# untitled

November 9, 2018

## 0.1 CASE STUDY: LATE DELIVERY ROOT CAUSE

**READING THE DATA** The below code reads the data from excel file using python package pandas

```
In [117]: import pandas as pd

          data=pd.read_excel(r"D:\files\5th Sem\MS4110-Introduction to Data Analytics\assignmen
```

```
In [118]: data.head()
```

```
Out[118]:     order_id         country shipping_method  units_per_order facility  \
          0  E00000001  UNITED KINGDOM          Ground                1   OXFORD
          1  E00000002          FRANCE          Ground                1  ANTWERP
          2  E00000003          FRANCE          Ground                1  ANTWERP
          3  E00000004          FRANCE          Ground                1  ANTWERP
          4  E00000005  UNITED KINGDOM        Next Day                1   OXFORD

            product_category on_sale  transit_days    datetime_ordered  \
          0      ACCESSORIES       Y             2 2016-07-03 03:07:29
          1  JACKETS & VESTS       N             3 2016-07-03 00:08:43
          2             TOPS       Y             3 2016-07-03 00:36:00
          3  JACKETS & VESTS       Y             5 2016-07-03 00:47:45
          4  JACKETS & VESTS       Y             1 2016-07-03 03:52:13

               datetime_sourced datetime_product_ready datetime_planned  \
          0 2016-07-03 04:09:49    2016-07-06 00:59:42       2016-07-08
          1 2016-07-03 02:16:24    2016-07-03 07:17:04       2016-07-06
          2 2016-07-03 02:16:18    2016-07-03 06:16:57       2016-07-06
          3 2016-07-03 02:16:18    2016-07-03 06:16:55       2016-07-07
          4 2016-07-03 07:56:33    2016-07-05 08:53:19       2016-07-06

             deadline_source  deadline_make  deadline_deliver delivered_to_plan
          0           1612.0             38                 3              PASS
          1            531.0              8                 3              PASS
          2            504.0              8                 3              PASS
          3            492.0              8                 5              PASS
          4           1567.0              6                 1              PASS
```

```
In [119]: data.describe(include='all')
          #we can see the number of unique categories in the categorical data
```

```
Out[119]:          order_id  country shipping_method  units_per_order  facility  \
          count       79999    79999           79999     79999.000000     79999
          unique      79999        5               4              NaN         6
          top     E00079666  GERMANY          Ground              NaN  AUGSBURG
          freq            1    46259           55494              NaN     19080
          first         NaN      NaN             NaN              NaN       NaN
          last          NaN      NaN             NaN              NaN       NaN
          mean          NaN      NaN             NaN         1.040013       NaN
          std           NaN      NaN             NaN         0.466923       NaN
          min           NaN      NaN             NaN         1.000000       NaN
          25%           NaN      NaN             NaN         1.000000       NaN
          50%           NaN      NaN             NaN         1.000000       NaN
          75%           NaN      NaN             NaN         1.000000       NaN
          max           NaN      NaN             NaN        50.000000       NaN

                 product_category on_sale  transit_days     datetime_ordered  \
          count             79999   79999  79999.000000                79999
          unique                3       2           NaN                78681
          top      JACKETS & VESTS       Y           NaN  2016-08-20 17:03:18
          freq              48523   41168           NaN                    8
          first               NaN     NaN           NaN  2016-07-03 00:08:43
          last                NaN     NaN           NaN  2016-10-21 17:55:30
          mean                NaN     NaN      2.338067                  NaN
          std                 NaN     NaN      0.992345                  NaN
          min                 NaN     NaN      1.000000                  NaN
          25%                 NaN     NaN      2.000000                  NaN
          50%                 NaN     NaN      2.000000                  NaN
