

# Feature Engineering Project

December 15, 2022

## 1 Feature Engineering Project By Muzamil Showkat

```
[1]: import numpy as np  
import pandas as pd  
import seaborn as sns
```

```
import matplotlib.pyplot as plt  
%matplotlib inline  
import seaborn as sns
```

```
#Import and suppress warnings  
import warnings  
warnings.filterwarnings('ignore')
```

```
[2]: df = pd.read_csv("PEP1.csv")
```

```
[3]: df
```

```
[3]:      Id  MSSubClass MSZoning  LotFrontage  LotArea  Street Alley LotShape  \  
0       1        60      RL       65.0     8450    Pave   NaN    Reg  
1       2        20      RL       80.0     9600    Pave   NaN    Reg  
2       3        60      RL       68.0    11250    Pave   NaN   IR1  
3       4        70      RL       60.0     9550    Pave   NaN   IR1  
4       5        60      RL       84.0    14260    Pave   NaN   IR1  
...     ...      ...     ...     ...     ...     ...     ...     ...  
1455  1456        60      RL       62.0     7917    Pave   NaN    Reg  
1456  1457        20      RL       85.0    13175    Pave   NaN    Reg  
1457  1458        70      RL       66.0     9042    Pave   NaN    Reg  
1458  1459        20      RL       68.0     9717    Pave   NaN    Reg  
1459  1460        20      RL       75.0     9937    Pave   NaN    Reg  
  
      LandContour Utilities  ...  PoolArea  PoolQC  Fence  MiscFeature  MiscVal  \  
0          Lvl    AllPub  ...       0     NaN     NaN      NaN      0  
1          Lvl    AllPub  ...       0     NaN     NaN      NaN      0  
2          Lvl    AllPub  ...       0     NaN     NaN      NaN      0  
3          Lvl    AllPub  ...       0     NaN     NaN      NaN      0
```

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4          Lvl      AllPub ...      0      NaN      NaN      NaN      0
...
1455      ...      AllPub ...      0      NaN      NaN      NaN      0
1456      Lvl      AllPub ...      0      NaN      MnPrv      NaN      0
1457      Lvl      AllPub ...      0      NaN      GdPrv      Shed     2500
1458      Lvl      AllPub ...      0      NaN      NaN      NaN      0
1459      Lvl      AllPub ...      0      NaN      NaN      NaN      0

      MoSold YrSold SaleType SaleCondition SalePrice
0        2   2008      WD       Normal    208500
1        5   2007      WD       Normal    181500
2        9   2008      WD       Normal    223500
3        2   2006      WD      Abnормл  140000
4       12   2008      WD       Normal   250000
...
1455      8   2007      WD       Normal   175000
1456      2   2010      WD       Normal   210000
1457      5   2010      WD       Normal   266500
1458      4   2010      WD       Normal   142125
1459      6   2008      WD       Normal   147500

```

[1460 rows x 81 columns]

[4]: df.head(2)

```

[4]:   Id MSSubClass MSZoning LotFrontage LotArea Street Alley LotShape \
0   1           60      RL       65.0     8450    Pave   NaN   Reg
1   2           20      RL       80.0     9600    Pave   NaN   Reg

      LandContour Utilities ... PoolArea PoolQC Fence MiscFeature MiscVal MoSold \
0          Lvl      AllPub ...      0      NaN      NaN      NaN      0      2
1          Lvl      AllPub ...      0      NaN      NaN      NaN      0      5

      YrSold SaleType SaleCondition SalePrice
0   2008      WD       Normal    208500
1   2007      WD       Normal    181500

```

[2 rows x 81 columns]

[5]: df.tail(2)

```

[5]:   Id MSSubClass MSZoning LotFrontage LotArea Street Alley LotShape \
1458  1459           20      RL       68.0     9717    Pave   NaN   Reg
1459  1460           20      RL       75.0     9937    Pave   NaN   Reg

      LandContour Utilities ... PoolArea PoolQC Fence MiscFeature MiscVal \
1458          Lvl      AllPub ...      0      NaN      NaN      NaN      0

```

```

1459          Lvl      AllPub   ...
                0       NaN     NaN
                NaN      0

MoSold  YrSold  SaleType  SaleCondition  SalePrice
1458      4    2010        WD           Normal    142125
1459      6    2008        WD           Normal    147500

[2 rows x 81 columns]

```

[6]: df.columns

```

[6]: Index(['Id', 'MSSubClass', 'MSZoning', 'LotFrontage', 'LotArea', 'Street',
       'Alley', 'LotShape', 'LandContour', 'Utilities', 'LotConfig',
       'LandSlope', 'Neighborhood', 'Condition1', 'Condition2', 'BldgType',
       'HouseStyle', 'OverallQual', 'OverallCond', 'YearBuilt', 'YearRemodAdd',
       'RoofStyle', 'RoofMatl', 'Exterior1st', 'Exterior2nd', 'MasVnrType',
       'MasVnrArea', 'ExterQual', 'ExterCond', 'Foundation', 'BsmtQual',
       'BsmtCond', 'BsmtExposure', 'BsmtFinType1', 'BsmtFinSF1',
       'BsmtFinType2', 'BsmtFinSF2', 'BsmtUnfSF', 'TotalBsmtSF', 'Heating',
       'HeatingQC', 'CentralAir', 'Electrical', '1stFlrSF', '2ndFlrSF',
       'LowQualFinSF', 'GrLivArea', 'BsmtFullBath', 'BsmtHalfBath', 'FullBath',
       'HalfBath', 'BedroomAbvGr', 'KitchenAbvGr', 'KitchenQual', 'TotRmsAbvGrd',
       'Functional', 'Fireplaces', 'FireplaceQu', 'GarageType', 'GarageYrBlt',
       'GarageFinish', 'GarageCars', 'GarageArea', 'GarageQual', 'GarageCond',
       'PavedDrive', 'WoodDeckSF', 'OpenPorchSF', 'EnclosedPorch', '3SsnPorch',
       'ScreenPorch', 'PoolArea', 'PoolQC', 'Fence', 'MiscFeature', 'MiscVal',
       'MoSold', 'YrSold', 'SaleType', 'SaleCondition', 'SalePrice'],
      dtype='object')

```

[7]: df.shape

[7]: (1460, 81)

[8]: df.isna().sum()

```

[8]: Id                  0
      MSSubClass         0
      MSZoning           0
      LotFrontage        259
      LotArea             0
      ...
      MoSold              0
      YrSold              0
      SaleType            0
      SaleCondition       0
      SalePrice           0
Length: 81, dtype: int64

```

```
[9]: #Printing total count of Null values  
print(df.isnull().sum().sum())
```

6965

```
[10]: for i in df.columns:  
        print (i , ":" , df[i].unique())  
        print ("_ _ _ _ _ *40")  
        print ("_ _ _ _ _ *40")
```



```
- - - - -  
BldgType : ['1Fam' '2fmCon' 'Duplex' 'TwnhsE' 'Twnhs']  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
HouseStyle : ['2Story' '1Story' '1.5Fin' '1.5Unf' 'SFoyer' 'SLvl' '2.5Unf'  
'2.5Fin']  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
OverallQual : [ 7 6 8 5 9 4 10 3 1 2]  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
OverallCond : [5 8 6 7 4 2 3 9 1]  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
YearBuilt : [2003 1976 2001 1915 2000 1993 2004 1973 1931 1939 1965 2005 1962  
2006  
1960 1929 1970 1967 1958 1930 2002 1968 2007 1951 1957 1927 1920 1966  
1959 1994 1954 1953 1955 1983 1975 1997 1934 1963 1981 1964 1999 1972  
1921 1945 1982 1998 1956 1948 1910 1995 1991 2009 1950 1961 1977 1985  
1979 1885 1919 1990 1969 1935 1988 1971 1952 1936 1923 1924 1984 1926  
1940 1941 1987 1986 2008 1908 1892 1916 1932 1918 1912 1947 1925 1900  
1980 1989 1992 1949 1880 1928 1978 1922 1996 2010 1946 1913 1937 1942  
1938 1974 1893 1914 1906 1890 1898 1904 1882 1875 1911 1917 1872 1905]  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
YearRemodAdd : [2003 1976 2002 1970 2000 1995 2005 1973 1950 1965 2006 1962 2007  
1960  
2001 1967 2004 2008 1997 1959 1990 1955 1983 1980 1966 1963 1987 1964  
1972 1996 1998 1989 1953 1956 1968 1981 1992 2009 1982 1961 1993 1999  
1985 1979 1977 1969 1958 1991 1971 1952 1975 2010 1984 1986 1994 1988  
1954 1957 1951 1978 1974]  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
- - - - -  
RoofStyle : ['Gable' 'Hip' 'Gambrel' 'Mansard' 'Flat' 'Shed']  
- - - - -  
- - - - -
```

```

-----
RoofMatl : ['CompShg' 'WdShngl' 'Metal' 'WdShake' 'Membran' 'Tar&Grv' 'Roll'
'ClyTile']

-----
Exterior1st : ['VinylSd' 'MetalSd' 'Wd Sdng' 'HdBoard' 'BrkFace' 'WdShing'
'CemntBd'
'Plywood' 'AsbShng' 'Stucco' 'BrkComm' 'AsphShn' 'Stone' 'ImStucc'
'CBlock']

-----
Exterior2nd : ['VinylSd' 'MetalSd' 'Wd Shng' 'HdBoard' 'Plywood' 'Wd Sdng'
'CmentBd'
'BrkFace' 'Stucco' 'AsbShng' 'Brk Cmn' 'ImStucc' 'AsphShn' 'Stone'
'Other' 'CBlock']

-----
MasVnrType : ['BrkFace' 'None' 'Stone' 'BrkCmn' nan]

-----
MasVnrArea : [1.960e+02 0.000e+00 1.620e+02 3.500e+02 1.860e+02 2.400e+02
2.860e+02
3.060e+02 2.120e+02 1.800e+02 3.800e+02 2.810e+02 6.400e+02 2.000e+02
2.460e+02 1.320e+02 6.500e+02 1.010e+02 4.120e+02 2.720e+02 4.560e+02
1.031e+03 1.780e+02 5.730e+02 3.440e+02 2.870e+02 1.670e+02 1.115e+03
4.000e+01 1.040e+02 5.760e+02 4.430e+02 4.680e+02 6.600e+01 2.200e+01
2.840e+02 7.600e+01 2.030e+02 6.800e+01 1.830e+02 4.800e+01 2.800e+01
3.360e+02 6.000e+02 7.680e+02 4.800e+02 2.200e+02 1.840e+02 1.129e+03
1.160e+02 1.350e+02 2.660e+02 8.500e+01 3.090e+02 1.360e+02 2.880e+02
7.000e+01 3.200e+02 5.000e+01 1.200e+02 4.360e+02 2.520e+02 8.400e+01
6.640e+02 2.260e+02 3.000e+02 6.530e+02 1.120e+02 4.910e+02 2.680e+02
7.480e+02 9.800e+01 2.750e+02 1.380e+02 2.050e+02 2.620e+02 1.280e+02
2.600e+02 1.530e+02 6.400e+01 3.120e+02 1.600e+01 9.220e+02 1.420e+02
2.900e+02 1.270e+02 5.060e+02 2.970e+02      nan 6.040e+02 2.540e+02
3.600e+01 1.020e+02 4.720e+02 4.810e+02 1.080e+02 3.020e+02 1.720e+02
3.990e+02 2.700e+02 4.600e+01 2.100e+02 1.740e+02 3.480e+02 3.150e+02
2.990e+02 3.400e+02 1.660e+02 7.200e+01 3.100e+01 3.400e+01 2.380e+02
1.600e+03 3.650e+02 5.600e+01 1.500e+02 2.780e+02 2.560e+02 2.250e+02
3.700e+02 3.880e+02 1.750e+02 2.960e+02 1.460e+02 1.130e+02 1.760e+02

```

|           |           |           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 6.160e+02 | 3.000e+01 | 1.060e+02 | 8.700e+02 | 3.620e+02 | 5.300e+02 | 5.000e+02 |
| 5.100e+02 | 2.470e+02 | 3.050e+02 | 2.550e+02 | 1.250e+02 | 1.000e+02 | 4.320e+02 |
| 1.260e+02 | 4.730e+02 | 7.400e+01 | 1.450e+02 | 2.320e+02 | 3.760e+02 | 4.200e+01 |
| 1.610e+02 | 1.100e+02 | 1.800e+01 | 2.240e+02 | 2.480e+02 | 8.000e+01 | 3.040e+02 |
| 2.150e+02 | 7.720e+02 | 4.350e+02 | 3.780e+02 | 5.620e+02 | 1.680e+02 | 8.900e+01 |
| 2.850e+02 | 3.600e+02 | 9.400e+01 | 3.330e+02 | 9.210e+02 | 7.620e+02 | 5.940e+02 |
| 2.190e+02 | 1.880e+02 | 4.790e+02 | 5.840e+02 | 1.820e+02 | 2.500e+02 | 2.920e+02 |
| 2.450e+02 | 2.070e+02 | 8.200e+01 | 9.700e+01 | 3.350e+02 | 2.080e+02 | 4.200e+02 |
| 1.700e+02 | 4.590e+02 | 2.800e+02 | 9.900e+01 | 1.920e+02 | 2.040e+02 | 2.330e+02 |
| 1.560e+02 | 4.520e+02 | 5.130e+02 | 2.610e+02 | 1.640e+02 | 2.590e+02 | 2.090e+02 |
| 2.630e+02 | 2.160e+02 | 3.510e+02 | 6.600e+02 | 3.810e+02 | 5.400e+01 | 5.280e+02 |
| 2.580e+02 | 4.640e+02 | 5.700e+01 | 1.470e+02 | 1.170e+03 | 2.930e+02 | 6.300e+02 |
| 4.660e+02 | 1.090e+02 | 4.100e+01 | 1.600e+02 | 2.890e+02 | 6.510e+02 | 1.690e+02 |
| 9.500e+01 | 4.420e+02 | 2.020e+02 | 3.380e+02 | 8.940e+02 | 3.280e+02 | 6.730e+02 |
| 6.030e+02 | 1.000e+00 | 3.750e+02 | 9.000e+01 | 3.800e+01 | 1.570e+02 | 1.100e+01 |
| 1.400e+02 | 1.300e+02 | 1.480e+02 | 8.600e+02 | 4.240e+02 | 1.047e+03 | 2.430e+02 |
| 8.160e+02 | 3.870e+02 | 2.230e+02 | 1.580e+02 | 1.370e+02 | 1.150e+02 | 1.890e+02 |
| 2.740e+02 | 1.170e+02 | 6.000e+01 | 1.220e+02 | 9.200e+01 | 4.150e+02 | 7.600e+02 |
| 2.700e+01 | 7.500e+01 | 3.610e+02 | 1.050e+02 | 3.420e+02 | 2.980e+02 | 5.410e+02 |
| 2.360e+02 | 1.440e+02 | 4.230e+02 | 4.400e+01 | 1.510e+02 | 9.750e+02 | 4.500e+02 |
| 2.300e+02 | 5.710e+02 | 2.400e+01 | 5.300e+01 | 2.060e+02 | 1.400e+01 | 3.240e+02 |
| 2.950e+02 | 3.960e+02 | 6.700e+01 | 1.540e+02 | 4.250e+02 | 4.500e+01 | 1.378e+03 |
| 3.370e+02 | 1.490e+02 | 1.430e+02 | 5.100e+01 | 1.710e+02 | 2.340e+02 | 6.300e+01 |
| 7.660e+02 | 3.200e+01 | 8.100e+01 | 1.630e+02 | 5.540e+02 | 2.180e+02 | 6.320e+02 |
| 1.140e+02 | 5.670e+02 | 3.590e+02 | 4.510e+02 | 6.210e+02 | 7.880e+02 | 8.600e+01 |
| 7.960e+02 | 3.910e+02 | 2.280e+02 | 8.800e+01 | 1.650e+02 | 4.280e+02 | 4.100e+02 |
| 5.640e+02 | 3.680e+02 | 3.180e+02 | 5.790e+02 | 6.500e+01 | 7.050e+02 | 4.080e+02 |
| 2.440e+02 | 1.230e+02 | 3.660e+02 | 7.310e+02 | 4.480e+02 | 2.940e+02 | 3.100e+02 |
| 2.370e+02 | 4.260e+02 | 9.600e+01 | 4.380e+02 | 1.940e+02 | 1.190e+02 |           |

ExterQual : ['Gd' 'TA' 'Ex' 'Fa']

ExterCond : ['TA' 'Gd' 'Fa' 'Po' 'Ex']

Foundation : ['PConc' 'CBlock' 'BrkTil' 'Wood' 'Slab' 'Stone']

