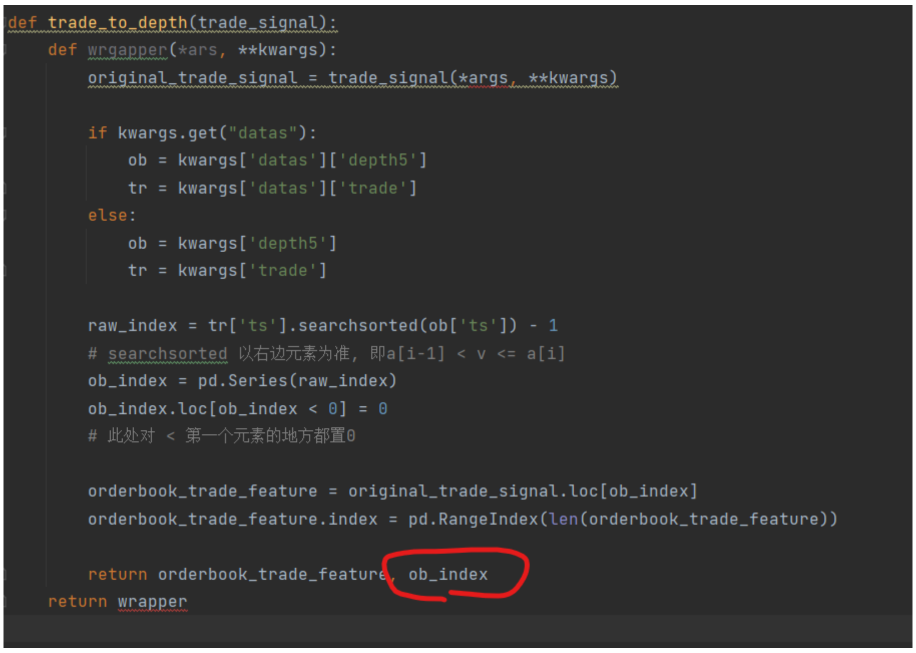
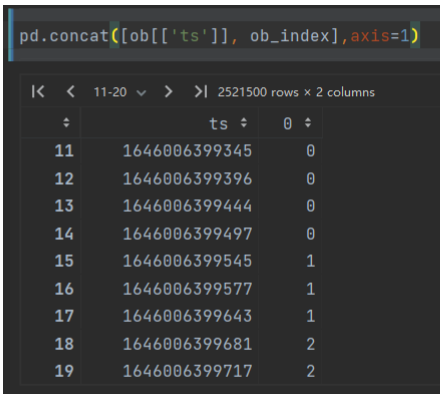
数据对齐方法

- 此处trade_to_depth 是装饰器，可认为在不修改具体函数写法(trade_signal，实例为arrival因子)的基础上，按照自己需要改变输出。装饰器细节可参考[1]
  - 此处为了展现数据对齐结果，我对装饰器内部做了小修改，输出ob_index（见红色圈圈内部）
  - ob_index 为 ob 各值在 tr 中位置，具体可看代码，其中searchsorted函数可参考[2]



```python
def trade_to_depth(trade_signal):
    def wrapper(*ars, **kwargs):
        original_trade_signal = trade_signal(*args, **kwargs)

        if kwargs.get("datas"):
            ob = kwargs['datas']['depth5']
            tr = kwargs['datas']['trade']
        else:
            ob = kwargs['depth5']
            tr = kwargs['trade']

        raw_index = tr['ts'].searchsorted(ob['ts']) - 1
        # searchsorted 以右边元素为准, 即a[i-1] < v <= a[i]
        ob_index = pd.Series(raw_index)
        ob_index.loc[ob_index < 0] = 0
        # 此处对 < 第一个元素的地方都置0

        orderbook_trade_feature = original_trade_signal.loc[ob_index]
        orderbook_trade_feature.index = pd.RangeIndex(len(orderbook_trade_feature))

        return orderbook_trade_feature, ob_index
    return wrapper
```

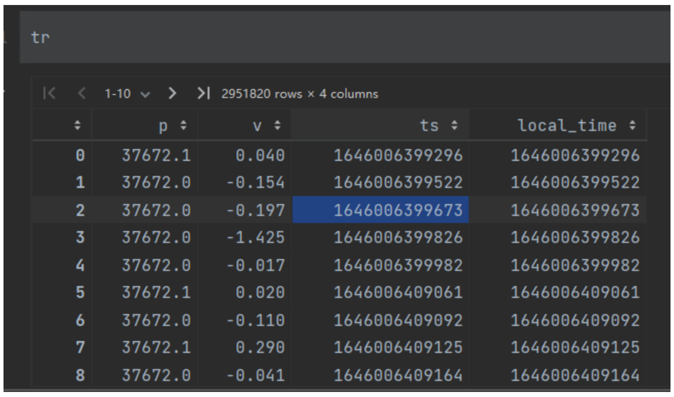
- 具体结果见下：（为方便查看我将ob中'ts'列和ob_index拼接）。主要关注第17和第18号元素，按照之前讨论的对齐方法， ob 第17号元素放在 tr 中第2号元素之前，ob 第18号元素放在 tr 中第2号元素之后。



```python
pd.concat([ob[['ts']], ob_index],axis=1)
```

11-20 2521500 rows × 2 columns

	ts	0
11	1646006399345	0
12	1646006399396	0
13	1646006399444	0
14	1646006399497	0
15	1646006399545	1
16	1646006399577	1
17	1646006399643	1
18	1646006399681	2
19	1646006399717	2



```python
tr
```

1-10 2951820 rows × 4 columns

	p	v	ts	local_time
0	37672.1	0.040	1646006399296	1646006399296
1	37672.0	-0.154	1646006399522	1646006399522
2	37672.0	-0.197	1646006399673	1646006399673
3	37672.0	-1.425	1646006399826	1646006399826
4	37672.0	-0.017	1646006399982	1646006399982
5	37672.1	0.020	1646006409061	1646006409061
6	37672.0	-0.110	1646006409092	1646006409092
7	37672.1	0.290	1646006409125	1646006409125
8	37672.0	-0.041	1646006409164	1646006409164

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1. https://www.bilibili.com/video/BV1zK411n7ZA/?spm_id_from=333.880.my_history.page.click ↩
2. https://blog.csdn.net/qq_17753903/article/details/85165637 ↩