          75%                 NaN     NaN      3.000000                  NaN
          max                 NaN     NaN      8.000000                  NaN

                     datetime_sourced datetime_product_ready     datetime_planned  \
          count                 79999                  79999                79999
          unique                72611                  77461                  127
          top     2016-09-16 08:39:53    2016-07-11 11:38:10  2016-09-30 00:00:00
          freq                      6                      4                 1539
          first   2016-07-03 02:16:18    2016-07-03 06:16:55  2016-07-05 00:00:00
          last    2016-11-10 00:33:50    2016-11-10 19:30:18  2016-11-17 00:00:00
          mean                    NaN                    NaN                  NaN
          std                     NaN                    NaN                  NaN
          min                     NaN                    NaN                  NaN
          25%                     NaN                    NaN                  NaN
          50%                     NaN                    NaN                  NaN
          75%                     NaN                    NaN                  NaN
          max                     NaN                    NaN                  NaN
```

```
       deadline_source  deadline_make  deadline_deliver delivered_to_plan
count      79464.000000   79999.000000      79999.000000             79999
unique              NaN            NaN               NaN                 2
top                 NaN            NaN               NaN              PASS
freq                NaN            NaN               NaN             70978
first               NaN            NaN               NaN               NaN
last                NaN            NaN               NaN               NaN
mean        1349.708975      41.173127          3.450756               NaN
std         1104.229891      25.686936          1.617486               NaN
min            1.000000       1.000000          1.000000               NaN
25%          484.000000      23.000000          2.000000               NaN
50%         1115.000000      33.000000          3.000000               NaN
75%         1600.250000      55.000000          5.000000               NaN
max         6392.000000     168.000000         13.000000               NaN
```

```
In [120]: for i in data:
              print(i,data[i].dtype,sep='\t\t\t',end='\n')
          #confirming the data type of the date time variables as datetime64[ns] which can
          # be specially operated to find time intervals
```

```
order_id                        object
country                        object
shipping_method                        object
units_per_order                        int64
facility                        object
product_category                        object
on_sale                        object
transit_days                        int64
datetime_ordered                        datetime64[ns]
datetime_sourced                        datetime64[ns]
datetime_product_ready                        datetime64[ns]
datetime_planned                        datetime64[ns]
deadline_source                        float64
deadline_make                        int64
deadline_deliver                        int64
delivered_to_plan                        object
```

**CREATING NEW COLUMNS THAT RECORD THE TIME INTERVAL BETWEEN DATES**

We create new columns to record the time intervals between the carious dates and the time ordered as this is easier to work with and captures the necessary information from this data

```
In [122]: #cell pending deletion;was used to confirm the units of the three columns


          from datetime import timedelta
          # for i,j in enumerate((data.datetime_sourced-data.datetime_ordered)):
          #     print(j.seconds/60,data.deadline_source[i])
```

```
        print(((data.datetime_sourced-data.datetime_ordered).map(lambda x: x.seconds/(60))<da
              (((data.datetime_product_ready-data.datetime_ordered).map(lambda x: int(x.secon
              (((data.datetime_product_ready-data.datetime_ordered).map(lambda x: int(x.days/
        print(((data.datetime_sourced-data.datetime_ordered).map(lambda x: x.seconds/(60))>da
              (((data.datetime_product_ready-data.datetime_ordered).map(lambda x: int(x.secon
              (((data.datetime_product_ready-data.datetime_ordered).map(lambda x: int(x.days/