```

BsmtQual : ['Gd' 'TA' 'Ex' nan 'Fa']
- - - - -
- - - - -
- - - - -
- - - - -
BsmtCond : ['TA' 'Gd' nan 'Fa' 'Po']
- - - - -
- - - - -
- - - - -
- - - - -
BsmtExposure : ['No' 'Gd' 'Mn' 'Av' nan]
- - - - -
- - - - -
- - - - -
- - - - -
BsmtFinType1 : ['GLQ' 'ALQ' 'Unf' 'Rec' 'BLQ' nan 'LwQ']
- - - - -
- - - - -
- - - - -
- - - - -
BsmtFinSF1 : [ 706  978  486  216  655  732 1369  859      0   851   906   998   737
733
 578  646  504  840  188  234 1218 1277 1018 1153 1213  731  643  967
 747  280  179  456 1351   24  763  182  104 1810  384  490  649  632
 941  739  912 1013  603 1880  565  320  462  228  336  448 1201   33
 588  600  713 1046  648  310 1162  520  108  569 1200  224  705  444
 250  984   35  774  419  170 1470  938  570  300  120  116  512  567
 445  695  405 1005  668  821  432 1300  507  679 1332  209  680  716
1400  416  429  222   57  660 1016  370  351  379 1288  360  639  495
 288 1398  477  831 1904  436  352  611 1086  297  626  560  390  566
1126 1036 1088  641  617  662  312 1065  787  468   36  822  378  946
 341    16  550  524   56  321  842  689  625  358  402   94 1078  329
 929  697 1573  270  922  503 1334  361  672  506  714  403  751  226
 620  546  392  421  905  904  430  614  450  210  292  795 1285  819
 420  841  281  894 1464  700  262 1274  518 1236  425  692  987  970
   28  256 1619    40  846 1124  720  828 1249  810  213  585  129  498
1270  573 1410 1082  236  388  334  874  956  773  399  162  712  609
 371  540    72  623  428  350  298 1445  218  985  631 1280  241  690
 266  777  812  786 1116  789 1056   50 1128  775 1309 1246  986  616
1518  664  387  471  385  365 1767  133  642  247  331  742 1606  916
 185  544  553  326  778  386  426  368  459 1350 1196  630  994  168
1261 1567  299  897  607  836  515  374 1231  111  356  400  698 1247
 257  380    27  141  991  650  521 1436 2260  719  377 1330  348 1219
 783  969  673 1358 1260  144  584  554 1002  619  180  559  308  866
 895  637  604 1302 1071  290  728    2 1441  943  231  414  349  442
 328  594  816 1460 1324 1338  685 1422 1283   81  454  903  605  990
 206  150  457    48  871   41  674  624  480 1154  738  493 1121  282
 500  131 1696   806 1361  920 1721  187 1138  988  193  551  767 1186

```

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 892  | 311  | 827  | 543  | 1003 | 1059 | 239  | 945  | 20   | 1455 | 965  | 980  | 863  | 533  |
| 1084 | 1173 | 523  | 1148 | 191  | 1234 | 375  | 808  | 724  | 152  | 1180 | 252  | 832  | 575  |
| 919  | 439  | 381  | 438  | 549  | 612  | 1163 | 437  | 394  | 1416 | 422  | 762  | 975  | 1097 |
| 251  | 686  | 656  | 568  | 539  | 862  | 197  | 516  | 663  | 608  | 1636 | 784  | 249  | 1040 |
| 483  | 196  | 572  | 338  | 330  | 156  | 1390 | 513  | 460  | 659  | 364  | 564  | 306  | 505  |
| 932  | 750  | 64   | 633  | 1170 | 899  | 902  | 1238 | 528  | 1024 | 1064 | 285  | 2188 | 465  |
| 322  | 860  | 599  | 354  | 63   | 223  | 301  | 443  | 489  | 284  | 294  | 814  | 165  | 552  |
| 833  | 464  | 936  | 772  | 1440 | 748  | 982  | 398  | 562  | 484  | 417  | 699  | 696  | 896  |
| 556  | 1106 | 651  | 867  | 854  | 1646 | 1074 | 536  | 1172 | 915  | 595  | 1237 | 273  | 684  |
| 324  | 1165 | 138  | 1513 | 317  | 1012 | 1022 | 509  | 900  | 1085 | 1104 | 240  | 383  | 644  |
| 397  | 740  | 837  | 220  | 586  | 535  | 410  | 75   | 824  | 592  | 1039 | 510  | 423  | 661  |
| 248  | 704  | 412  | 1032 | 219  | 708  | 415  | 1004 | 353  | 702  | 369  | 622  | 212  | 645  |
| 852  | 1150 | 1258 | 275  | 176  | 296  | 538  | 1157 | 492  | 1198 | 1387 | 522  | 658  | 1216 |
| 1480 | 2096 | 1159 | 440  | 1456 | 883  | 547  | 788  | 485  | 340  | 1220 | 427  | 344  | 756  |
| 1540 | 666  | 803  | 1000 | 885  | 1386 | 319  | 534  | 125  | 1314 | 602  | 192  | 593  | 804  |
| 1053 | 532  | 1158 | 1014 | 194  | 167  | 776  | 5644 | 694  | 1572 | 746  | 1406 | 925  | 482  |
| 189  | 765  | 80   | 1443 | 259  | 735  | 734  | 1447 | 548  | 315  | 1282 | 408  | 309  | 203  |
| 865  | 204  | 790  | 1320 | 769  | 1070 | 264  | 759  | 1373 | 976  | 781  | 25   | 1110 | 404  |
| 580  | 678  | 958  | 1336 | 1079 | 49   | 830] |      |      |      |      |      |      |      |

BsmtFinType2 : ['Unf' 'BLQ' nan 'ALQ' 'Rec' 'LwQ' 'GLQ']

|     |   |
|-----|---|
| 670 | BsmtFinSF2 : [ 0 32 668 486 93 491 506 712 362 41 169 869 150 |
| 28  | 1080 181 768 215 374 208 441 184 279 306 180 580 690          |
| 692 | 228 125 1063 620 175 820 1474 264 479 147 232 380 544         |
| 294 | 258 121 391 531 344 539 713 210 311 1120 165 532 96           |
| 495 | 174 1127 139 202 645 123 551 219 606 612 480 182 132          |
| 336 | 468 287 35 499 723 119 40 117 239 80 472 64 1057              |
| 127 | 630 128 377 764 345 1085 435 823 500 290 324 634 411          |
| 841 | 1061 466 396 354 149 193 273 465 400 682 557 230 106          |
| 791 | 240 547 469 177 108 600 492 211 168 1031 438 375 144          |
| 81  | 906 608 276 661 68 173 972 105 420 546 334 352 872            |
| 110 | 627 163 1029]   |

|      |  |
|------|--|
| 1494 | BsmtUnfSF : [ 150 284 434 540 490 64 317 216 952 140 134 177 175 |
| 520  | 832 426 0 468 525 1158 637 1777 200 204 1566 180 486             |
| 207  | 649 1228 1234 380 408 1117 1097 84 326 445 383 167 465           |

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1296 | 83   | 1632 | 736  | 192  | 612  | 816  | 32   | 935  | 321  | 860  | 1410 | 148  | 217  |
| 530  | 1346 | 576  | 318  | 1143 | 1035 | 440  | 747  | 701  | 343  | 280  | 404  | 840  | 724  |
| 295  | 1768 | 448  | 36   | 1530 | 1065 | 384  | 1288 | 684  | 1013 | 402  | 635  | 163  | 168  |
| 176  | 370  | 350  | 381  | 410  | 741  | 1226 | 1053 | 641  | 516  | 793  | 1139 | 550  | 905  |
| 104  | 310  | 252  | 1125 | 203  | 728  | 732  | 510  | 899  | 1362 | 30   | 958  | 556  | 413  |
| 479  | 297  | 658  | 262  | 891  | 1304 | 519  | 1907 | 336  | 107  | 432  | 403  | 811  | 396  |
| 970  | 506  | 884  | 400  | 896  | 253  | 409  | 93   | 1200 | 572  | 774  | 769  | 1335 | 340  |
| 882  | 779  | 112  | 470  | 294  | 1686 | 360  | 441  | 354  | 700  | 725  | 320  | 554  | 312  |
| 968  | 504  | 1107 | 577  | 660  | 99   | 871  | 474  | 289  | 600  | 755  | 625  | 1121 | 276  |
| 186  | 1424 | 1140 | 375  | 92   | 305  | 1176 | 78   | 274  | 311  | 710  | 686  | 457  | 1232 |
| 1498 | 1010 | 160  | 2336 | 630  | 638  | 162  | 70   | 1357 | 1194 | 773  | 483  | 235  | 125  |
| 1390 | 594  | 1694 | 488  | 357  | 626  | 916  | 1020 | 1367 | 798  | 452  | 392  | 975  | 361  |
| 270  | 602  | 1482 | 680  | 606  | 88   | 342  | 212  | 1095 | 96   | 628  | 1560 | 744  | 2121 |
| 768  | 386  | 1468 | 1145 | 244  | 698  | 1079 | 570  | 476  | 131  | 184  | 143  | 1092 | 324  |
| 1541 | 1470 | 536  | 319  | 599  | 622  | 179  | 292  | 286  | 80   | 712  | 291  | 153  | 1088 |
| 1249 | 166  | 906  | 604  | 100  | 818  | 844  | 596  | 210  | 1603 | 115  | 103  | 673  | 726  |
| 995  | 967  | 721  | 1656 | 972  | 460  | 208  | 191  | 438  | 1869 | 371  | 624  | 552  | 322  |
| 598  | 268  | 130  | 484  | 785  | 733  | 953  | 847  | 333  | 1580 | 411  | 982  | 808  | 1293 |
| 939  | 784  | 595  | 229  | 114  | 522  | 735  | 405  | 117  | 961  | 1286 | 672  | 1141 | 806  |
| 165  | 1064 | 1063 | 245  | 1276 | 892  | 1008 | 499  | 1316 | 463  | 242  | 444  | 281  | 35   |
| 356  | 988  | 580  | 651  | 619  | 544  | 387  | 901  | 926  | 135  | 648  | 75   | 788  | 1307 |
| 1078 | 1258 | 273  | 1436 | 557  | 930  | 780  | 813  | 878  | 122  | 248  | 588  | 524  | 288  |
| 389  | 424  | 1375 | 1626 | 406  | 298  | 2153 | 417  | 739  | 225  | 611  | 237  | 290  | 264  |
| 238  | 363  | 190  | 1969 | 697  | 414  | 316  | 466  | 420  | 254  | 960  | 397  | 1191 | 548  |
| 50   | 178  | 1368 | 169  | 748  | 689  | 1264 | 467  | 605  | 1257 | 551  | 678  | 707  | 880  |
| 378  | 223  | 578  | 969  | 379  | 765  | 149  | 912  | 620  | 1709 | 132  | 993  | 197  | 1374 |
| 90   | 195  | 706  | 1163 | 367  | 1122 | 1515 | 55   | 1497 | 450  | 846  | 23   | 390  | 861  |
| 285  | 1050 | 331  | 2042 | 1237 | 113  | 742  | 924  | 512  | 119  | 314  | 308  | 293  | 537  |
| 126  | 427  | 309  | 914  | 173  | 1774 | 823  | 485  | 1116 | 978  | 636  | 564  | 108  | 1184 |
| 796  | 366  | 300  | 542  | 645  | 664  | 756  | 247  | 776  | 849  | 1392 | 38   | 1406 | 111  |
| 545  | 121  | 2046 | 161  | 261  | 567  | 1195 | 874  | 1342 | 151  | 989  | 1073 | 927  | 219  |
| 224  | 526  | 1164 | 761  | 461  | 876  | 859  | 171  | 718  | 138  | 941  | 464  | 250  | 72   |
| 508  | 1584 | 415  | 82   | 948  | 893  | 864  | 1349 | 76   | 487  | 652  | 1240 | 801  | 279  |
| 1030 | 348  | 234  | 1198 | 740  | 89   | 586  | 323  | 1836 | 480  | 456  | 1935 | 338  | 1594 |
| 102  | 374  | 1413 | 491  | 1129 | 255  | 1496 | 650  | 1926 | 154  | 999  | 1734 | 124  | 1417 |
| 15   | 834  | 1649 | 936  | 778  | 1489 | 442  | 1434 | 352  | 458  | 1221 | 1099 | 416  | 1800 |
| 227  | 907  | 528  | 189  | 1273 | 563  | 372  | 702  | 1090 | 435  | 198  | 1372 | 174  | 1638 |
| 894  | 299  | 105  | 676  | 1120 | 431  | 218  | 110  | 795  | 1098 | 1043 | 481  | 666  | 142  |
| 447  | 783  | 1670 | 277  | 412  | 794  | 239  | 662  | 1072 | 717  | 546  | 430  | 422  | 188  |
| 266  | 1181 | 1753 | 964  | 1450 | 1905 | 1480 | 772  | 1032 | 220  | 187  | 29   | 495  | 640  |
| 193  | 196  | 720  | 918  | 1428 | 77   | 1266 | 1128 | 692  | 770  | 750  | 1442 | 1007 | 501  |
| 691  | 1550 | 1680 | 1330 | 1710 | 746  | 814  | 515  | 571  | 359  | 355  | 301  | 668  | 920  |
| 1055 | 1420 | 1752 | 304  | 1302 | 833  | 133  | 549  | 705  | 722  | 799  | 462  | 429  | 810  |
| 155  | 170  | 230  | 1459 | 1082 | 758  | 1290 | 1074 | 251  | 172  | 868  | 797  | 365  | 418  |
| 730  | 533  | 671  | 1012 | 1528 | 1005 | 1373 | 500  | 762  | 752  | 399  | 1042 | 40   | 26   |
| 932  | 278  | 459  | 568  | 1502 | 543  | 574  | 977  | 449  | 983  | 731  | 120  | 538  | 831  |
| 994  | 341  | 879  | 815  | 1212 | 866  | 1630 | 328  | 141  | 364  | 1380 | 81   | 303  | 940  |
| 764  | 1048 | 334  | 1689 | 690  | 792  | 585  | 473  | 246  | 1045 | 1405 | 201  | 14   | 841  |

|               |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| 1104          | 241  | 925  | 2002 | 74   | 661  | 708  | 1152 | 256  | 804  | 812  | 1085 | 344  | 425  |     |
| 1616          | 976  | 496  | 349  | 971  | 1393 | 1622 | 1352 | 1795 | 1017 | 1588 | 428  | 803  | 693  |     |
| 858           | 1284 | 1203 | 1652 | 39   | 539  | 1217 | 257  | 715  | 616  | 240  | 315  | 1351 | 1026 |     |
| 1571          | 156  | 61   | 95   | 482  | 1094 | 60   | 862  | 221  | 791  | 398  | 777  | 503  | 734  |     |
| 709           | 1252 | 656  | 1319 | 1422 | 560  | 1573 | 589  | 877  | 136] |      |      |      |      |     |
| -             | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |     |
| -             | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |     |
| -             | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |     |
| TotalBsmtSF : | [    | 856  | 1262 | 920  | 756  | 1145 | 796  | 1686 | 1107 | 952  | 991  | 1040 | 1175 | 912 |
| 1494          |      |      |      |      |      |      |      |      |      |      |      |      |      |     |
| 1253          | 832  | 1004 | 0    | 1114 | 1029 | 1158 | 637  | 1777 | 1060 | 1566 | 900  | 1704 | 1484 |     |
| 520           | 649  | 1228 | 1234 | 1398 | 1561 | 1117 | 1097 | 1297 | 1057 | 1088 | 1350 | 840  | 938  |     |
| 1150          | 1752 | 1434 | 1656 | 736  | 955  | 794  | 816  | 1842 | 384  | 1425 | 970  | 860  | 1410 |     |
| 780           | 530  | 1370 | 576  | 1143 | 1947 | 1453 | 747  | 1304 | 2223 | 845  | 1086 | 462  | 672  |     |
| 1768          | 440  | 896  | 1237 | 1563 | 1065 | 1288 | 684  | 612  | 1013 | 990  | 1235 | 876  | 1214 |     |
| 824           | 680  | 1588 | 960  | 458  | 950  | 1610 | 741  | 1226 | 1053 | 641  | 789  | 793  | 1844 |     |
| 994           | 1264 | 1809 | 1028 | 729  | 1092 | 1125 | 1673 | 728  | 732  | 1080 | 1199 | 1362 | 1078 |     |
| 660           | 1008 | 924  | 992  | 1063 | 1267 | 1461 | 1907 | 928  | 864  | 1734 | 910  | 1490 | 1728 |     |
| 715           | 884  | 969  | 1710 | 825  | 1602 | 1200 | 572  | 774  | 1392 | 1232 | 1572 | 1541 | 882  |     |
| 1149          | 644  | 1617 | 1582 | 720  | 1064 | 1606 | 1202 | 1151 | 1052 | 2216 | 968  | 504  | 1188 |     |
| 1593          | 853  | 725  | 1431 | 855  | 1726 | 1360 | 755  | 1713 | 1121 | 1196 | 617  | 848  | 1424 |     |
| 1140          | 1100 | 1157 | 1212 | 689  | 1070 | 1436 | 686  | 798  | 1248 | 1498 | 1010 | 713  | 2392 |     |
| 630           | 1203 | 483  | 1373 | 1194 | 1462 | 894  | 1414 | 996  | 1694 | 735  | 540  | 626  | 948  |     |
| 1845          | 1020 | 1367 | 1444 | 1573 | 1302 | 1314 | 975  | 1604 | 963  | 1482 | 506  | 926  | 1422 |     |
| 802           | 740  | 1095 | 1385 | 1152 | 1240 | 1560 | 2121 | 1160 | 807  | 1468 | 1575 | 625  | 858  |     |
| 698           | 1079 | 768  | 795  | 1416 | 1003 | 702  | 1165 | 1470 | 2000 | 700  | 319  | 861  | 1896 |     |
| 697           | 972  | 2136 | 716  | 1347 | 1372 | 1249 | 1136 | 1502 | 1162 | 710  | 1719 | 1383 | 844  |     |
| 596           | 1056 | 3206 | 1358 | 943  | 1499 | 1922 | 1536 | 1208 | 1215 | 967  | 721  | 1684 | 536  |     |
| 958           | 1478 | 764  | 1848 | 1869 | 616  | 624  | 940  | 1142 | 1062 | 888  | 883  | 1394 | 1099 |     |
| 1268          | 953  | 744  | 608  | 847  | 683  | 870  | 1580 | 1856 | 982  | 1026 | 1293 | 939  | 784  |     |
| 1256          | 658  | 1041 | 1682 | 804  | 788  | 1144 | 961  | 1260 | 1310 | 1141 | 806  | 1281 | 1034 |     |
| 1276          | 1340 | 1344 | 988  | 651  | 1518 | 907  | 901  | 765  | 799  | 648  | 3094 | 1440 | 1258 |     |
| 915           | 1517 | 930  | 813  | 1533 | 872  | 1242 | 1364 | 588  | 709  | 560  | 1375 | 1277 | 1626 |     |
| 1488          | 808  | 547  | 1976 | 2153 | 1705 | 1833 | 1792 | 1216 | 999  | 1113 | 1073 | 954  | 264  |     |
| 1269          | 190  | 3200 | 866  | 1501 | 777  | 1218 | 1368 | 1084 | 2006 | 1244 | 3138 | 1379 | 1257 |     |
| 1452          | 528  | 2035 | 611  | 707  | 880  | 1051 | 1581 | 1838 | 1650 | 723  | 654  | 1204 | 1069 |     |
| 1709          | 998  | 993  | 1374 | 1389 | 1163 | 1122 | 1496 | 846  | 372  | 1164 | 1050 | 2042 | 1868 |     |
| 1437          | 742  | 770  | 1722 | 1814 | 1430 | 1058 | 908  | 600  | 965  | 1032 | 1299 | 1120 | 936  |     |
| 783           | 1822 | 1522 | 980  | 1116 | 978  | 1156 | 636  | 1554 | 1386 | 811  | 1520 | 1952 | 1766 |     |
| 981           | 1094 | 2109 | 525  | 776  | 1486 | 1629 | 1138 | 2077 | 1406 | 1021 | 1408 | 738  | 1477 |     |
| 2046          | 923  | 1291 | 1195 | 1190 | 874  | 551  | 1419 | 2444 | 1210 | 927  | 1112 | 1391 | 1800 |     |
| 360           | 1473 | 1643 | 1324 | 270  | 859  | 718  | 1176 | 1311 | 971  | 1742 | 941  | 1698 | 1584 |     |
| 1595          | 868  | 1153 | 893  | 1349 | 1337 | 1720 | 1479 | 1030 | 1318 | 1252 | 983  | 1860 | 836  |     |
| 1935          | 1614 | 761  | 1413 | 956  | 712  | 650  | 773  | 1926 | 731  | 1417 | 1024 | 849  | 1442 |     |
| 1649          | 1568 | 778  | 1489 | 2078 | 1454 | 1516 | 1067 | 1559 | 1127 | 1390 | 1273 | 918  | 1763 |     |
| 1090          | 1054 | 1039 | 1148 | 1002 | 1638 | 105  | 676  | 1184 | 1109 | 892  | 2217 | 1505 | 1059 |     |
| 951           | 2330 | 1670 | 1623 | 1017 | 1105 | 1001 | 546  | 480  | 1134 | 1104 | 1272 | 1316 | 1126 |     |

|      |      |      |      |      |      |       |      |      |      |      |      |      |      |
|------|------|------|------|------|------|-------|------|------|------|------|------|------|------|
| 1181 | 1753 | 964  | 1466 | 925  | 1905 | 1500  | 585  | 1632 | 819  | 1616 | 1161 | 828  | 945  |
| 979  | 561  | 696  | 1330 | 817  | 1098 | 1428  | 673  | 1241 | 944  | 1225 | 1266 | 1128 | 485  |
| 1930 | 1396 | 916  | 822  | 750  | 1700 | 1007  | 1187 | 691  | 1574 | 1680 | 1346 | 985  | 1657 |
| 602  | 1022 | 1082 | 810  | 1504 | 1220 | 1132  | 1565 | 1338 | 1654 | 1620 | 1055 | 800  | 1306 |
| 1475 | 2524 | 1992 | 1193 | 973  | 854  | 662   | 1103 | 1154 | 942  | 1048 | 727  | 690  | 1096 |
| 1459 | 1251 | 1247 | 1074 | 1271 | 290  | 655   | 1463 | 1836 | 803  | 833  | 408  | 533  | 1012 |
| 1552 | 1005 | 1530 | 974  | 1567 | 1006 | 1042  | 1298 | 704  | 932  | 1219 | 1296 | 1198 | 959  |
| 1261 | 1598 | 1683 | 818  | 1600 | 2396 | 1624  | 831  | 1224 | 663  | 879  | 815  | 1630 | 2158 |
| 931  | 1660 | 559  | 1300 | 1702 | 1075 | 1361  | 1106 | 1476 | 1689 | 2076 | 792  | 2110 | 1405 |
| 1192 | 746  | 1986 | 841  | 2002 | 1332 | 935   | 1019 | 661  | 1309 | 1328 | 1085 | 6110 | 1246 |
| 771  | 976  | 1652 | 1278 | 1902 | 1274 | 1393  | 1622 | 1352 | 420  | 1795 | 544  | 1510 | 911  |
| 693  | 1284 | 1732 | 2033 | 570  | 1980 | 814   | 873  | 757  | 1108 | 2633 | 1571 | 984  | 1205 |
| 714  | 1746 | 1525 | 482  | 1356 | 862  | 839   | 1286 | 1485 | 1594 | 622  | 791  | 708  | 1223 |
| 913  | 656  | 1319 | 1932 | 539  | 1221 | 1542] |      |      |      |      |      |      |      |

Heating : ['GasA' 'GasW' 'Grav' 'Wall' 'OthW' 'Floor']

HeatingQC : ['Ex' 'Gd' 'TA' 'Fa' 'Po']

CentralAir : ['Y' 'N']

Electrical : ['SBrkr' 'FuseF' 'FuseA' 'FuseP' 'Mix' nan]

1stFlrSF : [ 856 1262 920 961 1145 796 1694 1107 1022 1077 1040 1182 912 ]

1494

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1253 | 854  | 1004 | 1296 | 1114 | 1339 | 1158 | 1108 | 1795 | 1060 | 1600 | 900  | 1704 | 520  |
| 649  | 1228 | 1234 | 1700 | 1561 | 1132 | 1097 | 1297 | 1057 | 1152 | 1324 | 1328 | 884  | 938  |
| 1150 | 1752 | 1518 | 1656 | 736  | 955  | 794  | 816  | 1842 | 1360 | 1425 | 983  | 860  | 1426 |
| 780  | 581  | 1370 | 902  | 1143 | 2207 | 1479 | 747  | 1304 | 2223 | 845  | 885  | 1086 | 840  |
| 526  | 952  | 1072 | 1768 | 682  | 1337 | 1563 | 1065 | 804  | 1301 | 684  | 612  | 1013 | 990  |
| 1235 | 964  | 1260 | 905  | 680  | 1588 | 960  | 835  | 1225 | 1610 | 977  | 1535 | 1226 | 1053 |
| 1047 | 789  | 997  | 1844 | 1216 | 774  | 1282 | 2259 | 1436 | 729  | 1092 | 1125 | 1699 | 728  |
| 988  | 772  | 1080 | 1199 | 1586 | 958  | 660  | 1327 | 1721 | 1682 | 1214 | 1959 | 928  | 864  |

|      |      |      |      |      |      |      |      |      |      |       |      |      |      |
|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|
| 1734 | 910  | 1501 | 1728 | 970  | 875  | 896  | 969  | 1710 | 1252 | 1200  | 572  | 991  | 1392 |
| 1232 | 1572 | 1541 | 882  | 1149 | 808  | 1867 | 1707 | 1064 | 1362 | 1651  | 2158 | 1164 | 2234 |
| 968  | 769  | 901  | 1340 | 936  | 1217 | 1224 | 1593 | 1549 | 725  | 1431  | 855  | 1726 | 929  |
| 1713 | 1121 | 1279 | 865  | 848  | 720  | 1442 | 1696 | 1100 | 1180 | 1212  | 932  | 689  | 1236 |
| 810  | 1137 | 1248 | 1498 | 1010 | 811  | 2392 | 630  | 483  | 1555 | 1194  | 1490 | 894  | 1414 |
| 1014 | 798  | 1566 | 866  | 889  | 626  | 1222 | 1872 | 908  | 1375 | 1444  | 1306 | 1625 | 1302 |
| 1314 | 1005 | 1604 | 963  | 1382 | 1482 | 926  | 764  | 1422 | 802  | 1052  | 778  | 1113 | 1095 |
| 1363 | 1632 | 1560 | 2121 | 1156 | 1175 | 1468 | 1575 | 625  | 1085 | 858   | 698  | 1079 | 1148 |
| 1644 | 1003 | 975  | 1041 | 1336 | 1210 | 1675 | 2000 | 1122 | 1035 | 861   | 1944 | 697  | 972  |
| 793  | 2036 | 832  | 716  | 1153 | 1088 | 1372 | 1472 | 1249 | 1136 | 1553  | 1163 | 1898 | 803  |
| 1719 | 1383 | 1445 | 596  | 1056 | 1629 | 1358 | 943  | 1619 | 1922 | 1536  | 1621 | 1215 | 993  |
| 841  | 1684 | 536  | 1478 | 1848 | 1869 | 1453 | 616  | 1192 | 1167 | 1142  | 1352 | 495  | 790  |
| 672  | 1394 | 1268 | 1287 | 953  | 1120 | 752  | 1319 | 847  | 904  | 914   | 1580 | 1856 | 1007 |
| 1026 | 939  | 784  | 1269 | 658  | 1742 | 788  | 735  | 1144 | 876  | 1112  | 1288 | 1310 | 1165 |
| 806  | 1620 | 1166 | 1071 | 1050 | 1276 | 1028 | 756  | 1344 | 1602 | 1470  | 1196 | 707  | 907  |
| 1208 | 1412 | 765  | 827  | 734  | 694  | 2402 | 1440 | 1128 | 1258 | 933   | 1689 | 1888 | 956  |
| 679  | 813  | 1533 | 888  | 786  | 1242 | 624  | 1663 | 833  | 979  | 575   | 849  | 1277 | 1634 |
| 1502 | 1161 | 1976 | 1652 | 1493 | 2069 | 1718 | 1131 | 1850 | 1792 | 916   | 999  | 1073 | 1484 |
| 1766 | 886  | 3228 | 1133 | 899  | 1801 | 1218 | 1368 | 2020 | 1378 | 1244  | 3138 | 1266 | 1476 |
| 605  | 2515 | 1509 | 751  | 334  | 820  | 880  | 1159 | 1601 | 1838 | 1680  | 767  | 664  | 1377 |
| 915  | 768  | 825  | 1069 | 1717 | 1126 | 1006 | 1048 | 897  | 1557 | 1389  | 996  | 1134 | 1496 |
| 846  | 576  | 877  | 1320 | 703  | 1429 | 2042 | 1521 | 989  | 2028 | 838   | 1473 | 779  | 770  |
| 924  | 1826 | 1402 | 1647 | 1058 | 927  | 600  | 1186 | 1940 | 1029 | 1032  | 1299 | 1054 | 807  |
| 1828 | 1548 | 980  | 1012 | 1116 | 1520 | 1350 | 1089 | 1554 | 1411 | 800   | 1567 | 981  | 1094 |
| 1051 | 822  | 755  | 909  | 2113 | 525  | 851  | 1486 | 1686 | 1181 | 2097  | 1454 | 1465 | 1679 |
| 1437 | 738  | 1839 | 792  | 2046 | 923  | 1291 | 1668 | 1195 | 1190 | 874   | 551  | 1419 | 2444 |
| 1238 | 1067 | 1391 | 1800 | 1264 | 372  | 1824 | 859  | 1576 | 1178 | 1325  | 971  | 1698 | 1776 |
| 1616 | 1146 | 948  | 1349 | 1464 | 1720 | 1038 | 742  | 757  | 1506 | 1836  | 1690 | 1220 | 1117 |
| 1973 | 1204 | 1614 | 1430 | 1110 | 1342 | 966  | 976  | 1062 | 1127 | 1285  | 773  | 1966 | 1428 |
| 1075 | 1309 | 1044 | 686  | 1661 | 1008 | 944  | 1489 | 2084 | 1434 | 1160  | 941  | 1516 | 1559 |
| 1099 | 1701 | 1307 | 1456 | 918  | 1779 | 702  | 1512 | 1039 | 1002 | 1646  | 1547 | 1036 | 676  |
| 1184 | 1462 | 1155 | 1090 | 1187 | 954  | 892  | 1709 | 1712 | 872  | 2217  | 1505 | 1068 | 951  |
| 2364 | 1670 | 1063 | 1636 | 1020 | 1105 | 1015 | 1001 | 546  | 480  | 1229  | 1272 | 1316 | 1617 |
| 1098 | 1788 | 1466 | 925  | 1905 | 1500 | 1207 | 1188 | 1381 | 965  | 1168  | 561  | 696  | 1542 |
| 824  | 783  | 673  | 869  | 1241 | 1118 | 1407 | 750  | 691  | 1574 | 1504  | 985  | 1657 | 1664 |
| 1082 | 2898 | 1687 | 1654 | 1055 | 1803 | 1532 | 2524 | 1733 | 1992 | 1771  | 930  | 1526 | 1091 |
| 1523 | 1364 | 1130 | 1096 | 1338 | 1103 | 1154 | 799  | 893  | 829  | 1240  | 1459 | 1251 | 1247 |
| 1390 | 438  | 950  | 887  | 1021 | 1552 | 812  | 1530 | 974  | 986  | 1042  | 1298 | 1811 | 1265 |
| 1640 | 1432 | 959  | 1831 | 1261 | 1170 | 2129 | 818  | 1124 | 2411 | 949   | 1624 | 831  | 1622 |
| 842  | 663  | 879  | 815  | 1630 | 1074 | 2196 | 1283 | 1660 | 1318 | 1211  | 2136 | 1138 | 1702 |
| 1507 | 1361 | 1024 | 1141 | 1173 | 2076 | 1140 | 1034 | 2110 | 1405 | 760   | 1987 | 1104 | 713  |
| 2018 | 1968 | 1332 | 935  | 1357 | 661  | 1724 | 1573 | 1582 | 1659 | 4692  | 1246 | 753  | 1203 |
| 1294 | 1902 | 1274 | 1787 | 1061 | 708  | 1584 | 1334 | 693  | 1284 | 1172  | 2156 | 2053 | 992  |
| 1078 | 1980 | 1281 | 814  | 2633 | 1571 | 984  | 754  | 2117 | 998  | 1416  | 1746 | 1525 | 1221 |
| 741  | 1569 | 1223 | 962  | 1537 | 1932 | 1423 | 913  | 1578 | 2073 | 1256] |      |      |      |

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2ndFlrSF : [ 854    0   866   756  1053   566   983   752  1142  1218   668  1320   631
716
 676  860 1519  530  808  977 1330  833  765  462  213  548  960  670
1116  876  612 1031  881  790  755  592  939  520  639  656 1414  884
 729 1523  728  351  688  941 1032  848  836  475  739 1151  448  896
 524 1194  956 1070 1096  467  547  551  880  703  901  720  316 1518
 704 1178  754  601 1360  929  445  564  882  920  518  817 1257  741
 672 1306  504 1304 1100  730  689  591  888 1020  828  700  842 1286
 864  829 1092  709  844 1106  596  807  625  649  698  840  780  568
 795  648  975  702 1242 1818 1121  371  804  325  809 1200  871 1274
1347 1332 1177 1080  695  167  915  576  605  862  495  403  838  517
1427  784  711  468 1081  886  793  665  858  874  526  590  406 1157
 299  936  438 1098  766 1101 1028 1017 1254  378 1160  682  110  600
 678  834  384  512  930  868  224 1103  560  811  878  574  910  620
 687  546  902 1000  846 1067  914  660 1538 1015 1237  611  707  527
1288  832  806 1182 1040  439  717  511 1129 1370  636  533  745  584
 812  684  595  988  800  677  573 1066  778  661 1440  872  788  843
 713  567  651  762  482  738  586  679  644  900  887 1872 1281  472
1312  319  978 1093  473  664 1540 1276  441  348 1060  714  744 1203
 783 1097  734  767 1589  742  686 1128 1111 1174  787 1072 1088 1063
 545  966  623  432  581  540  769 1051  761  779  514  455 1426  785
 521  252  813 1120 1037 1169 1001 1215  928 1140 1243  571 1196 1038
 561  979  701  332  368  883 1336 1141  634  912  798  985  826  831
 750  456  602  855  336  408  980  998 1168 1208  797  850  898 1054
 895  954  772 1230  727  454  370  628  304  582 1122 1134  885  640
 580 1112  653  220  240 1362  534  539  650  918  933  712 1796  971
1175  743  523 1216 2065  272  685  776  630  984  875  913  464 1039
1259  940  892  725  924  764  925 1479  192  589  992  903  430  748
 587  994  950 1323  732 1357  557 1296  390 1185  873 1611  457  796
 908  550  989  932  358 1392  349  691 1349  768  208  622  857  556
1044  708  626  904  510 1104  830  981  870  694 1152]

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LowQualFinSF : [ 0  360  513  234  528  572  144  392  371  390  420  473  156  515  80  53
232 481
 120 514 397 479 205 384]

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GrLivArea : [1710 1262 1786 1717 2198 1362 1694 2090 1774 1077 1040 2324  912
1494
 1253  854 1004 1296 1114 1339 2376 1108 1795 1060 1600  900 1704  520
1317 1228 1234 1700 1561 2452 1097 1297 1057 1152 1324 1328  884  938
1150 1752 2149 1656 1452  955 1470 1176  816 1842 1360 1425 1739 1720

