWindData/FULLExport.sql`