```

```
76275 68090 71902
3189 9736 2760
```

```
In [123]: #converting the given dates to time intervals which ccan be worked with. check the l
          # function for conversion to seconds minutes or days

          data['time_sourced']=(data.datetime_sourced-data.datetime_ordered).map(lambda x:int(
          data['time_make']=(data.datetime_product_ready-data.datetime_ordered).map(lambda x: 
          data['time_ready']=(data.datetime_product_ready-data.datetime_ordered).map(lambda x:
```

**IMPUTING NULL VALUES**

```
In [271]: #checking for null values in columns

          for i in data:
              print(i,data[i].isnull().values.any(),sep='\t\t\t')
```

```
order_id                        False
country                         False
shipping_method                         False
units_per_order                         False
facility                        False
product_category                        False
on_sale                         False
transit_days                            False
datetime_ordered                        False
datetime_sourced                        False
datetime_product_ready                          False
datetime_planned                        False
deadline_source                         True
deadline_make                           False
deadline_deliver                        False
delivered_to_plan                       False
time_sourced                            False
time_make                       False
time_ready                      False
```

```
In [124]: #surveying the null values. Below the dataset we can see 535 null values

          data[data.isnull().values]
```

```
Out[124]:        order_id         country shipping_method  units_per_order    facility  \
         25     E00000026          FRANCE          Ground                1     ANTWERP
         34     E00000035          FRANCE          Ground                1     ANTWERP
         37     E00000038          FRANCE          Ground                1     ANTWERP
         39     E00000040          FRANCE          Ground                1     ANTWERP
         40     E00000041          FRANCE          Ground                1     ANTWERP
         41     E00000042          FRANCE          Ground                1     ANTWERP
         42     E00000043          FRANCE          Ground                1     ANTWERP
         43     E00000044          FRANCE          Ground                1     ANTWERP
         44     E00000045          FRANCE          Ground                1     ANTWERP
         45     E00000046          FRANCE          Ground                1     ANTWERP
         47     E00000048          FRANCE          Ground                1     ANTWERP
         48     E00000049          FRANCE          Ground                1     ANTWERP
         49     E00000050          FRANCE          Ground                1     ANTWERP
         52     E00000053          FRANCE          Ground                1     ANTWERP
         53     E00000054          FRANCE          Ground                1     ANTWERP
         54     E00000055          FRANCE          Ground                1     ANTWERP
         55     E00000056          FRANCE          Ground                1     ANTWERP
         58     E00000059          FRANCE          Ground                1     ANTWERP
         60     E00000061          FRANCE          Ground                1     ANTWERP
         65     E00000066          FRANCE          Ground                1     ANTWERP
         70     E00000071          FRANCE          Ground                1     ANTWERP
         77     E00000078          FRANCE          Ground                1     ANTWERP
         78     E00000079          FRANCE          Ground                1     ANTWERP
         83     E00000084          FRANCE          Ground                1     ANTWERP
         97     E00000098          FRANCE          Ground                1     ANTWERP
         104    E00000105          FRANCE          Ground                1     ANTWERP
         111    E00000112         GERMANY          Ground                1   EINDHOVEN
         115    E00000116          FRANCE          Ground                1     ANTWERP
         116    E00000117          FRANCE          Ground                1     ANTWERP
         118    E00000119  UNITED KINGDOM        Next Day                1      OXFORD