```

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 2945 | 780  | 1158 | 1111 | 1370 | 2034 | 2473 | 2207 | 1479 | 747  | 2287 | 2223 | 845  | 1718 |
| 1086 | 1605 | 988  | 952  | 1285 | 1768 | 1230 | 2142 | 1337 | 1563 | 1065 | 1474 | 2417 | 1560 |
| 1224 | 1526 | 990  | 1235 | 964  | 2291 | 1588 | 960  | 835  | 1225 | 1610 | 1732 | 1535 | 1226 |
| 1818 | 1992 | 1047 | 789  | 1517 | 1844 | 1855 | 1430 | 2696 | 2259 | 2320 | 1458 | 1092 | 1125 |
| 3222 | 1456 | 1123 | 1080 | 1199 | 1586 | 754  | 958  | 840  | 1348 | 1053 | 2157 | 2054 | 1327 |
| 1721 | 1682 | 1214 | 1959 | 1852 | 1764 | 864  | 1734 | 1385 | 1501 | 1728 | 1709 | 875  | 2035 |
| 1344 | 969  | 1993 | 1252 | 1200 | 1096 | 1968 | 1947 | 2462 | 1232 | 2668 | 1541 | 882  | 1616 |
| 1355 | 1867 | 2161 | 1707 | 1382 | 1767 | 1651 | 2158 | 2060 | 1920 | 2234 | 968  | 1525 | 1802 |
| 1340 | 2082 | 3608 | 1217 | 1593 | 2727 | 1431 | 1726 | 3112 | 2229 | 1713 | 1121 | 1279 | 1310 |
| 848  | 1284 | 1442 | 1696 | 1100 | 2062 | 1212 | 1392 | 1236 | 1436 | 1954 | 1248 | 1498 | 2267 |
| 1552 | 2392 | 1302 | 2520 | 987  | 1555 | 1194 | 2794 | 894  | 1960 | 1414 | 1744 | 1487 | 1566 |
| 866  | 1440 | 2110 | 1872 | 1928 | 1375 | 1668 | 2144 | 1306 | 1625 | 1640 | 1314 | 1604 | 1792 |
| 2574 | 1316 | 764  | 1422 | 1511 | 2192 | 778  | 1113 | 1939 | 1363 | 2270 | 1632 | 1548 | 2121 |
| 2022 | 1982 | 1468 | 1575 | 1250 | 858  | 1396 | 1919 | 1716 | 2263 | 1644 | 1003 | 1558 | 1950 |
| 1743 | 1336 | 3493 | 2000 | 2243 | 1406 | 861  | 1944 | 972  | 1118 | 2036 | 1641 | 1432 | 2353 |
| 2646 | 1472 | 2596 | 2468 | 2730 | 1163 | 2978 | 803  | 1719 | 1383 | 2134 | 1192 | 1056 | 1629 |
| 1358 | 1638 | 1922 | 1536 | 1621 | 1215 | 1908 | 841  | 1684 | 1112 | 1577 | 1478 | 1626 | 2728 |
| 1869 | 1453 | 720  | 1595 | 1167 | 1142 | 1352 | 1924 | 1505 | 1574 | 1394 | 1268 | 1287 | 1664 |
| 752  | 1319 | 904  | 914  | 2466 | 1856 | 1800 | 1691 | 1301 | 1797 | 784  | 1953 | 1269 | 1184 |
| 2332 | 1367 | 1961 | 788  | 1034 | 1144 | 1812 | 1550 | 1288 | 672  | 1572 | 1620 | 1639 | 1680 |
| 2172 | 2078 | 1276 | 1028 | 2097 | 1400 | 2624 | 1134 | 1602 | 2630 | 1196 | 1389 | 907  | 1208 |
| 1412 | 1198 | 1365 | 630  | 1661 | 694  | 2402 | 1573 | 1258 | 1689 | 1888 | 1886 | 1376 | 1183 |
| 813  | 1533 | 1756 | 1590 | 1242 | 1663 | 1666 | 1203 | 1935 | 1135 | 1660 | 1277 | 1634 | 1502 |
| 1969 | 1072 | 1976 | 1652 | 970  | 1493 | 2643 | 1131 | 1850 | 1826 | 1216 | 999  | 1073 | 1484 |
| 2414 | 1304 | 1578 | 886  | 3228 | 1820 | 899  | 1218 | 1801 | 1322 | 1911 | 1378 | 1041 | 1368 |
| 2020 | 2119 | 2344 | 1796 | 2080 | 1294 | 1244 | 4676 | 2398 | 1266 | 928  | 2713 | 605  | 2515 |
| 1509 | 827  | 334  | 1347 | 1724 | 1159 | 1601 | 1838 | 2285 | 767  | 1496 | 2183 | 1635 | 768  |
| 825  | 2094 | 1069 | 1126 | 2046 | 1048 | 1446 | 1557 | 996  | 1674 | 2295 | 1647 | 2504 | 2132 |
| 943  | 1692 | 1109 | 1477 | 1320 | 1429 | 2042 | 2775 | 2028 | 838  | 860  | 1473 | 935  | 1582 |
| 2296 | 924  | 1402 | 1556 | 1904 | 1915 | 1986 | 2008 | 3194 | 1029 | 2153 | 1032 | 1120 | 1054 |
| 832  | 1828 | 2262 | 2614 | 980  | 1512 | 1790 | 1116 | 1520 | 1350 | 1750 | 1554 | 1411 | 3395 |
| 800  | 1387 | 796  | 1567 | 1518 | 1929 | 2704 | 1766 | 981  | 1094 | 1839 | 1665 | 1510 | 1469 |
| 2113 | 1486 | 2448 | 1181 | 1936 | 2380 | 1679 | 1437 | 1180 | 1476 | 1369 | 1136 | 1441 | 792  |
| 923  | 1291 | 1761 | 1102 | 1419 | 4316 | 2519 | 1539 | 1137 | 616  | 1148 | 1391 | 1164 | 2576 |
| 1824 | 729  | 1178 | 2554 | 2418 | 971  | 1742 | 1698 | 1776 | 1146 | 2031 | 948  | 1349 | 1464 |
| 2715 | 2256 | 2640 | 1529 | 1140 | 2098 | 1026 | 1471 | 1386 | 2531 | 1547 | 2365 | 1506 | 1714 |
| 1836 | 3279 | 1220 | 1117 | 1973 | 1204 | 1614 | 1603 | 1110 | 1342 | 2084 | 901  | 2087 | 1145 |
| 1062 | 2013 | 1895 | 1564 | 773  | 3140 | 1688 | 2822 | 1128 | 1428 | 1576 | 2138 | 1309 | 1044 |
| 1008 | 1052 | 936  | 1733 | 1489 | 1434 | 2126 | 1223 | 1829 | 1516 | 1067 | 1559 | 1099 | 1482 |
| 1165 | 1416 | 1701 | 1775 | 2358 | 1646 | 1445 | 1779 | 1481 | 2654 | 1426 | 1039 | 1372 | 1002 |
| 1949 | 910  | 2610 | 2224 | 1155 | 1090 | 2230 | 892  | 1712 | 1393 | 2217 | 1683 | 1068 | 951  |
| 2240 | 2364 | 1670 | 902  | 1063 | 1636 | 2057 | 2274 | 1015 | 2002 | 480  | 1229 | 2127 | 2200 |
| 1617 | 1686 | 2374 | 1978 | 1788 | 2236 | 1466 | 925  | 1905 | 1500 | 2069 | 1971 | 1962 | 2403 |
| 1381 | 965  | 1958 | 2872 | 1894 | 1308 | 1098 | 1095 | 918  | 2019 | 869  | 1241 | 2612 | 2290 |
| 1940 | 2030 | 1851 | 1050 | 944  | 691  | 1504 | 985  | 1657 | 1522 | 1271 | 1022 | 1082 | 1132 |
| 2898 | 1264 | 3082 | 1654 | 954  | 1803 | 2329 | 2524 | 2868 | 1771 | 930  | 1977 | 1989 | 1523 |
| 1364 | 2184 | 1991 | 1338 | 2337 | 1103 | 1154 | 2260 | 1571 | 1611 | 2521 | 893  | 1240 | 1740 |
| 1459 | 1251 | 1247 | 1088 | 438  | 950  | 2622 | 2021 | 1690 | 1658 | 1964 | 833  | 1012 | 698  |

1005 1530 1981 974 2210 986 1020 1868 2828 1006 1298 932 1811 1265  
1580 1876 1671 2108 3627 1261 3086 2345 1343 1124 2514 4476 1130 1221  
1699 1624 1804 1622 1863 1630 1074 2196 1283 1845 1902 1211 1846 2136  
1490 1138 1933 1702 1507 2620 1190 1188 1784 1948 1141 1173 2076 1553  
2058 1405 874 2167 1987 1166 1675 1889 2018 3447 1524 1357 1395 2447  
1659 1970 2372 5642 1246 1983 2526 1708 1122 1274 2810 2599 2112 1787  
1923 708 774 2792 1334 693 1861 872 2169 1913 2156 2634 3238 1865  
1078 1980 2601 1738 1475 1374 2633 790 2117 1762 2784 1746 1584 1912  
2482 1687 1513 1608 2093 1840 1848 1569 2450 2201 804 1537 1932 1725  
2555 2007 913 1346 2073 2340 1256]

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- -

BsmtFullBath : [1 0 2 3]

- -

- -

- -

- -

BsmtHalfBath : [0 1 2]

- -

- -

- -

FullBath : [2 1 3 0]

- -

- -

- -

HalfBath : [1 0 2]

- -

- -

- -

BedroomAbvGr : [3 4 1 2 0 5 6 8]

- -

- -

- -

KitchebvGr : [1 2 3 0]

- -

- -

- -

KitchenQual : ['Gd' 'TA' 'Ex' 'Fa']

- -

- -

- -

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- - - - - TotRmsAbvGrd : [ 8  6  7  9  5 11  4 10 12  3  2 14]
- - - - - 
- - - - - 
- - - - - 
- - - - - 
- - - - - 
Functiol : ['Typ' 'Min1' 'Maj1' 'Min2' 'Mod' 'Maj2' 'Sev']
- - - - - 
- - - - - 
- - - - - 
- - - - - 
- - - - - 
Fireplaces : [0 1 2 3]
- - - - - 
- - - - - 
- - - - - 
- - - - - 
- - - - - 
FireplaceQu : [nan 'TA' 'Gd' 'Fa' 'Ex' 'Po']
- - - - - 
- - - - - 
- - - - - 
- - - - - 
GarageType : ['Attchd' 'Detchd' 'BuiltIn' 'CarPort' nan 'Basment' '2Types']
- - - - - 
- - - - - 
- - - - - 
- - - - - 
- - - - - 
GarageYrBlt : [2003. 1976. 2001. 1998. 2000. 1993. 2004. 1973. 1931. 1939. 1965.
2005.
1962. 2006. 1960. 1991. 1970. 1967. 1958. 1930. 2002. 1968. 2007. 2008.
1957. 1920. 1966. 1959. 1995. 1954. 1953.  nan 1983. 1977. 1997. 1985.
1963. 1981. 1964. 1999. 1935. 1990. 1945. 1987. 1989. 1915. 1956. 1948.
1974. 2009. 1950. 1961. 1921. 1900. 1979. 1951. 1969. 1936. 1975. 1971.
1923. 1984. 1926. 1955. 1986. 1988. 1916. 1932. 1972. 1918. 1980. 1924.
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1947. 1937. 1942. 1938. 1952. 1928. 1922. 1934. 1906. 1914. 1946. 1908.
1929. 1933.]
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- - - - - 
- - - - - 
- - - - - 
- - - - - 
- - - - - 
GarageFinish : ['RFn' 'Unf' 'Fin' nan]
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- - - - - 
- - - - - 
- - - - - 
- - - - - 
- - - - - 
GarageCars : [2 3 1 0 4]
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GarageArea : [ 548 460 608 642 836 480 636 484 468 205 384 736 352  
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 576 516 294 853 280 534 572 270 890 772 319 240 250 271  
 447 556 691 672 498 246 0 440 308 504 300 670 826 386  
 388 528 894 565 641 288 645 852 558 220 667 360 427 490  
 379 297 283 509 405 758 461 400 462 420 432 506 684 472  
 366 476 410 740 648 273 546 325 792 450 180 430 594 390  
 540 264 530 435 453 750 487 624 471 318 766 660 470 720  
 577 380 434 866 495 564 312 625 680 678 726 532 216 303  
 789 511 616 521 451 1166 252 497 682 666 786 795 856 473  
 398 500 349 454 644 299 210 431 438 675 968 721 336 810  
 494 457 818 463 604 389 538 520 309 429 673 884 868 492  
 413 924 1053 439 671 338 573 732 505 575 626 898 529 685  
 281 539 418 588 282 375 683 843 552 870 888 746 708 513  
 1025 656 872 292 441 189 880 676 301 474 706 617 445 200  
 592 566 514 296 244 610 834 639 501 846 560 596 600 373  
 947 350 396 864 304 784 696 569 628 550 493 578 198 422  
 228 526 525 908 499 508 694 874 164 402 515 286 603 900  
 583 889 858 502 392 403 527 765 367 426 615 871 570 406  
 590 612 650 1390 275 452 842 816 621 544 486 230 261 531  
 393 774 749 364 627 260 256 478 442 562 512 839 330 711  
 1134 416 779 702 567 832 326 551 606 739 408 475 704 983  
 768 632 541 320 800 831 554 878 752 614 481 496 423 841  
 895 412 865 630 605 602 618 444 397 455 409 820 1020 598  
 857 595 433 776 1220 458 613 456 436 812 686 611 425 343  
 479 619 902 574 523 414 738 354 483 327 756 690 284 833  
 601 533 522 788 555 689 796 808 510 255 424 305 368 824  
 328 160 437 665 290 912 905 542 716 586 467 582 1248 1043  
 254 712 719 862 928 782 466 714 1052 225 234 324 306 830  
 807 358 186 693 482 813 995 757 1356 459 701 322 315 668  
 404 543 954 850 477 276 518 1014 753 1418 213 844 860 748  
 248 287 825 647 342 770 663 377 804 936 722 208 662 754  
 622 620 370 1069 372 923 192]

GarageQual : ['TA' 'Fa' 'Gd' nan 'Ex' 'Po']

GarageCond : ['TA' 'Fa' nan 'Gd' 'Po' 'Ex']

```

- - - - - PavedDrive : ['Y' 'N' 'P']
- - - - -
- - - - -
- - - - -
- - - - -
WoodDeckSF : [ 0 298 192 40 255 235 90 147 140 160 48 240 171 100 406 222
288 49
203 113 392 145 196 168 112 106 857 115 120 12 576 301 144 300 74 127
232 158 352 182 180 166 224 80 367 53 188 105 24 98 276 200 409 239
400 476 178 574 237 210 441 116 280 104 87 132 238 149 355 60 139 108
351 209 216 248 143 365 370 58 197 263 123 138 333 250 292 95 262 81
289 124 172 110 208 468 256 302 190 340 233 184 201 142 122 155 670 135
495 536 306 64 364 353 66 159 146 296 125 44 215 264 88 89 96 414
519 206 141 260 324 156 220 38 261 126 85 466 270 78 169 320 268 72
349 42 35 326 382 161 179 103 253 148 335 176 390 328 312 185 269 195
57 236 517 304 198 426 28 316 322 307 257 219 416 344 380 68 114 327
165 187 181 92 228 245 503 315 241 303 133 403 36 52 265 207 150 290
486 278 70 418 234 26 342 97 272 121 243 511 154 164 173 384 202 56
321 86 194 421 305 117 550 509 153 394 371 63 252 136 186 170 474 214
199 728 436 55 431 448 361 362 162 229 439 379 356 84 635 325 33 212
314 242 294 30 128 45 177 227 218 309 404 500 668 402 283 183 175 586
295 32 366 736]

- - - - -
- - - - -
- - - - -
- - - - -
OpenPorchSF : [ 61 0 42 35 84 30 57 204 4 21 33 213 112 102 154 159
110 90
56 32 50 258 54 65 38 47 64 52 138 104 82 43 146 75 72 70
49 11 36 151 29 94 101 199 99 234 162 63 68 46 45 122 184 120
20 24 130 205 108 80 66 48 25 96 111 106 40 114 8 136 132 62
228 60 238 260 27 74 16 198 26 83 34 55 22 98 172 119 208 105
140 168 28 39 148 12 51 150 117 250 10 81 44 144 175 195 128 76
17 59 214 121 53 231 134 192 123 78 187 85 133 176 113 137 125 523
100 285 88 406 155 73 182 502 274 158 142 243 235 312 124 267 265 87
288 23 152 341 116 160 174 247 291 18 170 156 166 129 418 240 77 364
188 207 67 69 131 191 41 118 252 189 282 135 95 224 169 319 58 93
244 185 200 92 180 263 304 229 103 211 287 292 241 547 91 86 262 210
141 15 126 236]

- - - - -
- - - - -
- - - - -
- - - - -
EnclosedPorch : [ 0 272 228 205 176 87 172 102 37 144 64 114 202 128 156 44
77 192
140 180 183 39 184 40 552 30 126 96 60 150 120 112 252 52 224 234
244 268 137 24 108 294 177 218 242 91 160 130 169 105 34 248 236 32

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- - - - -
- - - - -
- - - - -
MoSold : [ 2   5   9   12  10   8   11   4   1   7   3   6]
- - - - -
- - - - -
- - - - -
YrSold : [2008 2007 2006 2009 2010]
- - - - -
- - - - -
- - - - -
SaleType : ['WD'  'New'  'COD'  'ConLD' 'ConLI' 'CWD'  'ConLw' 'Con'  'Oth']
- - - - -
- - - - -
- - - - -
SaleCondition : ['Normal' 'Abnorml' 'Partial' 'AdjLand' 'Alloca' 'Family']
- - - - -
- - - - -
- - - - -
SalePrice : [208500 181500 223500 140000 250000 143000 307000 200000 129900
118000
129500 345000 144000 279500 157000 132000 149000 90000 159000 139000
325300 139400 230000 154000 256300 134800 306000 207500 68500 40000
149350 179900 165500 277500 309000 145000 153000 109000 82000 160000
170000 130250 141000 319900 239686 249700 113000 127000 177000 114500
110000 385000 130000 180500 172500 196500 438780 124900 158000 101000
202500 219500 317000 180000 226000 80000 225000 244000 185000 144900
107400 91000 135750 136500 193500 153500 245000 126500 168500 260000
174000 164500 85000 123600 109900 98600 163500 133900 204750 214000
94750 83000 128950 205000 178000 118964 198900 169500 100000 115000
190000 136900 383970 217000 259500 176000 155000 320000 163990 136000
153900 181000 84500 128000 87000 150000 150750 220000 171000 231500
166000 204000 125000 105000 222500 122000 372402 235000 79000 109500
269500 254900 162500 412500 103200 152000 127500 325624 183500 228000
128500 215000 239000 163000 184000 243000 211000 501837 200100 120000
475000 173000 135000 153337 286000 315000 192000 148500 311872 104000
274900 171500 112000 143900 277000 98000 186000 252678 156000 161750
134450 210000 107000 311500 167240 204900 97000 386250 290000 106000
192500 148000 403000 94500 128200 216500 89500 185500 194500 318000
262500 110500 241500 137000 76500 276000 151000 73000 175500 179500
120500 266000 124500 201000 415298 228500 244600 179200 164700 88000
153575 233230 135900 131000 167000 142500 175000 158500 267000 149900
295000 305900 82500 360000 165600 119900 375000 188500 270000 187500

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|        |        |         |        |        |        |        |        |        |        |
|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|
| 342643 | 354000 | 301000  | 126175 | 242000 | 324000 | 145250 | 214500 | 78000  | 119000 |
| 284000 | 207000 | 228950  | 377426 | 202900 | 87500  | 140200 | 151500 | 157500 | 437154 |
| 318061 | 95000  | 105900  | 177500 | 134000 | 280000 | 198500 | 147000 | 165000 | 162000 |
| 172400 | 134432 | 123000  | 61000  | 340000 | 394432 | 179000 | 187750 | 213500 | 76000  |
| 240000 | 81000  | 191000  | 426000 | 106500 | 129000 | 67000  | 241000 | 245500 | 164990 |
| 108000 | 258000 | 168000  | 339750 | 60000  | 222000 | 181134 | 149500 | 126000 | 142000 |
| 206300 | 275000 | 109008  | 195400 | 85400  | 79900  | 122500 | 212000 | 116000 | 90350  |
| 555000 | 162900 | 199900  | 119500 | 188000 | 256000 | 161000 | 263435 | 62383  | 188700 |
| 124000 | 178740 | 146500  | 187000 | 440000 | 251000 | 132500 | 208900 | 380000 | 297000 |
| 89471  | 326000 | 374000  | 164000 | 86000  | 133000 | 172785 | 91300  | 34900  | 430000 |
| 226700 | 289000 | 208300  | 164900 | 202665 | 96500  | 402861 | 265000 | 234000 | 106250 |
| 184750 | 315750 | 446261  | 200624 | 107500 | 39300  | 111250 | 272000 | 248000 | 213250 |
| 179665 | 229000 | 263000  | 112500 | 255500 | 121500 | 268000 | 325000 | 316600 | 135960 |
| 142600 | 224500 | 118500  | 146000 | 131500 | 181900 | 253293 | 369900 | 79500  | 185900 |
| 451950 | 138000 | 319000  | 114504 | 194201 | 217500 | 221000 | 359100 | 313000 | 261500 |
| 75500  | 137500 | 183200  | 105500 | 314813 | 305000 | 165150 | 139900 | 209500 | 93000  |
| 264561 | 274000 | 370878  | 143250 | 98300  | 205950 | 350000 | 145500 | 97500  | 197900 |
| 402000 | 423000 | 230500  | 173500 | 103600 | 257500 | 372500 | 159434 | 285000 | 227875 |
| 148800 | 392000 | 194700  | 755000 | 335000 | 108480 | 141500 | 89000  | 123500 | 138500 |
| 196000 | 312500 | 361919  | 213000 | 55000  | 302000 | 254000 | 179540 | 52000  | 102776 |
| 189000 | 130500 | 159500  | 341000 | 103000 | 236500 | 131400 | 93500  | 239900 | 299800 |
| 236000 | 265979 | 260400  | 275500 | 158900 | 179400 | 215200 | 337000 | 264132 | 216837 |
| 538000 | 134900 | 102000  | 395000 | 221500 | 175900 | 187100 | 161500 | 233000 | 107900 |
| 160200 | 146800 | 269790  | 143500 | 485000 | 582933 | 227680 | 135500 | 159950 | 144500 |
| 55993  | 157900 | 224900  | 271000 | 224000 | 183000 | 139500 | 232600 | 147400 | 237000 |
| 139950 | 174900 | 133500  | 189950 | 250580 | 248900 | 169000 | 200500 | 66500  | 303477 |
| 132250 | 328900 | 122900  | 154500 | 118858 | 142953 | 611657 | 125500 | 255000 | 154300 |
| 173733 | 75000  | 35311   | 238000 | 176500 | 145900 | 169990 | 193000 | 117500 | 184900 |
| 253000 | 239799 | 244400  | 150900 | 197500 | 172000 | 116500 | 214900 | 178900 | 37900  |
| 99500  | 182000 | 167500  | 85500  | 178400 | 336000 | 159895 | 255900 | 117000 | 395192 |
| 195000 | 197000 | 348000  | 173900 | 337500 | 121600 | 206000 | 232000 | 136905 | 119200 |
| 227000 | 203000 | 213490  | 194000 | 287000 | 293077 | 310000 | 119750 | 84000  | 315500 |
| 262280 | 278000 | 139600  | 556581 | 84900  | 176485 | 200141 | 185850 | 328000 | 167900 |
| 151400 | 91500  | 138800  | 155900 | 83500  | 252000 | 92900  | 176432 | 274725 | 134500 |
| 184100 | 133700 | 118400  | 212900 | 163900 | 259000 | 239500 | 94000  | 424870 | 174500 |
| 116900 | 201800 | 218000  | 235128 | 108959 | 233170 | 245350 | 625000 | 171900 | 154900 |
| 392500 | 745000 | 186700  | 104900 | 262000 | 219210 | 116050 | 271900 | 229456 | 80500  |
| 137900 | 367294 | 101800  | 138887 | 265900 | 248328 | 465000 | 186500 | 169900 | 171750 |
| 294000 | 165400 | 301500  | 99900  | 128900 | 183900 | 378500 | 381000 | 185750 | 68400  |
| 150500 | 281000 | 333168  | 206900 | 295493 | 111000 | 156500 | 72500  | 52500  | 155835 |
| 108500 | 283463 | 410000  | 156932 | 144152 | 216000 | 274300 | 466500 | 58500  | 237500 |
| 377500 | 246578 | 281213  | 137450 | 193879 | 282922 | 257000 | 223000 | 274970 | 182900 |
| 192140 | 143750 | 64500   | 394617 | 149700 | 149300 | 121000 | 179600 | 92000  | 287090 |
| 266500 | 142125 | 147500] |        |        |        |        |        |        |        |
| -      | -      | -       | -      | -      | -      | -      | -      | -      | -      |
| -      | -      | -       | -      | -      | -      | -      | -      | -      | -      |
| -      | -      | -       | -      | -      | -      | -      | -      | -      | -      |
| -      | -      | -       | -      | -      | -      | -      | -      | -      | -      |