         ...          ...             ...             ...              ...         ...
         75449  E00075531  UNITED KINGDOM          Ground                1  MANCHESTER
         75464  E00075546  UNITED KINGDOM          Ground                1  MANCHESTER
         75465  E00075547  UNITED KINGDOM          Ground                1  MANCHESTER
         75471  E00075553  UNITED KINGDOM          Ground                1      OXFORD
         75476  E00075558  UNITED KINGDOM          Ground                1      OXFORD
         75479  E00075561  UNITED KINGDOM          Ground                1      OXFORD
         75484  E00075566  UNITED KINGDOM          Ground                1      OXFORD
         75488  E00075570  UNITED KINGDOM          Ground                1  MANCHESTER
         75498  E00075580  UNITED KINGDOM          Ground                1  MANCHESTER
         75500  E00075582  UNITED KINGDOM          Ground                1      OXFORD
         75502  E00075584  UNITED KINGDOM          Ground                1      OXFORD
         75503  E00075585  UNITED KINGDOM          Ground                1  MANCHESTER
         75507  E00075589  UNITED KINGDOM          Ground                1      OXFORD
         75511  E00075593  UNITED KINGDOM          Ground                2      OXFORD
         75513  E00075595  UNITED KINGDOM          Ground                1  MANCHESTER
         75526  E00075608  UNITED KINGDOM          Ground                1      OXFORD
```

```
75529  E00075611  UNITED KINGDOM          Ground                 1      OXFORD
75544  E00075626  UNITED KINGDOM          Ground                 1      OXFORD
75545  E00075627  UNITED KINGDOM          Ground                 1      OXFORD
75550  E00075632  UNITED KINGDOM          Ground                 1      OXFORD
75552  E00075634  UNITED KINGDOM          Ground                 1      OXFORD
75554  E00075636  UNITED KINGDOM          Ground                 1  MANCHESTER
75556  E00075638  UNITED KINGDOM          Ground                 2  MANCHESTER
75557  E00075639  UNITED KINGDOM          Ground                 1      OXFORD
75572  E00075654  UNITED KINGDOM          Ground                 1      OXFORD
75583  E00075665  UNITED KINGDOM          Ground                 1      OXFORD
75606  E00075688  UNITED KINGDOM          Ground                 2  MANCHESTER
75620  E00075702  UNITED KINGDOM          Ground                 1      OXFORD
75678  E00075760  UNITED KINGDOM          Ground                 1  MANCHESTER
79998  E00080081  UNITED KINGDOM          Ground                 1      OXFORD

      product_category on_sale  transit_days    datetime_ordered  \
25                TOPS       Y             4 2016-07-03 04:52:12
34     JACKETS & VESTS       N             3 2016-07-03 05:42:00
37     JACKETS & VESTS       Y             3 2016-07-03 06:01:54
39                TOPS       N             3 2016-07-03 06:38:27
40                TOPS       Y             3 2016-07-03 06:39:40
41                TOPS       N             4 2016-07-03 07:16:03
42     JACKETS & VESTS       Y             3 2016-07-03 07:33:24
43     JACKETS & VESTS       Y             3 2016-07-03 07:49:19
44     JACKETS & VESTS       N             4 2016-07-03 07:55:02
45                TOPS       Y             4 2016-07-03 07:59:58
47         ACCESSORIES       Y             2 2016-07-03 08:16:49
48     JACKETS & VESTS       N             3 2016-07-03 08:22:15
49     JACKETS & VESTS       N             3 2016-07-03 08:25:17
52     JACKETS & VESTS       Y             4 2016-07-03 08:51:53
53     JACKETS & VESTS       Y             3 2016-07-03 08:52:33
54                TOPS       N             4 2016-07-03 08:55:24
55     JACKETS & VESTS       Y             3 2016-07-03 08:56:31
58                TOPS       Y             3 2016-07-03 09:41:02
60                TOPS       Y             3 2016-07-03 09:42:17
65     JACKETS & VESTS       Y             4 2016-07-03 10:18:41
70                TOPS       Y             3 2016-07-03 10:36:41
77                TOPS       Y             3 2016-07-03 11:27:04
78     JACKETS & VESTS       Y             3 2016-07-03 11:29:29
83         ACCESSORIES       Y             3 2016-07-03 11:36:10
97                TOPS       Y             2 2016-07-03 12:28:30
104    JACKETS & VESTS       N             5 2016-07-03 13:03:22
111        ACCESSORIES       N             2 2016-07-03 15:19:55