```
[11]: numeric_df= df.select_dtypes(include=[np.number])

category_df=df.select_dtypes(exclude=[np.number])
```

```
[12]: numericcol=numeric_df.columns.tolist()
categorycol=category_df.columns.tolist()

print ("Category : ",categorycol)
print ("Numeric : ",numericcol)
```

Category : ['MSZoning', 'Street', 'Alley', 'LotShape', 'LandContour', 'Utilities', 'LotConfig', 'LandSlope', 'Neighborhood', 'Condition1', 'Condition2', 'BldgType', 'HouseStyle', 'RoofStyle', 'RoofMatl', 'Exterior1st', 'Exterior2nd', 'MasVnrType', 'ExterQual', 'ExterCond', 'Foundation', 'BsmtQual', 'BsmtCond', 'BsmtExposure', 'BsmtFinType1', 'BsmtFinType2', 'Heating', 'HeatingQC', 'CentralAir', 'Electrical', 'KitchenQual', 'Functiol', 'FireplaceQu', 'GarageType', 'GarageFinish', 'GarageQual', 'GarageCond', 'PavedDrive', 'PoolQC', 'Fence', 'MiscFeature', 'SaleType', 'SaleCondition']

Numeric : ['Id', 'MSSubClass', 'LotFrontage', 'LotArea', 'OverallQual', 'OverallCond', 'YearBuilt', 'YearRemodAdd', 'MasVnrArea', 'BsmtFinSF1', 'BsmtFinSF2', 'BsmtUnfSF', 'TotalBsmtSF', '1stFlrSF', '2ndFlrSF', 'LowQualFinSF', 'GrLivArea', 'BsmtFullBath', 'BsmtHalfBath', 'FullBath', 'HalfBath', 'BedroomAbvGr', 'KitchebvGr', 'TotRmsAbvGrd', 'Fireplaces', 'GarageYrBlt', 'GarageCars', 'GarageArea', 'WoodDeckSF', 'OpenPorchSF', 'EnclosedPorch', '3SsnPorch', 'ScreenPorch', 'PoolArea', 'MiscVal', 'MoSold', 'YrSold', 'SalePrice']

```
[13]: #For reading entire dataset
df = pd.DataFrame(df)

df.describe()
```

|       | Id          | MSSubClass  | LotFrontage  | LotArea       | OverallQual | ... |
|-------|-------------|-------------|--------------|---------------|-------------|-----|
| count | 1460.000000 | 1460.000000 | 1201.000000  | 1460.000000   | 1460.000000 |     |
| mean  | 730.500000  | 56.897260   | 70.049958    | 10516.828082  | 6.099315    |     |
| std   | 421.610009  | 42.300571   | 24.284752    | 9981.264932   | 1.382997    |     |
| min   | 1.000000    | 20.000000   | 21.000000    | 1300.000000   | 1.000000    |     |
| 25%   | 365.750000  | 20.000000   | 59.000000    | 7553.500000   | 5.000000    |     |
| 50%   | 730.500000  | 50.000000   | 69.000000    | 9478.500000   | 6.000000    |     |
| 75%   | 1095.250000 | 70.000000   | 80.000000    | 11601.500000  | 7.000000    |     |
| max   | 1460.000000 | 190.000000  | 313.000000   | 215245.000000 | 10.000000   |     |
|       | OverallCond | YearBuilt   | YearRemodAdd | MasVnrArea    | BsmtFinSF1  | ... |
| count | 1460.000000 | 1460.000000 | 1460.000000  | 1452.000000   | 1460.000000 | ... |
| mean  | 5.575342    | 1971.267808 | 1984.865753  | 103.685262    | 443.639726  | ... |
| std   | 1.112799    | 30.202904   | 20.645407    | 181.066207    | 456.098091  | ... |
| min   | 1.000000    | 1872.000000 | 1950.000000  | 0.000000      | 0.000000    | ... |

|       |             |              |               |             |               |             |     |
|-------|-------------|--------------|---------------|-------------|---------------|-------------|-----|
| 25%   | 5.000000    | 1954.000000  | 1967.000000   | 0.000000    | 0.000000      | 0.000000    | ... |
| 50%   | 5.000000    | 1973.000000  | 1994.000000   | 0.000000    | 383.500000    | 383.500000  | ... |
| 75%   | 6.000000    | 2000.000000  | 2004.000000   | 166.000000  | 712.250000    | 712.250000  | ... |
| max   | 9.000000    | 2010.000000  | 2010.000000   | 1600.000000 | 5644.000000   | 5644.000000 | ... |
|       | WoodDeckSF  | OpenPorchSF  | EnclosedPorch | 3SsnPorch   | ScreenPorch   | \           |     |
| count | 1460.000000 | 1460.000000  | 1460.000000   | 1460.000000 | 1460.000000   | 1460.000000 |     |
| mean  | 94.244521   | 46.660274    | 21.954110     | 3.409589    | 15.060959     |             |     |
| std   | 125.338794  | 66.256028    | 61.119149     | 29.317331   | 55.757415     |             |     |
| min   | 0.000000    | 0.000000     | 0.000000      | 0.000000    | 0.000000      |             |     |
| 25%   | 0.000000    | 0.000000     | 0.000000      | 0.000000    | 0.000000      |             |     |
| 50%   | 0.000000    | 25.000000    | 0.000000      | 0.000000    | 0.000000      |             |     |
| 75%   | 168.000000  | 68.000000    | 0.000000      | 0.000000    | 0.000000      |             |     |
| max   | 857.000000  | 547.000000   | 552.000000    | 508.000000  | 480.000000    |             |     |
|       | PoolArea    | MiscVal      | MoSold        | YrSold      | SalePrice     |             |     |
| count | 1460.000000 | 1460.000000  | 1460.000000   | 1460.000000 | 1460.000000   |             |     |
| mean  | 2.758904    | 43.489041    | 6.321918      | 2007.815753 | 180921.195890 |             |     |
| std   | 40.177307   | 496.123024   | 2.703626      | 1.328095    | 79442.502883  |             |     |
| min   | 0.000000    | 0.000000     | 1.000000      | 2006.000000 | 34900.000000  |             |     |
| 25%   | 0.000000    | 0.000000     | 5.000000      | 2007.000000 | 129975.000000 |             |     |
| 50%   | 0.000000    | 0.000000     | 6.000000      | 2008.000000 | 163000.000000 |             |     |
| 75%   | 0.000000    | 0.000000     | 8.000000      | 2009.000000 | 214000.000000 |             |     |
| max   | 738.000000  | 15500.000000 | 12.000000     | 2010.000000 | 755000.000000 |             |     |

[8 rows x 38 columns]

[14]: #Checking the skewness of entire data  
df.skew(axis = 0, skipna = True)

|              |           |
|--------------|-----------|
| [14]: Id     | 0.000000  |
| MSSubClass   | 1.407657  |
| LotFrontage  | 2.163569  |
| LotArea      | 12.207688 |
| OverallQual  | 0.216944  |
| OverallCond  | 0.693067  |
| YearBuilt    | -0.613461 |
| YearRemodAdd | -0.503562 |
| MasVnrArea   | 2.669084  |
| BsmtFinSF1   | 1.685503  |
| BsmtFinSF2   | 4.255261  |
| BsmtUnfSF    | 0.920268  |
| TotalBsmtSF  | 1.524255  |
| 1stFlrSF     | 1.376757  |
| 2ndFlrSF     | 0.813030  |
| LowQualFinSF | 9.011341  |
| GrLivArea    | 1.366560  |

```
BsmtFullBath      0.596067
BsmtHalfBath     4.103403
FullBath         0.036562
HalfBath          0.675897
BedroomAbvGr     0.211790
KitchebvGr       4.488397
TotRmsAbvGrd    0.676341
Fireplaces        0.649565
GarageYrBlt     -0.649415
GarageCars        -0.342549
GarageArea        0.179981
WoodDeckSF        1.541376
OpenPorchSF       2.364342
EnclosedPorch    3.089872
3SsnPorch         10.304342
ScreenPorch       4.122214
PoolArea          14.828374
MiscVal           24.476794
MoSold            0.212053
YrSold             0.096269
SalePrice          1.882876
dtype: float64
```

```
[15]: #Checking skewness and kurtosis of SalePrice
print("Skewness: %f" % df['SalePrice'].skew())
```

```
Skewness: 1.882876
```

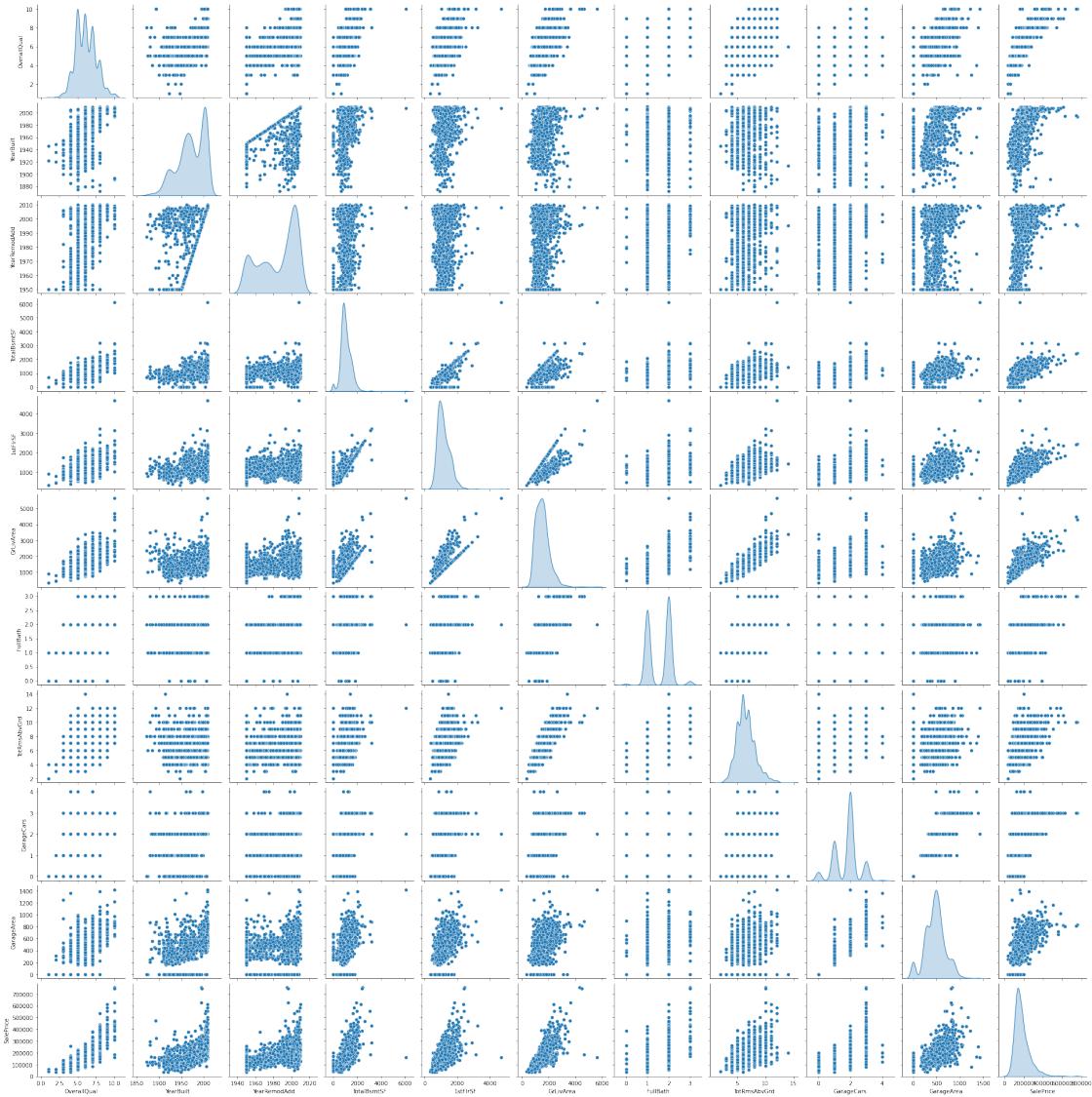
```
[16]: #Pair plotting the variables to check their distribution and relationship
pp = sns.pairplot(df, diag_kind="kde")
```



```
[17]: #Code to find correlation
corr = df.corr()
corr.style.background_gradient(cmap='coolwarm')
```

```
[17]: <pandas.io.formats.style.Styler at 0x7fe6232538d0>
```

```
[19]: #Code to Pair plot the significant variables to check their distribution and
      ↳relationship in accordance to "GarageCars"
IV_PP = sns.pairplot(df, vars=['OverallQual', 'YearBuilt', 'YearRemodAdd', ↳
      ↳'TotalBsmtSF', '1stFlrSF', 'GrLivArea', 'FullBath', 'TotRmsAbvGrd', ↳
      ↳'GarageCars', 'GarageArea', 'SalePrice'], diag_kind="kde")
```



```
[20]: #Creating a dataset with significant numerical variables
number_df = df.select_dtypes(include = 'int').copy()
number_df.head(2)
```

```
[20]:   Id  MSSubClass  LotArea  OverallQual  OverallCond  YearBuilt  YearRemodAdd \
0    1          60     8450         7           5      2003        2003
1    2          20     9600         6           8      1976        1976

          BsmtFinSF1  BsmtFinSF2  BsmtUnfSF ...  WoodDeckSF  OpenPorchSF  \
0            706          0       150 ...          0          61
1            978          0       284 ...         298          0

          EnclosedPorch  3SsnPorch  ScreenPorch  PoolArea  MiscVal  MoSold  YrSold \
0               0          0          0        0       0      0      0
1               0          0          0        0       0      0      0
```

```
0          0          0          0          0          0          2    2008
1          0          0          0          0          0          5    2007
```

```
SalePrice
0      208500
1      181500
```

[2 rows x 35 columns]

```
[21]: #Keep significant variables
number_df = number_df[['OverallQual', 'YearBuilt', 'TotalBsmtSF', 'GrLivArea', 'FullBath', 'GarageCars', 'SalePrice']]
number_df.head(2)
```

```
[21]: OverallQual  YearBuilt  TotalBsmtSF  GrLivArea  FullBath  GarageCars \
0           7        2003         856       1710        2          2
1           6        1976        1262       1262        2          2

SalePrice
0      208500
1      181500
```

```
[22]: #Separating dataset for categorical variable
category_df = df.select_dtypes(include = 'object').copy()
category_df.head(2)
```

```
[22]: MSZoning  Street  Alley  LotShape  LandContour  Utilities  LotConfig  LandSlope \
0      RL     Pave   NaN      Reg        Lvl     AllPub     Inside     Gtl
1      RL     Pave   NaN      Reg        Lvl     AllPub      FR2     Gtl

Neighborhood  Condition1 ... GarageType  GarageFinish  GarageQual  GarageCond \
0      CollgCr        Norm ...      Attchd        RFn        TA        TA
1      Veenker        Feedr ...      Attchd        RFn        TA        TA

PavedDrive  PoolQC  Fence  MiscFeature  SaleType  SaleCondition
0          Y     NaN     NaN        NaN        WD    Normal
1          Y     NaN     NaN        NaN        WD    Normal

[2 rows x 43 columns]
```

```
[23]: #Identifying all the variables which contain missing values
category_df_stats = pd.DataFrame(columns = ['column', 'num_miss', 'pct_miss'])

na_data = pd.DataFrame()

for c in category_df.columns:
    na_data['column'] = [c]
```

```

na_data['num_miss'] = category_df[c].isnull().sum()
na_data['pct_miss'] = (category_df[c].isnull().sum()/len(category_df)).round(3)*100
category_df_stats = category_df_stats.append(na_data)

category_df_stats

```

[23]:

|   |  | column       | num_miss | pct_miss |
|---|--|--------------|----------|----------|
| 0 |  | MSZoning     | 0        | 0.0      |
| 0 |  | Street       | 0        | 0.0      |
| 0 |  | Alley        | 1369     | 93.8     |
| 0 |  | LotShape     | 0        | 0.0      |
| 0 |  | LandContour  | 0        | 0.0      |
| 0 |  | Utilities    | 0        | 0.0      |
| 0 |  | LotConfig    | 0        | 0.0      |
| 0 |  | LandSlope    | 0        | 0.0      |
| 0 |  | Neighborhood | 0        | 0.0      |
| 0 |  | Condition1   | 0        | 0.0      |
| 0 |  | Condition2   | 0        | 0.0      |
| 0 |  | BldgType     | 0        | 0.0      |
| 0 |  | HouseStyle   | 0        | 0.0      |
| 0 |  | RoofStyle    | 0        | 0.0      |
| 0 |  | RoofMatl     | 0        | 0.0      |
| 0 |  | Exterior1st  | 0        | 0.0      |
| 0 |  | Exterior2nd  | 0        | 0.0      |
| 0 |  | MasVnrType   | 8        | 0.5      |
| 0 |  | ExterQual    | 0        | 0.0      |
| 0 |  | ExterCond    | 0        | 0.0      |
| 0 |  | Foundation   | 0        | 0.0      |
| 0 |  | BsmtQual     | 37       | 2.5      |
| 0 |  | BsmtCond     | 37       | 2.5      |
| 0 |  | BsmtExposure | 38       | 2.6      |
| 0 |  | BsmtFinType1 | 37       | 2.5      |
| 0 |  | BsmtFinType2 | 38       | 2.6      |
| 0 |  | Heating      | 0        | 0.0      |
| 0 |  | HeatingQC    | 0        | 0.0      |
| 0 |  | CentralAir   | 0        | 0.0      |
| 0 |  | Electrical   | 1        | 0.1      |
| 0 |  | KitchenQual  | 0        | 0.0      |
| 0 |  | Functiol     | 0        | 0.0      |
| 0 |  | FireplaceQu  | 690      | 47.3     |
| 0 |  | GarageType   | 81       | 5.5      |
| 0 |  | GarageFinish | 81       | 5.5      |
| 0 |  | GarageQual   | 81       | 5.5      |
| 0 |  | GarageCond   | 81       | 5.5      |
| 0 |  | PavedDrive   | 0        | 0.0      |
| 0 |  | PoolQC       | 1453     | 99.5     |

```

0      Fence      1179      80.8
0  MiscFeature    1406      96.3
0     SaleType        0      0.0
0  SaleCondition        0      0.0

```

[24]: *#Dropping variables which contain large number of missing values*

```

category_df = category_df.  
→drop(['MiscFeature', 'Fence', 'PoolQC', 'FireplaceQu', 'Alley',], axis=1)

```

[25]: `category_df.dropna(inplace=True)`  
`category_df.isnull().sum(axis=0)`

```

[25]: MSZoning      0  

Street          0  

LotShape         0  

LandContour      0  

Utilities        0  

LotConfig         0  

LandSlope         0  

Neighborhood      0  

Condition1       0  

Condition2       0  

BldgType         0  

HouseStyle        0  

RoofStyle         0  

RoofMatl         0  

Exterior1st       0  

Exterior2nd       0  

MasVnrType       0  

ExterQual         0  

ExterCond         0  

Foundation        0  

BsmtQual          0  

BsmtCond          0  

BsmtExposure      0  

BsmtFinType1      0  

BsmtFinType2      0  

Heating           0  

HeatingQC          0  

CentralAir         0  

Electrical         0  

KitchenQual        0  

Functiol          0  

GarageType         0  

GarageFinish        0  

GarageQual          0  

GarageCond          0

```

```
PavedDrive      0  
SaleType        0  
SaleCondition   0  
dtype: int64
```

```
[26]: print(category_df.head(2))  
print('-----')  
print(category_df.shape)
```

```
MSZoning Street LotShape LandContour Utilities LotConfig LandSlope  \  
0      RL    Pave     Reg       Lvl    AllPub    Inside     Gtl  
1      RL    Pave     Reg       Lvl    AllPub    FR2       Gtl  
  
Neighborhood Condition1 Condition2 ... Electrical KitchenQual Functiol  \  
0      CollgCr      Norm      Norm   ...      SBrkr      Gd      Typ  
1      Veenker      Feedr      Norm   ...      SBrkr      TA      Typ  
  
GarageType GarageFinish GarageQual GarageCond PavedDrive SaleType  \  
0      Attchd       RFn       TA      TA      Y       WD  
1      Attchd       RFn       TA      TA      Y       WD  
  
SaleCondition  
0          Normal  
1          Normal  
  
[2 rows x 38 columns]  
-----  
(1338, 38)
```

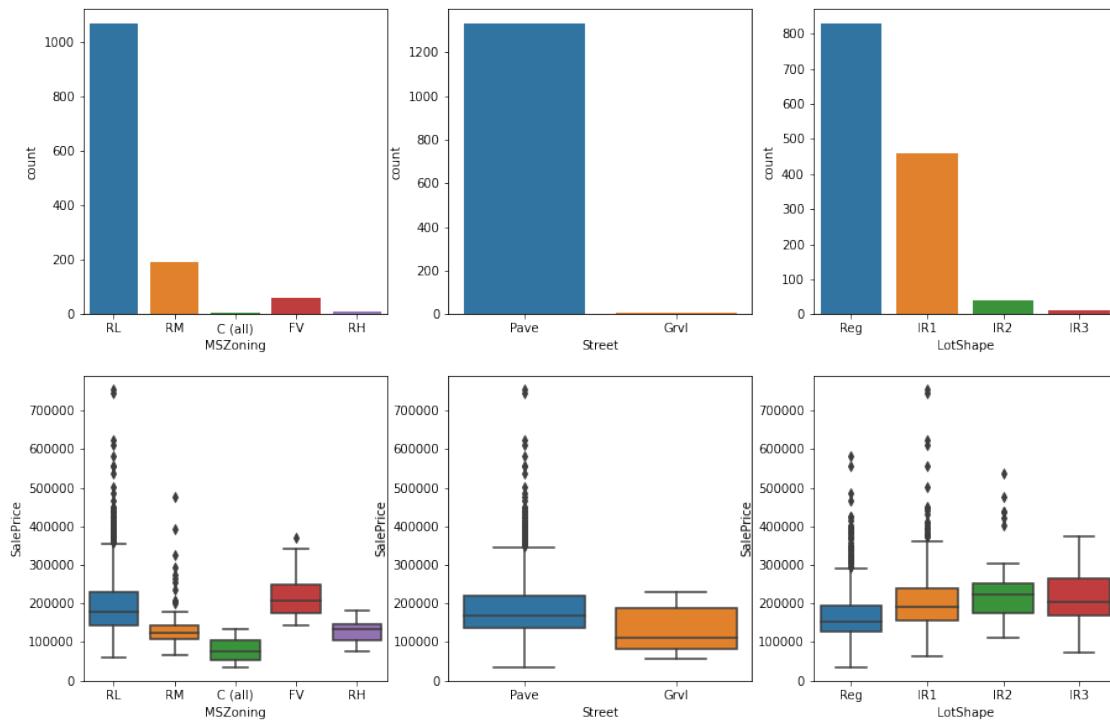
```
[27]: #Adding SalePrice to the category_df  
category_df['SalePrice'] = df.loc[category_df.index, 'SalePrice'].copy()  
category_df.head(2)
```

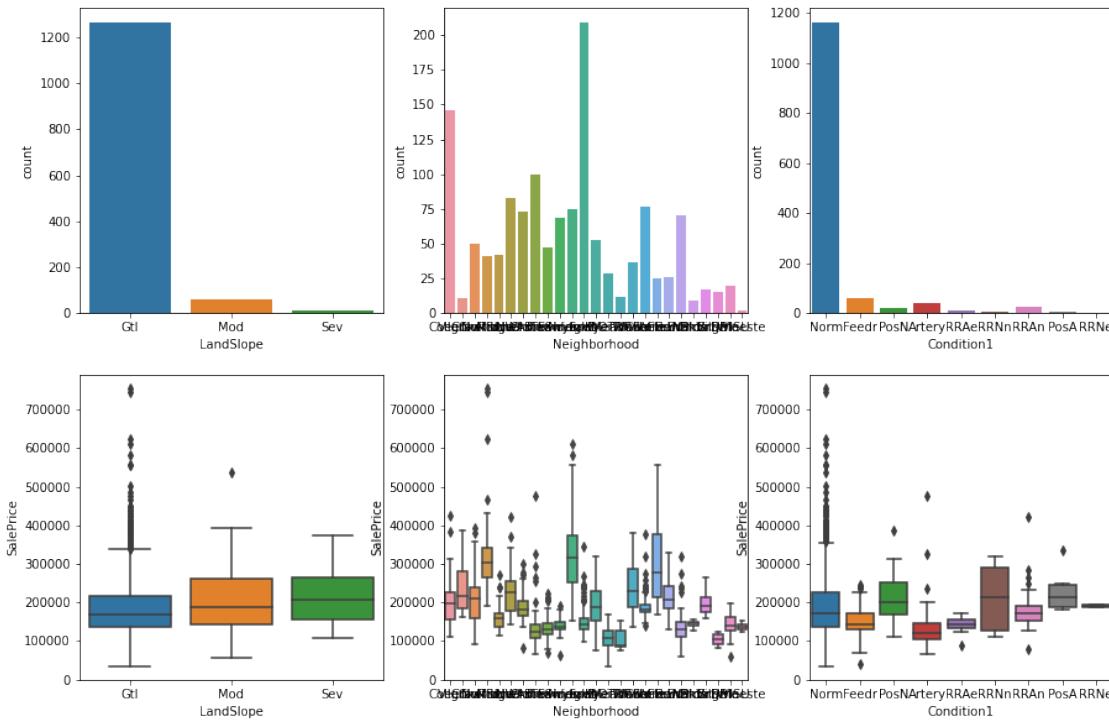
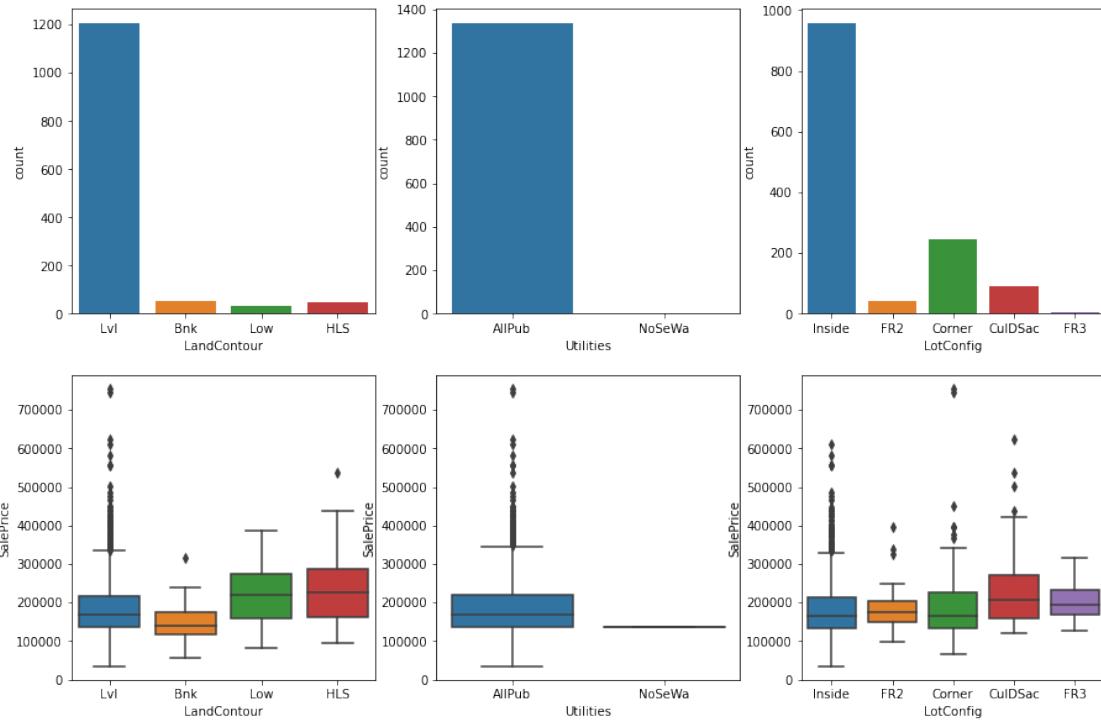
```
MSZoning Street LotShape LandContour Utilities LotConfig LandSlope  \  
0      RL    Pave     Reg       Lvl    AllPub    Inside     Gtl  
1      RL    Pave     Reg       Lvl    AllPub    FR2       Gtl  
  
Neighborhood Condition1 Condition2 ... KitchenQual Functiol GarageType  \  
0      CollgCr      Norm      Norm   ...      Gd      Typ      Attchd  
1      Veenker      Feedr      Norm   ...      TA      Typ      Attchd  
  
GarageFinish GarageQual GarageCond PavedDrive SaleType SaleCondition  \  
0          RFn       TA       TA      Y       WD      Normal  
1          RFn       TA       TA      Y       WD      Normal  
  
SalePrice  
0      208500
```

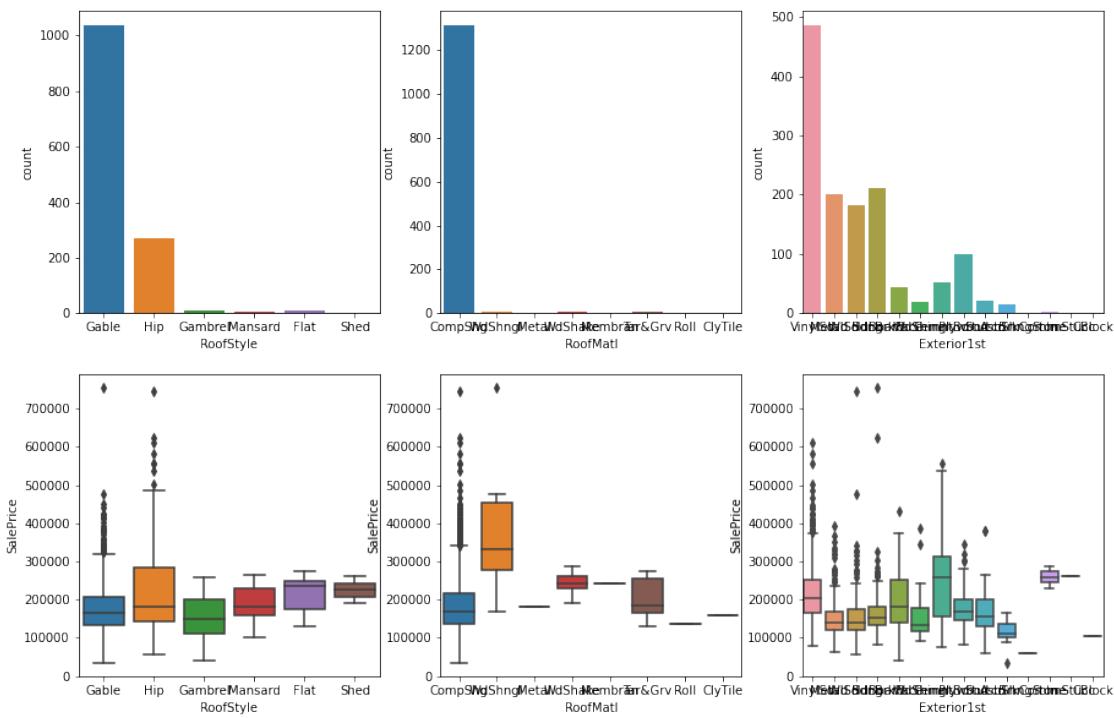
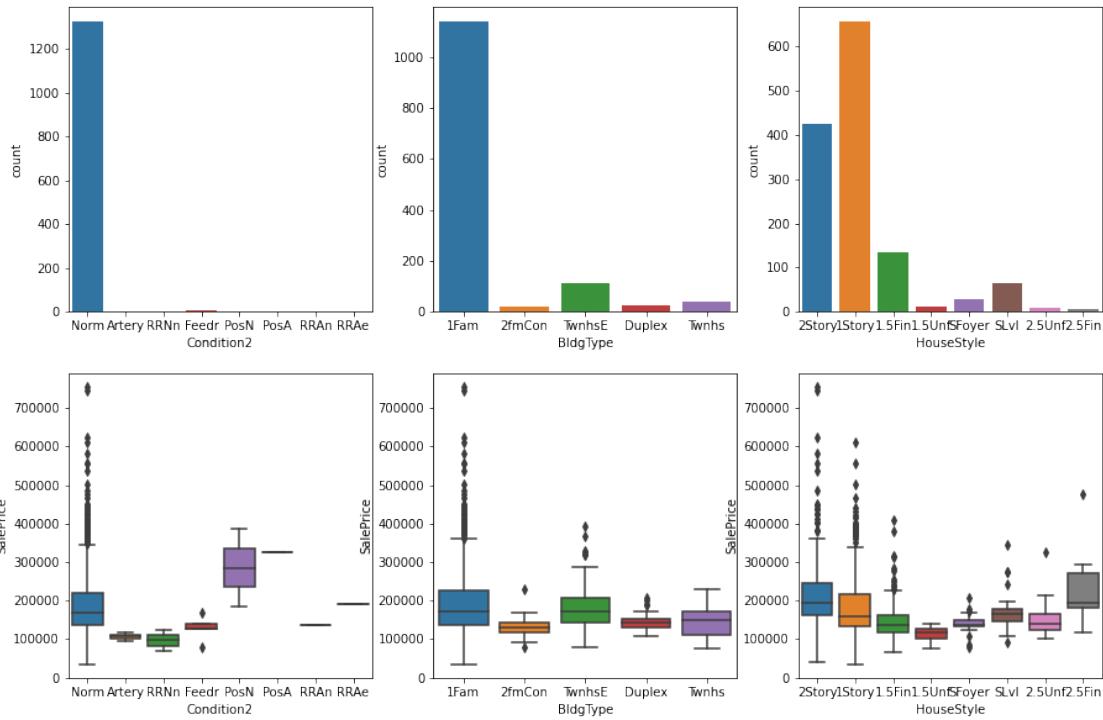
```
1     181500
```

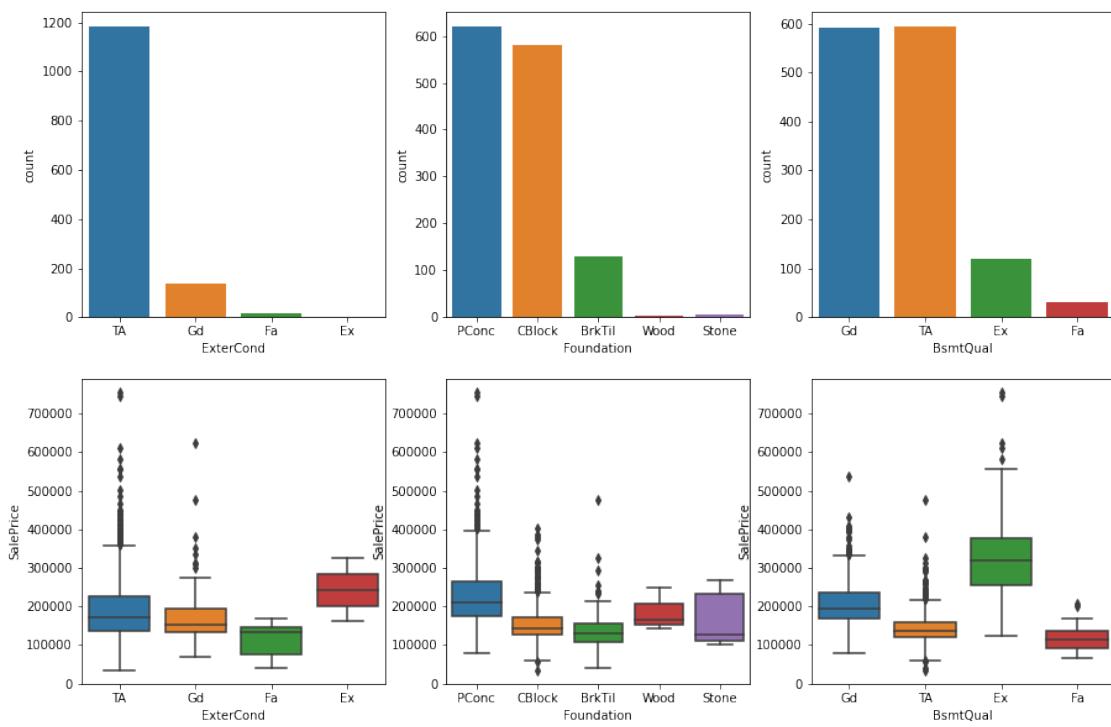
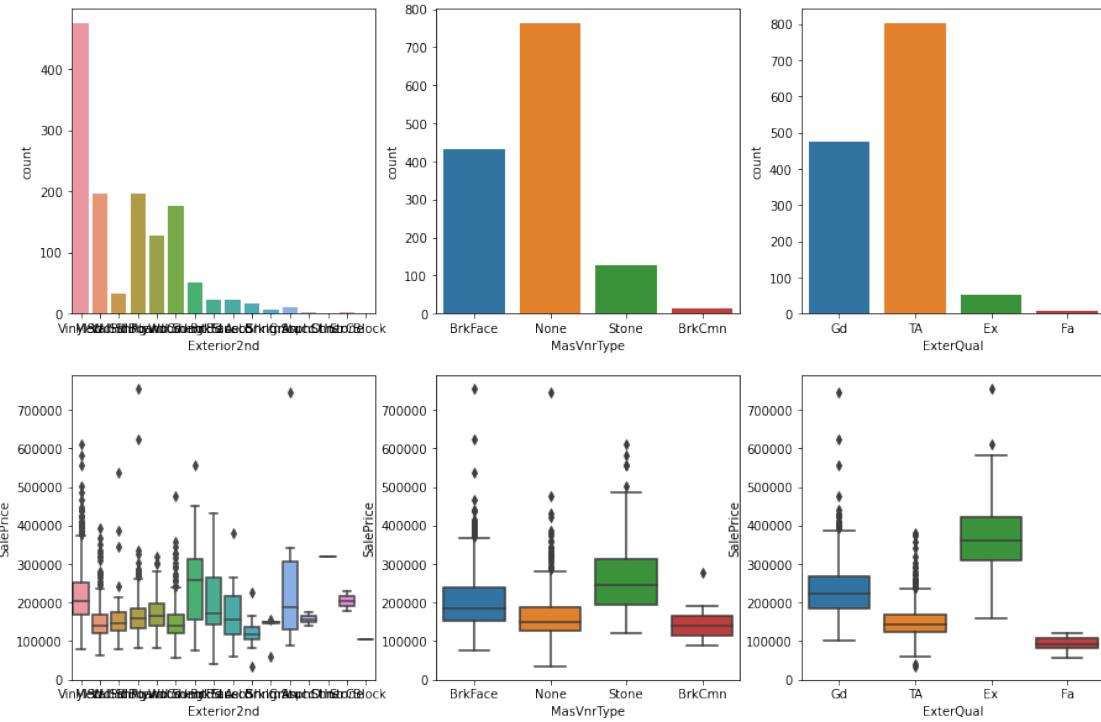
```
[2 rows x 39 columns]
```

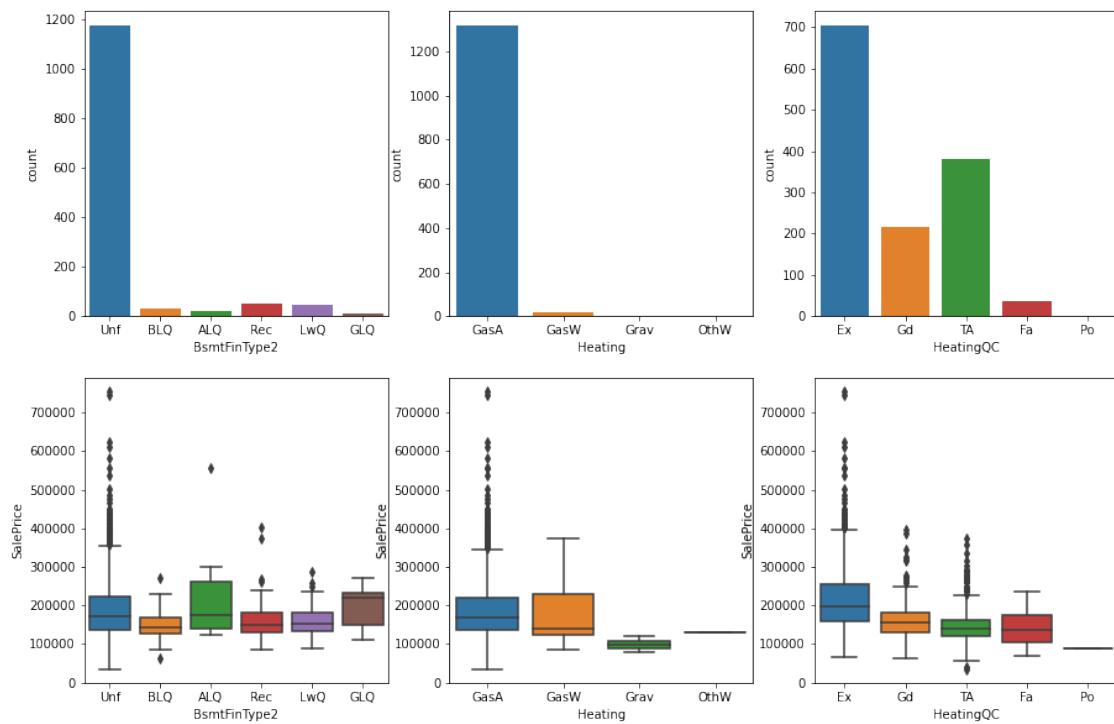
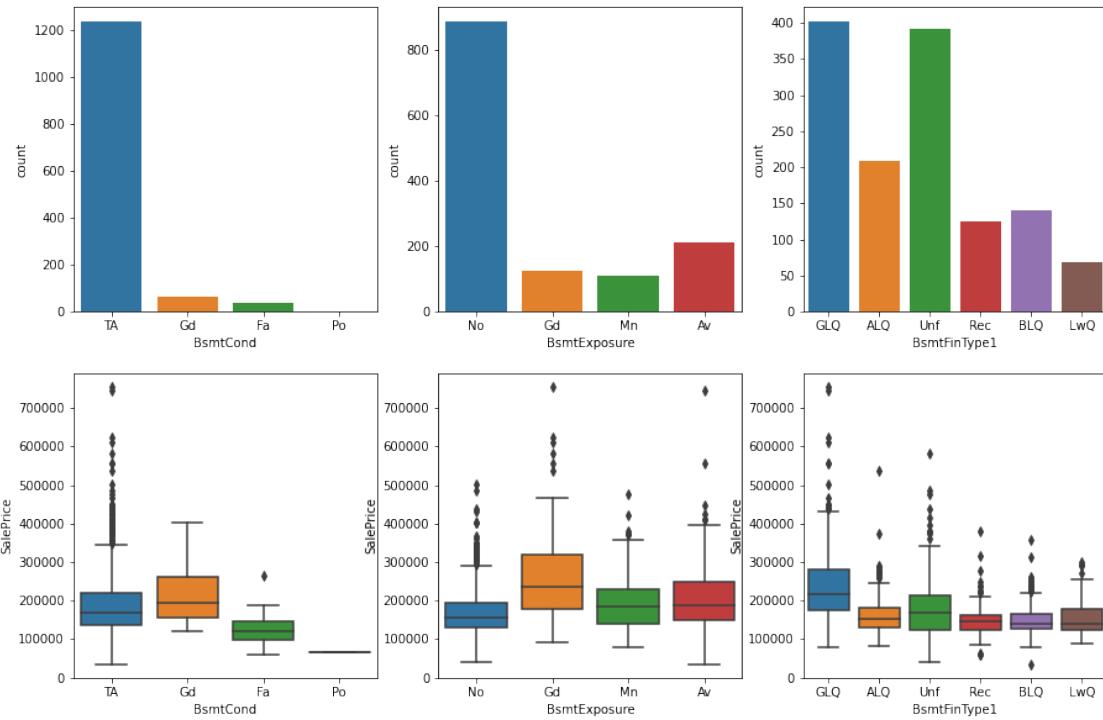
```
[28]: #Function to plot all independent categorical variables with SalePrice and  
      ↵count plot  
ix = 1  
fig = plt.figure(figsize = (15,10))  
for c in list(category_df.columns):  
    if ix <= 3:  
        if c != 'SalePrice':  
            ax1 = fig.add_subplot(2,3,ix)  
            sns.countplot(data = category_df, x=c, ax = ax1) #For countplot  
            ax2 = fig.add_subplot(2,3,ix+3)  
            sns.boxplot(data=category_df, x=c, y='SalePrice', ax=ax2) #For  
      ↵boxplot  
  