115    JACKETS & VESTS       Y             3 2016-07-03 13:30:37
116               TOPS       Y             3 2016-07-03 13:34:35
118    JACKETS & VESTS       N             1 2016-07-03 16:38:00
...                ...     ...           ...                 ...
75449             TOPS       Y             1 2016-10-14 17:59:01
```

```
75464             TOPS       Y             1 2016-10-14 18:08:15
75465      ACCESSORIES       N             3 2016-10-14 18:10:40
75471  JACKETS & VESTS       Y             2 2016-10-14 18:18:18
75476  JACKETS & VESTS       Y             1 2016-10-14 18:26:35
75479  JACKETS & VESTS       N             2 2016-10-14 18:27:03
75484  JACKETS & VESTS       Y             1 2016-10-14 18:37:41
75488             TOPS       Y             2 2016-10-14 18:44:12
75498             TOPS       N             2 2016-10-14 18:57:49
75500  JACKETS & VESTS       N             2 2016-10-14 18:58:52
75502  JACKETS & VESTS       Y             1 2016-10-14 19:02:06
75503             TOPS       N             1 2016-10-14 19:03:39
75507  JACKETS & VESTS       Y             1 2016-10-14 19:14:17
75511  JACKETS & VESTS       Y             1 2016-10-14 19:17:36
75513             TOPS       Y             3 2016-10-14 19:19:50
75526  JACKETS & VESTS       Y             1 2016-10-14 19:34:48
75529  JACKETS & VESTS       Y             3 2016-10-14 19:36:43
75544  JACKETS & VESTS       N             1 2016-10-14 19:50:58
75545  JACKETS & VESTS       Y             1 2016-10-14 19:53:14
75550  JACKETS & VESTS       Y             1 2016-10-14 20:00:25
75552  JACKETS & VESTS       Y             2 2016-10-14 20:01:00
75554             TOPS       Y             1 2016-10-14 20:02:16
75556      ACCESSORIES       N             1 2016-10-14 20:03:24
75557  JACKETS & VESTS       Y             2 2016-10-14 20:03:43
75572  JACKETS & VESTS       N             2 2016-10-14 20:24:07
75583  JACKETS & VESTS       Y             1 2016-10-14 20:40:16
75606      ACCESSORIES       N             1 2016-10-14 21:04:55
75620  JACKETS & VESTS       N             1 2016-10-14 21:28:55
75678             TOPS       N             2 2016-10-14 22:46:46
79998  JACKETS & VESTS       N             3 2016-10-21 12:15:57

         datetime_sourced datetime_product_ready datetime_planned  \
25    2016-07-03 07:17:09    2016-07-03 09:17:13       2016-07-06
34    2016-07-03 07:16:36    2016-07-03 10:16:49       2016-07-05
37    2016-07-03 08:16:37    2016-07-03 10:17:00       2016-07-05
39    2016-07-03 08:17:11    2016-07-04 08:17:50       2016-07-05
40    2016-07-03 08:16:57    2016-07-04 03:16:16       2016-07-06
41    2016-07-03 09:16:34    2016-07-04 04:16:23       2016-07-06
42    2016-07-03 09:17:23    2016-07-04 04:16:47       2016-07-05
43    2016-07-03 09:17:20    2016-07-04 07:18:13       2016-07-06
44    2016-07-03 10:16:45    2016-07-04 05:17:01       2016-07-06
45    2016-07-03 10:16:52    2016-07-04 07:18:00       2016-07-07
47    2016-07-03 10:17:01    2016-07-04 04:18:33       2016-07-06
48    2016-07-03 10:16:57    2016-07-04 04:17:25       2016-07-06
49    2016-07-03 10:16:57    2016-07-04 07:19:29       2016-07-06
52    2016-07-03 10:16:24    2016-07-04 04:17:49       2016-07-07
53    2016-07-03 11:16:29    2016-07-04 07:17:06       2016-07-06
54    2016-07-03 11:16:22    2016-07-04 07:16:16       2016-07-08
55    2016-07-03 11:16:37    2016-07-04 04:17:52       2016-07-06
```

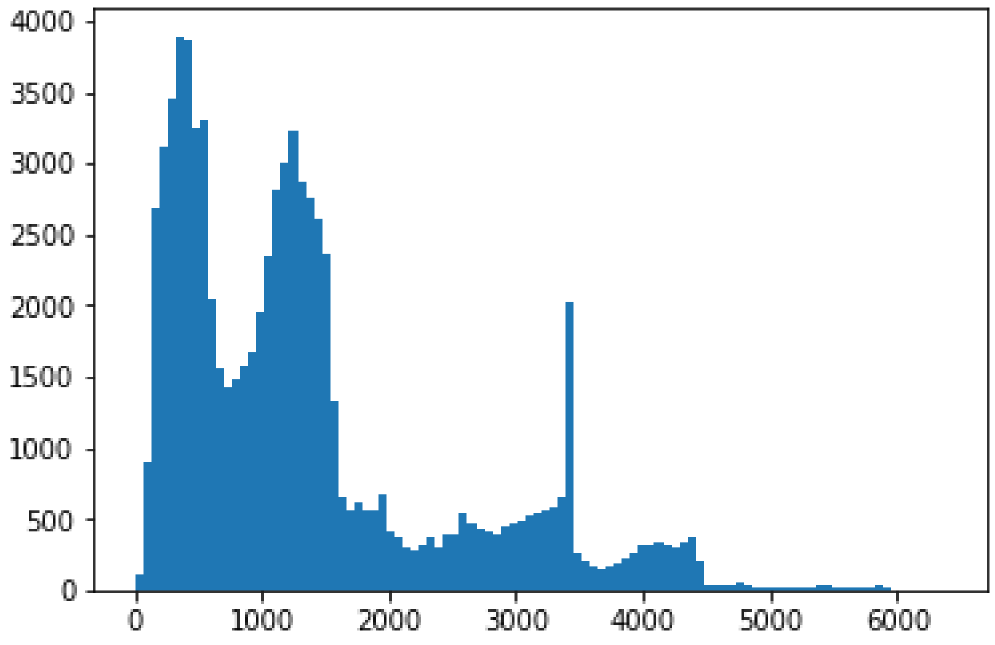
```
58    2016-07-04 03:16:31    2016-07-04 07:19:21       2016-07-06
60    2016-07-03 11:16:26    2016-07-04 03:17:04       2016-07-06
65    2016-07-03 12:16:29    2016-07-04 06:16:18       2016-07-09
70    2016-07-03 13:16:30    2016-07-04 06:16:27       2016-07-06
77    2016-07-03 13:16:44    2016-07-04 04:17:35       2016-07-07
78    2016-07-03 13:16:38    2016-07-04 04:17:25       2016-07-07
83    2016-07-03 13:16:50    2016-07-04 04:16:16       2016-07-07
97    2016-07-03 14:16:38    2016-07-04 08:18:23       2016-07-06
104   2016-07-03 15:16:40    2016-07-04 05:16:35       2016-07-13
111   2016-07-03 15:56:23    2016-07-06 11:58:22       2016-07-07
115   2016-07-03 15:16:17    2016-07-04 04:18:16       2016-07-07
116   2016-07-03 16:16:21    2016-07-04 04:17:31       2016-07-07
118   2016-07-03 17:41:49    2016-07-05 06:19:13       2016-07-06
...                   ...                    ...              ...
75449 2016-10-14 19:09:18    2016-10-18 19:09:56       2016-10-19
75464 2016-10-14 19:09:22    2016-10-18 19:29:07       2016-10-19
75465 2016-10-14 19:29:24    2016-10-18 15:49:13       2016-10-21
75471 2016-10-14 19:28:20    2016-10-18 19:18:48       2016-10-20
75476 2016-10-14 19:28:36    2016-10-18 10:49:21       2016-10-19
75479 2016-10-14 19:28:32    2016-10-17 10:05:15       2016-10-20
75484 2016-10-14 19:28:38    2016-10-17 10:20:22       2016-10-19
75488 2016-10-14 19:50:33    2016-10-18 19:23:35       2016-10-20
75498 2016-10-14 20:03:00    2016-10-18 19:27:22       2016-10-20
75500 2016-10-14 19:51:31    2016-10-18 14:12:39       2016-10-20
75502 2016-10-14 19:55:39    2016-10-18 14:12:43       2016-10-19
75503 2016-10-14 20:03:22    2016-10-18 19:23:18       2016-10-19
75507 2016-10-14 20:31:47    2016-10-17 10:22:37       2016-10-19
75511 2016-10-14 20:33:45    2016-10-18 18:25:25       2016-10-19
75513 2016-10-14 20:32:29    2016-10-18 19:31:01       2016-10-21
75526 2016-10-14 20:33:56    2016-10-19 18:05:18       2016-10-19
75529 2016-10-14 20:21:51    2016-10-18 14:10:35       2016-10-21
75544 2016-10-14 21:10:36    2016-10-17 10:21:10       2016-10-21
75545 2016-10-14 21:10:32    2016-10-18 10:52:38       2016-10-19
75550 2016-10-14 21:10:31    2016-10-18 19:28:21       2016-10-19
75552 2016-10-14 20:56:40    2016-10-18 14:30:53       2016-10-20
75554 2016-10-14 21:10:21    2016-10-18 19:20:27       2016-10-19
75556 2016-10-14 20:59:27    2016-10-18 19:20:58       2016-10-19
75557 2016-10-14 21:10:37    2016-10-18 18:25:24       2016-10-20
75572 2016-10-14 21:35:47    2016-10-17 10:22:46       2016-10-20
75583 2016-10-14 21:57:33    2016-10-18 14:36:15       2016-10-19
75606 2016-10-14 21:59:30    2016-10-18 19:20:21       2016-10-19
75620 2016-10-14 22:21:58    2016-10-18 14:57:24       2016-10-19
75678 2016-10-15 00:04:43    2016-10-17 16:08:02       2016-10-19
79998 2016-10-21 13:19:49    2016-10-24 17:20:54       2016-10-31

       deadline_source  deadline_make  deadline_deliver delivered_to_plan  \
25                 NaN              3                 4              PASS
34                 NaN              3                 3              PASS
```

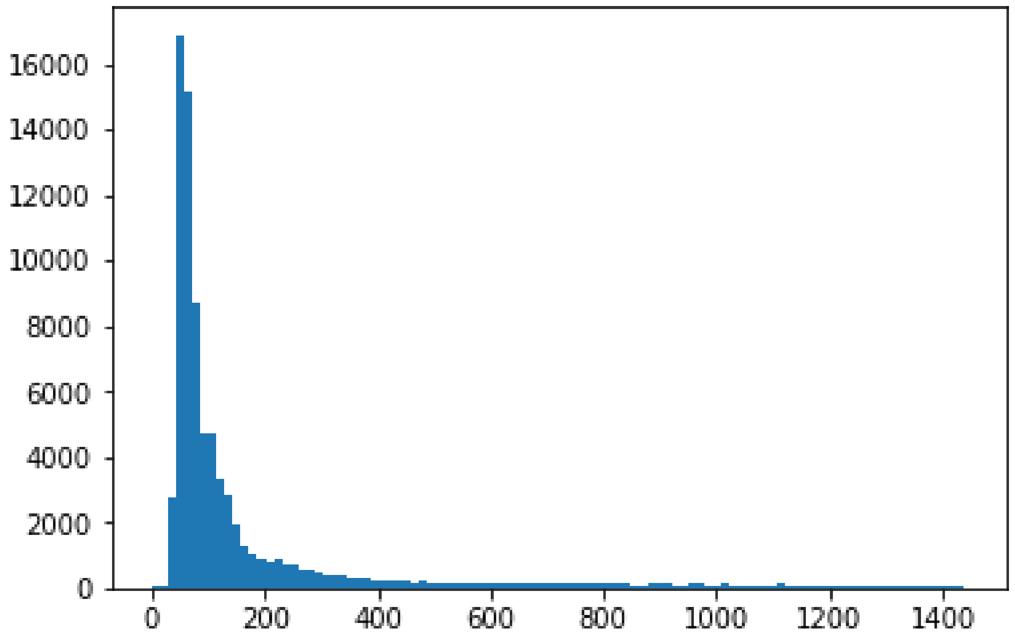
```
37           NaN       2           3      PASS
39           NaN       2           3      PASS
40           NaN       2           3      PASS
41           NaN      25           4      PASS
42           NaN      25           3      FAIL
43           NaN      25           3      PASS
44           NaN      24           4      FAIL
45           NaN      24           4      PASS
47           NaN      24           2      PASS
48           NaN      24           3      PASS
49           NaN      24           3      PASS
52           NaN      24           4      PASS
53           NaN      23           3      PASS
54           NaN      23           4      PASS
55           NaN      23           3      PASS
58           NaN       7           3      PASS
60           NaN      23           3      PASS
65           NaN      22           4      PASS
70           NaN      21           3      PASS
77           NaN      21           3      PASS
78           NaN      21           3      PASS
83           NaN      21           3      PASS
97           NaN      20           2      PASS