    ix = ix +1  
    if ix == 4:  
        fig = plt.figure(figsize = (15,10))  
        ix =1
```

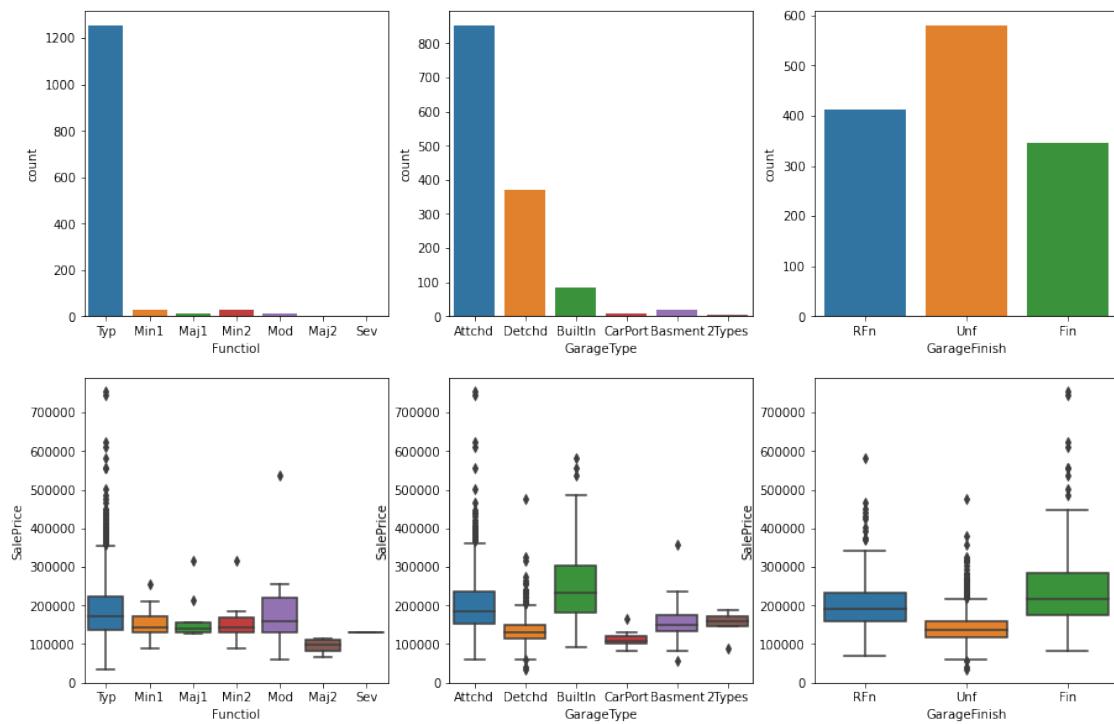
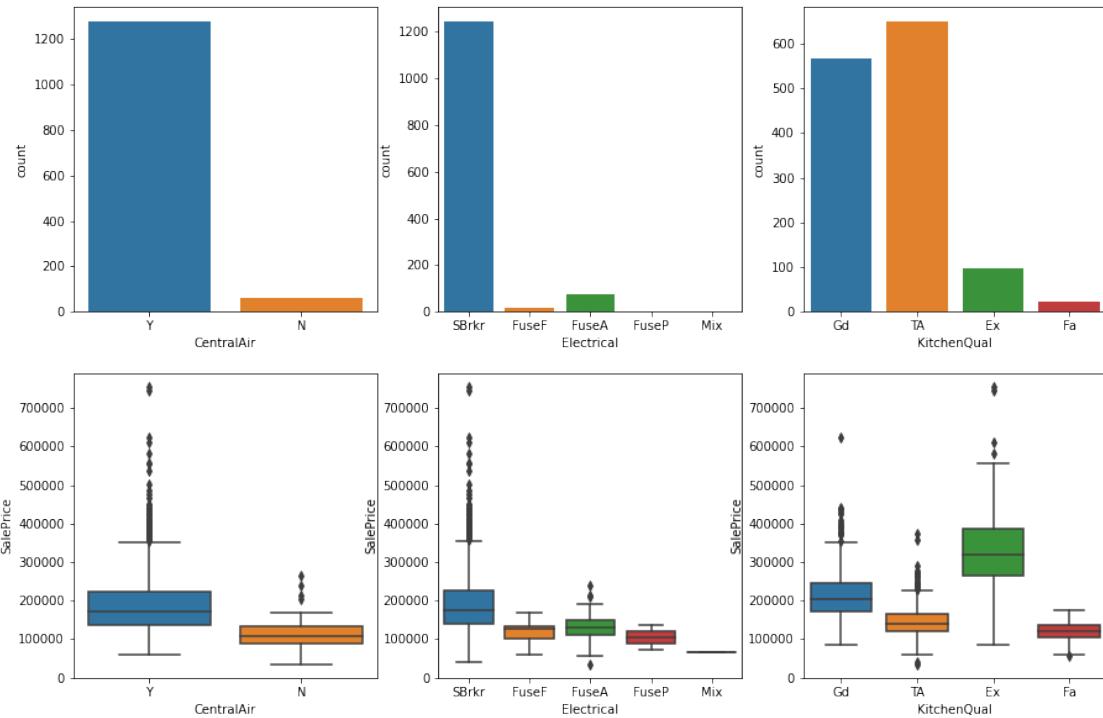


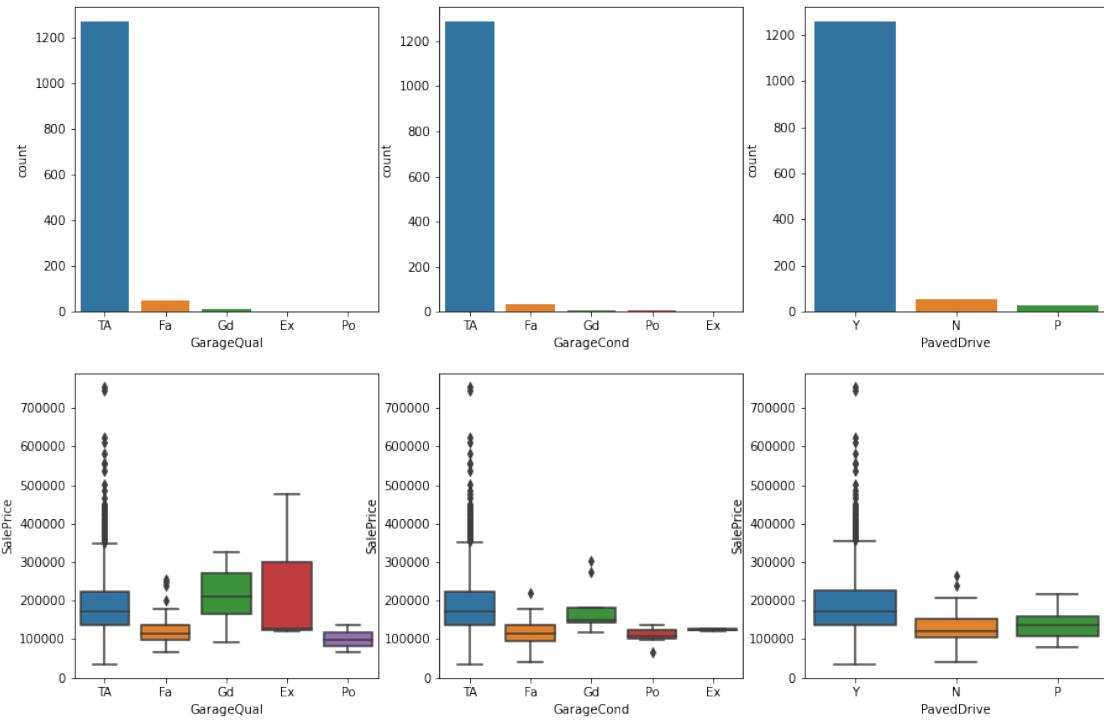


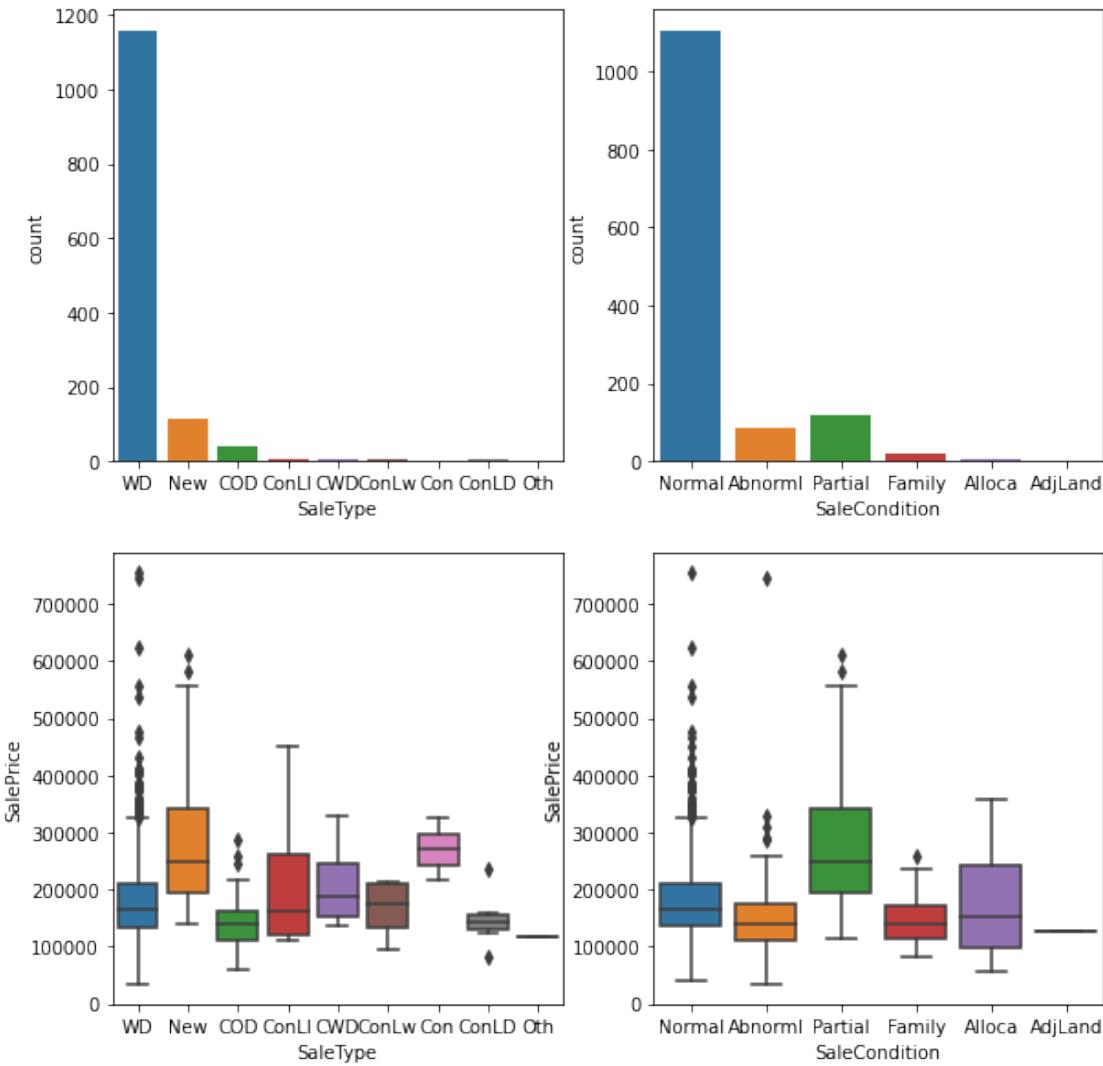












<Figure size 1080x720 with 0 Axes>

```
[29]: import numpy as np
import scipy.stats as stats
from scipy.stats import chi2_contingency
class ChiSquare:
    #Function to determine p-value and perform chi-square test
    def __init__(self, dataframe):
        self.df = dataframe
        self.p = None #P-Value
        self.chi2 = None #Chi-square Test Statistic
        self.dof = None

        self.dfObserved = None
```

```

    self.dfExpected = None

#Function to print the results of p-value and chi-square test
def _print_chisquare_result(self, colX, alpha):
    result = ""
    if self.p<alpha:
        result="{0} is IMPORTANT for Prediction".format(colX)
    else:
        result="{0} is NOT an important predictor. (Discard {0} from model)".format(colX)
    print(result)

#Function to determine chi-square and p-value less than or equal to 0.05
def TestIndependence(self,colX,colY, alpha=0.05):
    X = self.df[colX].astype(str)
    Y = self.df[colY].astype(str)

    self.dfObserved = pd.crosstab(Y,X)
    chi2, p, dof, expected = stats.chi2_contingency(self.dfObserved.values)
    self.p = p
    self.chi2 = chi2
    self.dof = dof

    self.dfExpected = pd.DataFrame(expected, columns=self.dfObserved.columns, index = self.dfObserved.index)

    self._print_chisquare_result(colX,alpha)