104          NaN      19           5      PASS
111          NaN      83           2      FAIL
115          NaN      19           3      PASS
116          NaN      18           3      PASS
118          NaN      20           1      PASS
...          ...     ...         ...       ...
75449        NaN     143           2      FAIL
75464        NaN     143           2      PASS
75465        NaN     143           3      PASS
75471        NaN     143           3      PASS
75476        NaN     143           1      PASS
75479        NaN     143           2      PASS
75484        NaN     143           1      PASS
75488        NaN     142           3      PASS
75498        NaN     142           3      FAIL
75500        NaN     142           2      FAIL
75502        NaN     142           1      PASS
75503        NaN     142           2      PASS
75507        NaN     141           1      PASS
75511        NaN     141           1      PASS
75513        NaN     141           6      FAIL
75526        NaN     141           1      FAIL
75529        NaN     142           3      PASS
75544        NaN     141           1      FAIL
75545        NaN     141           1      PASS
```

```
75550             NaN          141                2             PASS
75552             NaN          141                2             PASS
75554             NaN          141                2             PASS
75556             NaN          141                2             PASS
75557             NaN          141                2             PASS
75572             NaN          140                2             PASS
75583             NaN          140                1             PASS
75606             NaN          140                2             FAIL
75620             NaN          140                1             PASS
75678             NaN          134                3             PASS
79998             NaN           77                3             PASS

       time_sourced  time_make  time_ready
25              144          4           0
34               94          4           0
37              134          4           0
39               98          1           1
40               97         20           0
41              120         21           0
42              103         20           0
43               88         23           0
44              141         21           0
45              136         23           0
47              120         20           0
48              114         19           0
49              111         22           0
52               84         19           0
53              143         22           0
54              140         22           0
55              140         19           0
58             1055         21           0
60               94         17           0
65              117         19           0
70              159         19           0
77              109         16           0
78              107         16           0
83              100         16           0
97              108         19           0
104             133         16           0
111              36         20           2
115             105         14           0
116             161         14           0
118              63         13           1
...             ...        ...         ...
75449            70          1           4
75464            61          1           4
75465            78         21           3
75471            70          1           4
```

```
75476              62          16            3
75479              61          15            2
75484              50          15            2
75488              66           0            4
75498              65           0            4
75500              52          19            3
75502              53          19            3
75503              59           0            4
75507              77          15            2
75511              76          23            3
75513              72           0            4
75526              59          22            4
75529              45          18            3
75544              79          14            2
75545              77          14            3
75550              70          23            3
75552              55          18            3
75554              68          23            3
75556              56          23            3
75557              66          22            3
75572              71          13            2
75583              77          17            3
75606              54          22            3
75620              53          17            3
75678              77          17            2
79998              63           5            3

[535 rows x 19 columns]
```

```
In [125]: #pending deletion. to check the plot of the misiing na values. Can keep/ expand for

          import matplotlib.pyplot as plt
          from tqdm import tqdm_notebook as tqdm
          import seaborn as sns
          %matplotlib inline

          plt.hist(data.deadline_source.dropna(),bins=100)
          plt.show()
          plt.hist(data.time_sourced.dropna(),bins=100)
          plt.show()
```





```
In [126]: #creating a new variable data_corr with ehich we can work on our dataset
          # and drop the colums irrelevant to the problem
          data_corr=data;
          data_corr=data_corr.drop(['order_id','delivered_to_plan','datetime_ordered','datetim
          data_corr.head()
```

```
Out[126]:          country shipping_method  units_per_order facility product_category  \
          0  UNITED KINGDOM          Ground                1   OXFORD      ACCESSORIES
          1          FRANCE          Ground                1  ANTWERP  JACKETS & VESTS
          2          FRANCE          Ground                1  ANTWERP             TOPS
          3          FRANCE          Ground                1  ANTWERP  JACKETS & VESTS
          4  UNITED KINGDOM        Next Day                1   OXFORD  JACKETS & VESTS

            on_sale  transit_days  deadline_source  deadline_make  deadline_deliver  \
          0       Y             2           1612.0             38                 3
          1       N             3            531.0              8                 3
          2       Y             3            504.0              8                 3
          3       Y             5            492.0              8                 5
          4       Y             1           1567.0              6                 1

             time_sourced  time_make  time_ready
          0            62         21           2
          1           127          7           0
          2           100          5           0
          3            88          5           0
          4           244          5           2
```

```
In [127]: #creating a dictionary so that we can map the categorical values. can create the map

          col=['country','shipping_method','facility','product_category','on_sale']#categorica
          tmp=[];
          for i,j in enumerate(col):
              a=data_corr[j].unique()
              tmp.append(dict(zip(a,list(range(0,len(a))))))
              print(tmp[i])
              data_corr[j]=data_corr[j].map(tmp[i])
          data_corr.head()
```

```
{'UNITED KINGDOM': 0, 'FRANCE': 1, 'GERMANY': 2, 'SWEDEN': 3, 'BELGIUM': 4}
{'Ground': 0, 'Next Day': 1, '3-Day': 2, '2-Day': 3}
{'OXFORD': 0, 'ANTWERP': 1, 'MANCHESTER': 2, 'AUGSBURG': 3, 'HANOVER': 4, 'EINDHOVEN': 5}
{'ACCESSORIES': 0, 'JACKETS & VESTS': 1, 'TOPS': 2}
{'Y': 0, 'N': 1}
```

```
Out[127]:    country  shipping_method  units_per_order  facility  product_category  \
          0        0                0                1         0                 0
          1        1                0                1         1                 1
          2        1                0                1         1                 2
          3        1                0                1         1                 1
          4        0                1                1         0                 1
```