#Initializing ChiSquare Class
cT = ChiSquare(category_df)
#Perform Feature Selection
testColumns = ['MSZoning', 'Street', 'LotShape', 'LandContour', 'Utilities',
               'LotConfig', 'LandSlope', 'Neighborhood', 'Condition1', 'Condition2',
               'BldgType', 'HouseStyle', 'RoofStyle', 'RoofMatl', 'Exterior1st',
               'Exterior2nd', 'MasVnrType', 'ExterQual', 'ExterCond', 'Foundation',
               'BsmtQual', 'BsmtCond', 'BsmtExposure', 'BsmtFinType1', 'BsmtFinType2',
               'Heating', 'HeatingQC', 'CentralAir', 'Electrical', 'KitchenQual',
               'Functiol', 'GarageType', 'GarageFinish', 'GarageQual', 'GarageCond',
               'PavedDrive', 'SaleType', 'SaleCondition','SalePrice']

for var in testColumns:
    cT.TestIndependence(colX=var,colY="SalePrice" )

```

MSZoning is IMPORTANT for Prediction  
 Street is IMPORTANT for Prediction  
 LotShape is IMPORTANT for Prediction  
 LandContour is NOT an important predictor. (Discard LandContour from model)  
 Utilities is NOT an important predictor. (Discard Utilities from model)

LotConfig is NOT an important predictor. (Discard LotConfig from model)  
 LandSlope is NOT an important predictor. (Discard LandSlope from model)  
 Neighborhood is IMPORTANT for Prediction  
 Condition1 is NOT an important predictor. (Discard Condition1 from model)  
 Condition2 is IMPORTANT for Prediction  
 BldgType is NOT an important predictor. (Discard BldgType from model)  
 HouseStyle is NOT an important predictor. (Discard HouseStyle from model)  
 RoofStyle is NOT an important predictor. (Discard RoofStyle from model)  
 RoofMatl is NOT an important predictor. (Discard RoofMatl from model)  
 Exterior1st is NOT an important predictor. (Discard Exterior1st from model)  
 Exterior2nd is NOT an important predictor. (Discard Exterior2nd from model)  
 MasVnrType is IMPORTANT for Prediction  
 ExterQual is IMPORTANT for Prediction  
 ExterCond is NOT an important predictor. (Discard ExterCond from model)  
 Foundation is IMPORTANT for Prediction  
 BsmtQual is IMPORTANT for Prediction  
 BsmtCond is IMPORTANT for Prediction  
 BsmtExposure is IMPORTANT for Prediction  
 BsmtFinType1 is NOT an important predictor. (Discard BsmtFinType1 from model)  
 BsmtFinType2 is NOT an important predictor. (Discard BsmtFinType2 from model)  
 Heating is NOT an important predictor. (Discard Heating from model)  
 HeatingQC is NOT an important predictor. (Discard HeatingQC from model)  
 CentralAir is IMPORTANT for Prediction  
 Electrical is IMPORTANT for Prediction  
 KitchenQual is IMPORTANT for Prediction  
 Functiol is NOT an important predictor. (Discard Functiol from model)  
 GarageType is IMPORTANT for Prediction  
 GarageFinish is IMPORTANT for Prediction  
 GarageQual is IMPORTANT for Prediction  
 GarageCond is NOT an important predictor. (Discard GarageCond from model)  
 PavedDrive is NOT an important predictor. (Discard PavedDrive from model)  
 SaleType is IMPORTANT for Prediction  
 SaleCondition is IMPORTANT for Prediction  
 SalePrice is IMPORTANT for Prediction

```
[31]: category_df = 
    ↪category_df[['MSZoning', 'Street', 'LotShape', 'Neighborhood', 'Condition2', 'MasVnrType', 'Exter-
    ↪'Functiol', 'GarageType', 'GarageFinish', 'GarageQual', 'GarageCond', ↪
    ↪'PavedDrive', 'SaleType', 'SaleCondition', 'SalePrice']]
```

```
[32]: category_df.head(2)
```

|   | MSZoning | Street | LotShape | Neighborhood | Condition2 | MasVnrType | ExterQual | ExterCond | Functiol | GarageType | GarageFinish | GarageQual | GarageCond | PavedDrive | SaleType | SaleCondition | SalePrice |
|---|----------|--------|----------|--------------|------------|------------|-----------|-----------|----------|------------|--------------|------------|------------|------------|----------|---------------|-----------|
| 0 | RL       | Pave   | Reg      | CollgCr      | Norm       | BrkFace    | Gd        | TA        | None     | None       | None         | None       | None       | None       | None     | None          | None      |
| 1 | RL       | Pave   | Reg      | Veenker      | Norm       | None       | TA        | TA        | None     | None       | None         | None       | None       | None       | None     | None          | None      |

```
Foundation BsmtQual BsmtCond ... KitchenQual Functiol GarageType \
```

```

0      PConc      Gd      TA ...      Gd      Typ      Attchd
1      CBlock      Gd      TA ...      TA      Typ      Attchd

GarageFinish GarageQual GarageCond PavedDrive SaleType SaleCondition \
0          RFn        TA        TA        Y        WD      Normal
1          RFn        TA        TA        Y        WD      Normal

SalePrice
0      208500
1      181500

[2 rows x 23 columns]

```

[33]: `number_df.head(2)`

```

[33]: OverallQual  YearBuilt  TotalBsmtSF  GrLivArea  FullBath  GarageCars  \
0            7        2003        856        1710        2            2
1            6        1976       1262        1262        2            2

SalePrice
0      208500
1      181500

```

[34]: `#Combining the datasets`

```
House = pd.merge(category_df, number_df, how="outer", on=["SalePrice"])
```

[35]: `House.head(2)`

```

[35]: MSZoning Street LotShape Neighborhood Condition2 MasVnrType ExterQual \
0      RL    Pave      Reg     CollgCr      Norm    BrkFace      Gd
1      RL    Pave      Reg     Veenker      Norm      None      TA

Foundation BsmtQual BsmtCond ... PavedDrive SaleType SaleCondition \
0      PConc      Gd      TA ...        Y        WD      Normal
1      CBlock      Gd      TA ...        Y        WD      Normal

SalePrice OverallQual YearBuilt TotalBsmtSF GrLivArea FullBath GarageCars
0      208500          7        2003        856        1710        2            2
1      181500          6        1976       1262        1262        2            2

[2 rows x 29 columns]

```

[36]: `#Function to plot all independent categorical variables with SalePrice and ↵count plot`

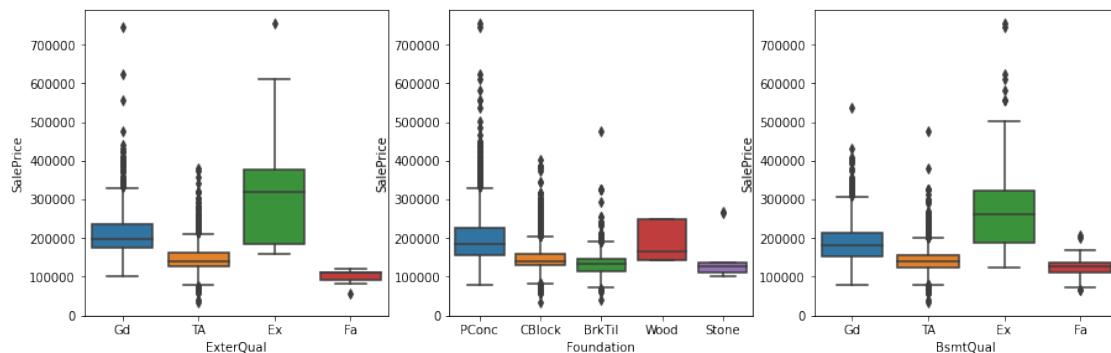
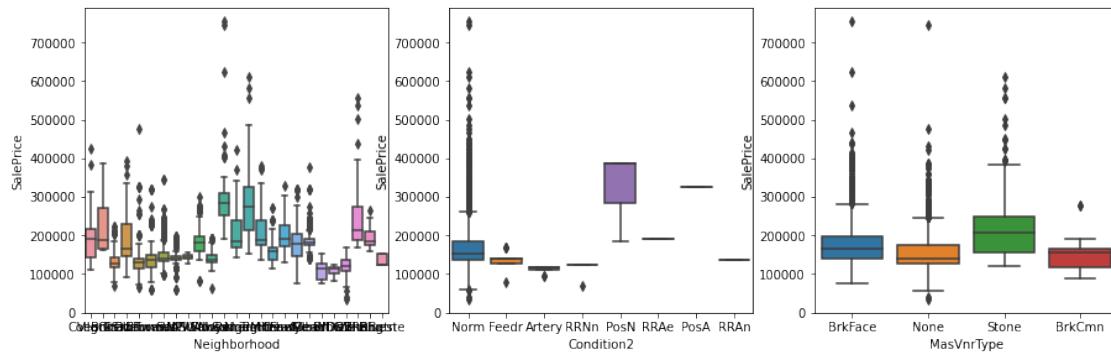
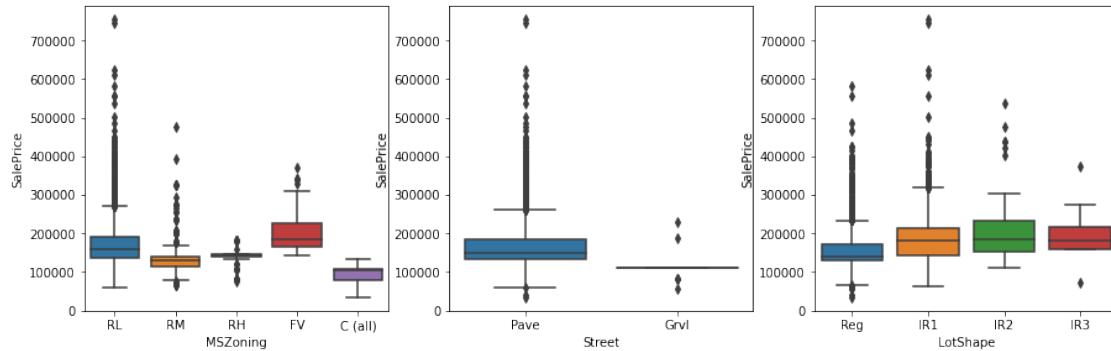
```
ix = 1
fig = plt.figure(figsize = (15,10))
for c in list(House.columns):
```

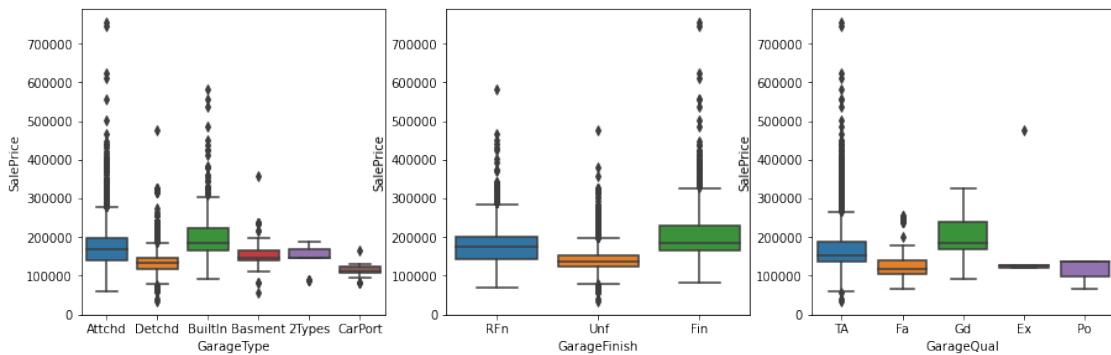
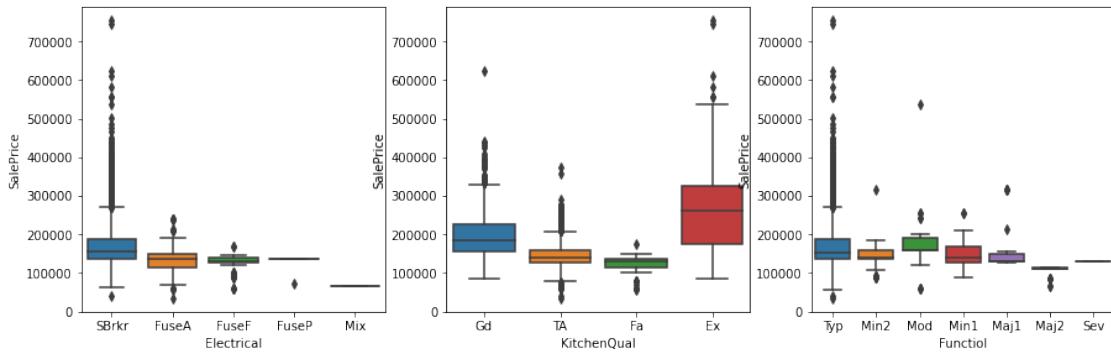
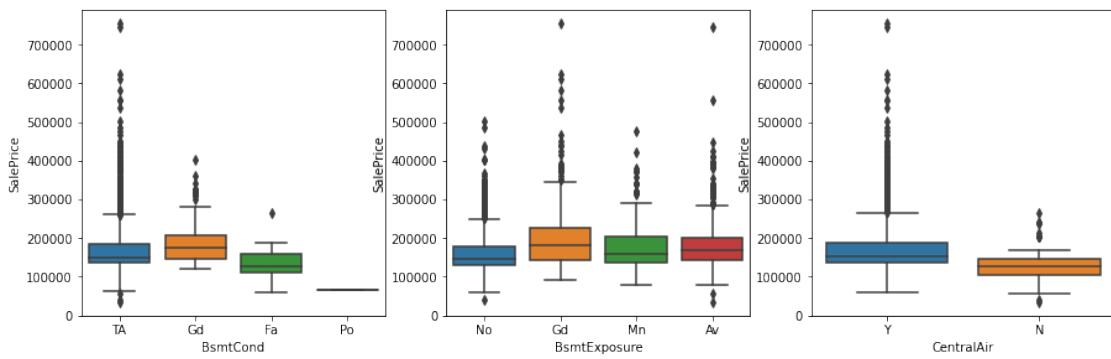
```

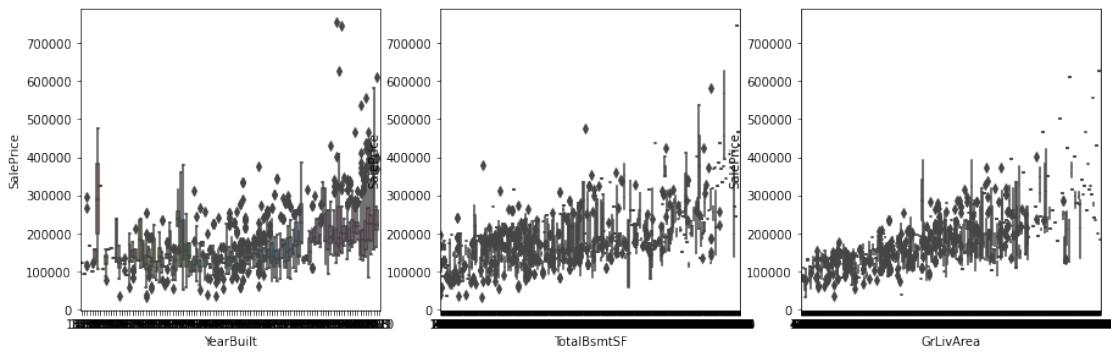
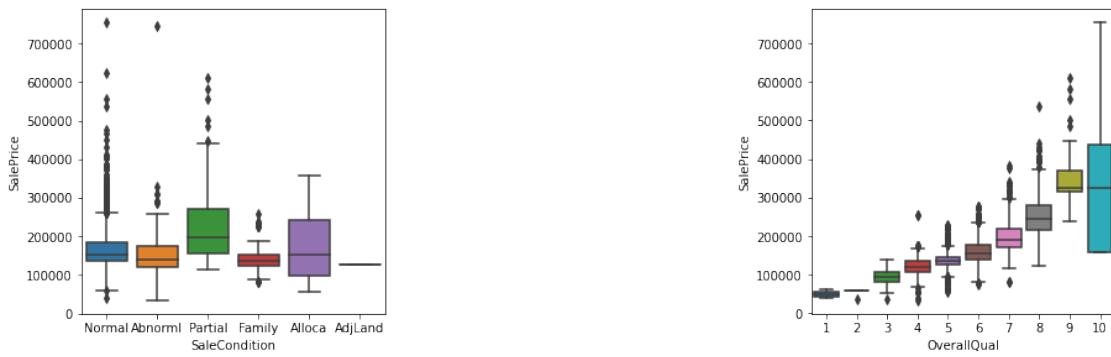
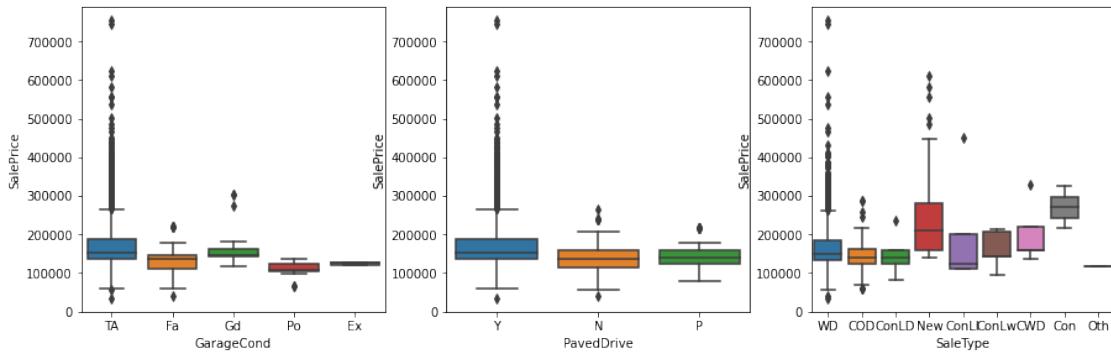
if ix <= 3:
    if c != 'SalePrice':
        ax2 = fig.add_subplot(2,3,ix+3)
        sns.boxplot(data=House, x=c, y='SalePrice', ax=ax2) #for boxplot

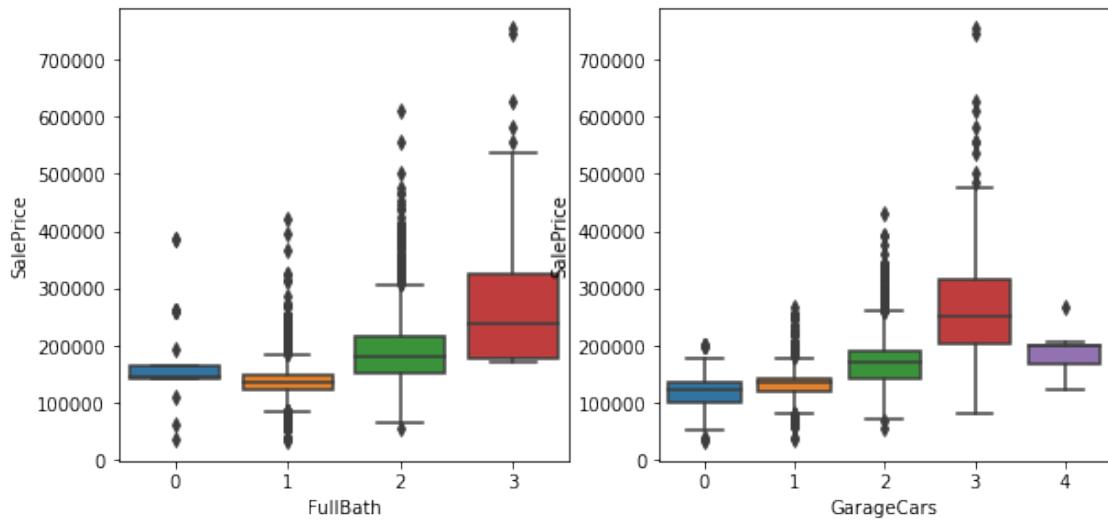
ix = ix +1
if ix == 4:
    fig = plt.figure(figsize = (15,10))
    ix =1

```









#### 1.0.1 Project Submitted By - Muzamil Showkat

[ ]: