In [303…
```
import pandas as pd
```

In [304…
```
df=pd.read_csv('training_set.csv')
df_test=pd.read_csv('testing_set.csv')
```

In [304…

In [305…
```
df
```

Out[305…

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotSha
0	1	60	RL	65.0	8450	Pave	NaN	
1	2	20	RL	80.0	9600	Pave	NaN	
2	3	60	RL	68.0	11250	Pave	NaN	
3	4	70	RL	60.0	9550	Pave	NaN	
4	5	60	RL	84.0	14260	Pave	NaN	
...	...	...	...	...	...	...	...	
1455	1456	60	RL	62.0	7917	Pave	NaN	
1456	1457	20	RL	85.0	13175	Pave	NaN	
1457	1458	70	RL	66.0	9042	Pave	NaN	
1458	1459	20	RL	68.0	9717	Pave	NaN	
1459	1460	20	RL	75.0	9937	Pave	NaN	

1460 rows × 81 columns

In [306…
```
df_test
```

Out[306…

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotSha
0	1461	20	RH	80.0	11622	Pave	NaN	
1	1462	20	RL	81.0	14267	Pave	NaN	
2	1463	60	RL	74.0	13830	Pave	NaN	
3	1464	60	RL	78.0	9978	Pave	NaN	
4	1465	120	RL	43.0	5005	Pave	NaN	
...	...	...	...	...	...	...	...	
1454	2915	160	RM	21.0	1936	Pave	NaN	
1455	2916	160	RM	21.0	1894	Pave	NaN	
1456	2917	20	RL	160.0	20000	Pave	NaN	
1457	2918	85	RL	62.0	10441	Pave	NaN	
1458	2919	60	RL	74.0	9627	Pave	NaN	

1459 rows × 80 columns

In [307…
```
df.columns
```

Out[307…
```
Index(['Id', 'MSSubClass', 'MSZoning', 'LotFrontage', 'LotArea', 'Street',
       'Alley', 'LotShape', 'LandContour', 'Utilities', 'LotConfig',
       'LandSlope', 'Neighborhood', 'Condition1', 'Condition2', 'BldgType',
       'HouseStyle', 'OverallQual', 'OverallCond', 'YearBuilt', 'YearRemodAd
d',
       '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', 'FullBat
h',
       'HalfBath', 'BedroomAbvGr', 'KitchenAbvGr', 'KitchenQual',
       'TotRmsAbvGrd', 'Functional', 'Fireplaces', 'FireplaceQu', 'GarageTyp
e',
       'GarageYrBlt', 'GarageFinish', 'GarageCars', 'GarageArea', 'GarageQua
l',
       'GarageCond', 'PavedDrive', 'WoodDeckSF', 'OpenPorchSF',
       'EnclosedPorch', '3SsnPorch', 'ScreenPorch', 'PoolArea', 'PoolQC',
       'Fence', 'MiscFeature', 'MiscVal', 'MoSold', 'YrSold', 'SaleType',
       'SaleCondition', 'SalePrice'],
      dtype='object')
```

In [308…
```
df.isna().sum()
```

Out[308…

	0
Id	0
MSSubClass	0
MSZoning	0
LotFrontage	259
LotArea	0
...	...
MoSold	0
YrSold	0
SaleType	0
SaleCondition	0
SalePrice	0

81 rows × 1 columns

dtype: int64

In [309…
```
for i in df.columns:
  if df[i].dtype==object:
    df[i]=df[i].fillna(df[i].mode()[0])
  else:
      df[i]=df[i].fillna(df[i].mean())
```

In [310…
```
cat=[]
con=[]
for i in df.columns:
  if df[i].dtype==object:
    cat.append(i)
  else:
    con.append(i)
```

In [311…
```
from sklearn.preprocessing import LabelEncoder,StandardScaler
from sklearn.metrics import r2_score,mean_absolute_error
from sklearn.model_selection import GridSearchCV,train_test_split
from sklearn.linear_model import LinearRegression,Ridge,Lasso
```

In [312…
```
#for col in cat:
 #   if df[col].isnull().sum() > 0:
  #      most_freq = df[col].mode()[0]
   #     df[col].fillna(most_freq, inplace=True)
    #    print(f"Filled missing in '{col}' with '{most_freq}'")
```

In [313…
```
le=LabelEncoder()
```

```
ss=StandardScaler()
lr=LinearRegression()
```

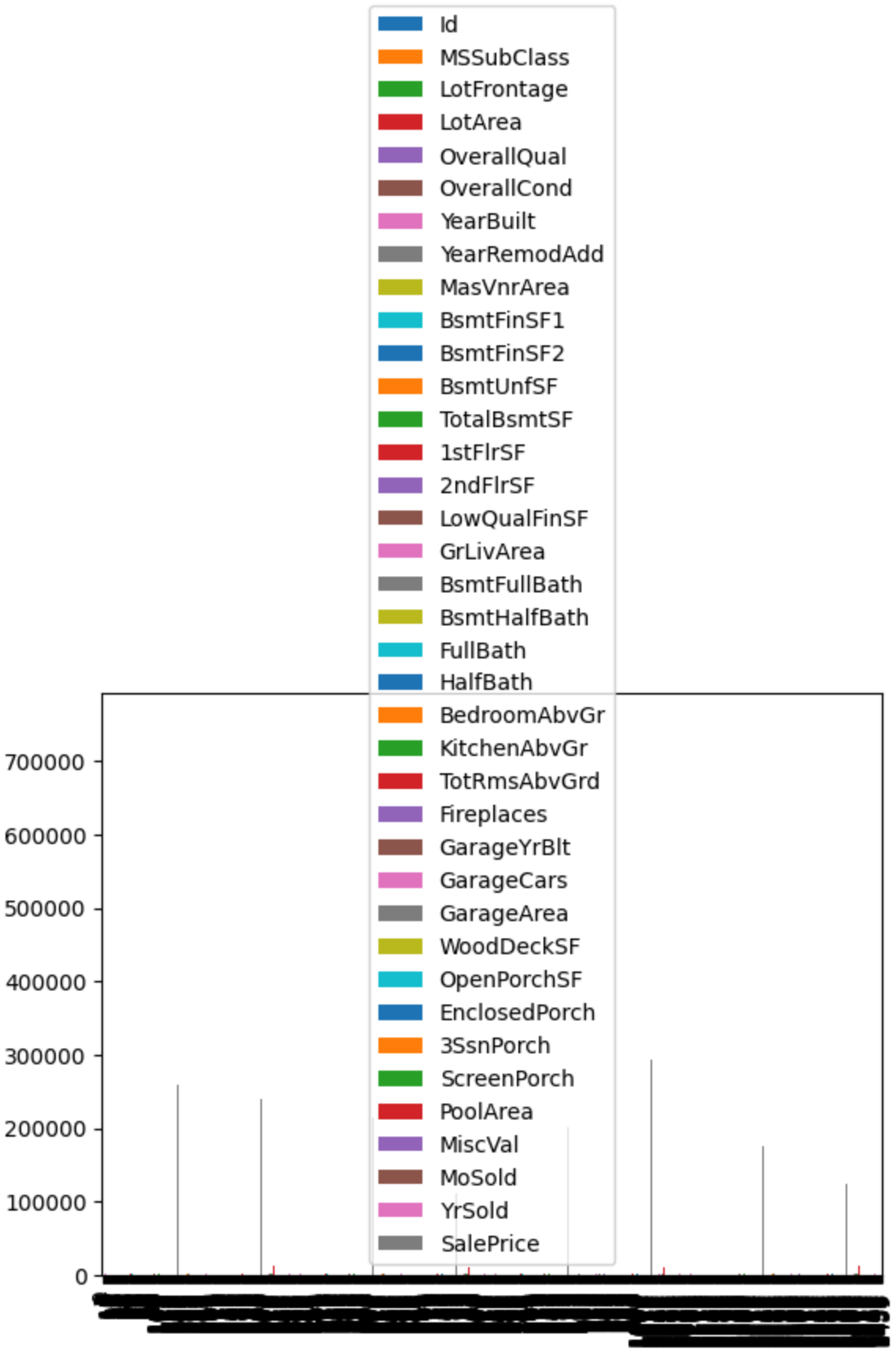
EDA

In [314…

```
df.plot(kind='bar')
```

Out[314…

```
<Axes: >
```



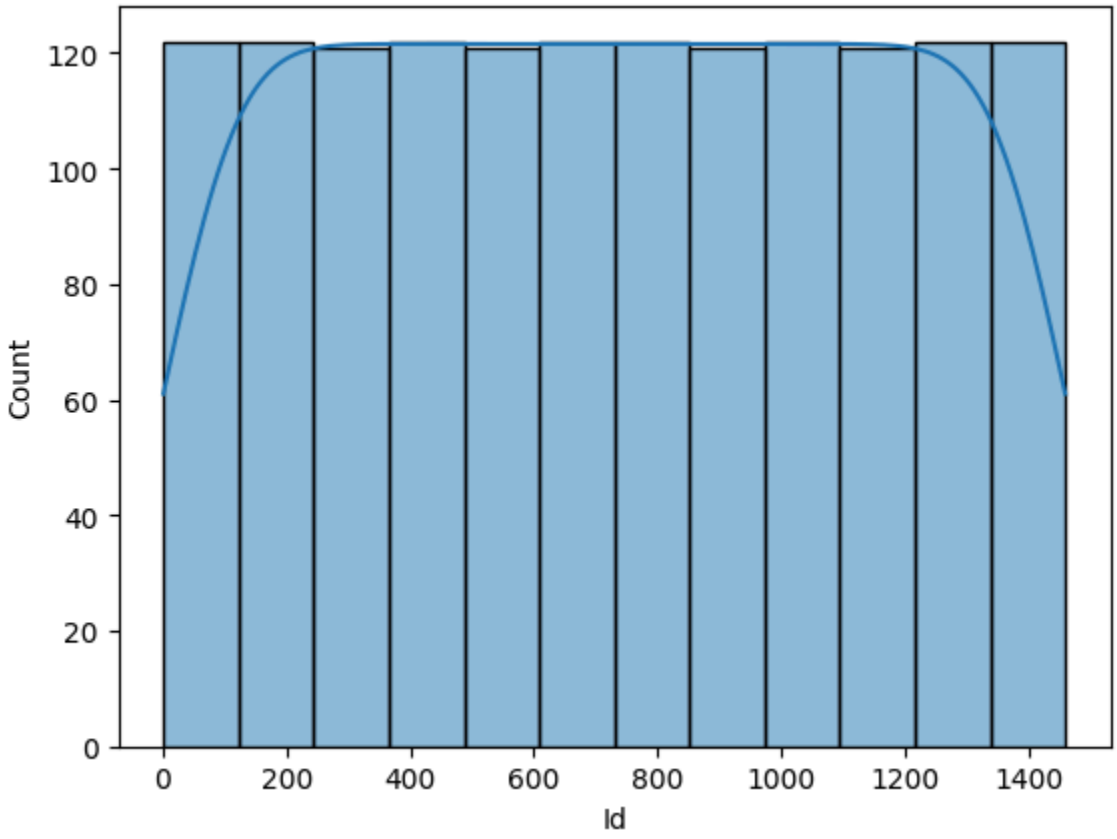
In [315…

```
from matplotlib.pyplot import show
```

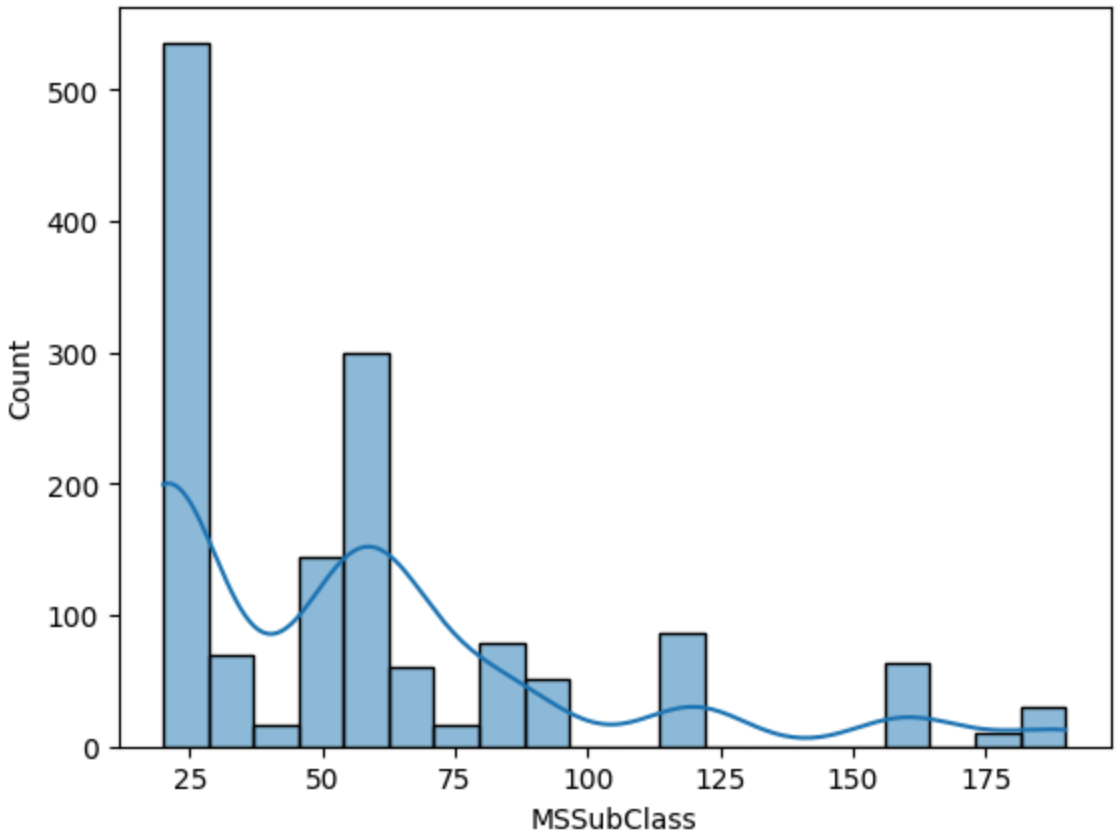
In [316…
```
import seaborn as sns
```

In [317…
```
for i in df[con].columns:
  sns.histplot(data=df,x=i,kde=True)
  print(i)
  show()
```

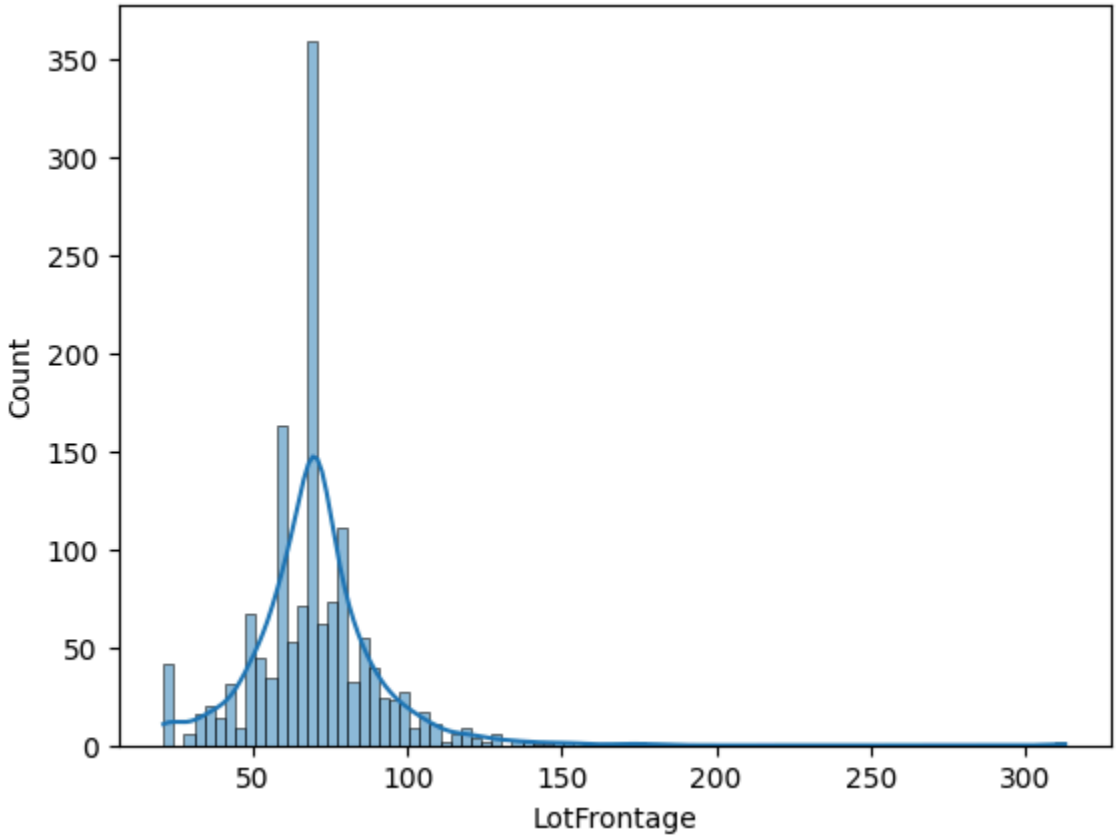
Id



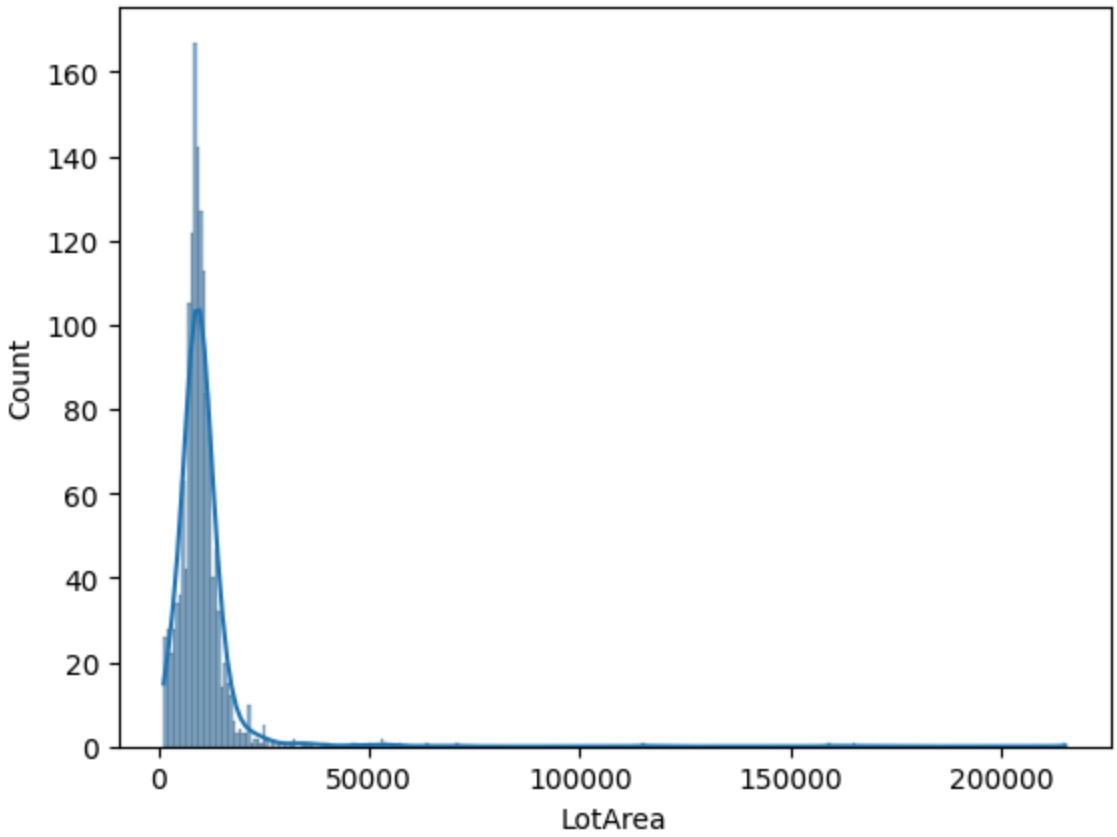
MSSubClass



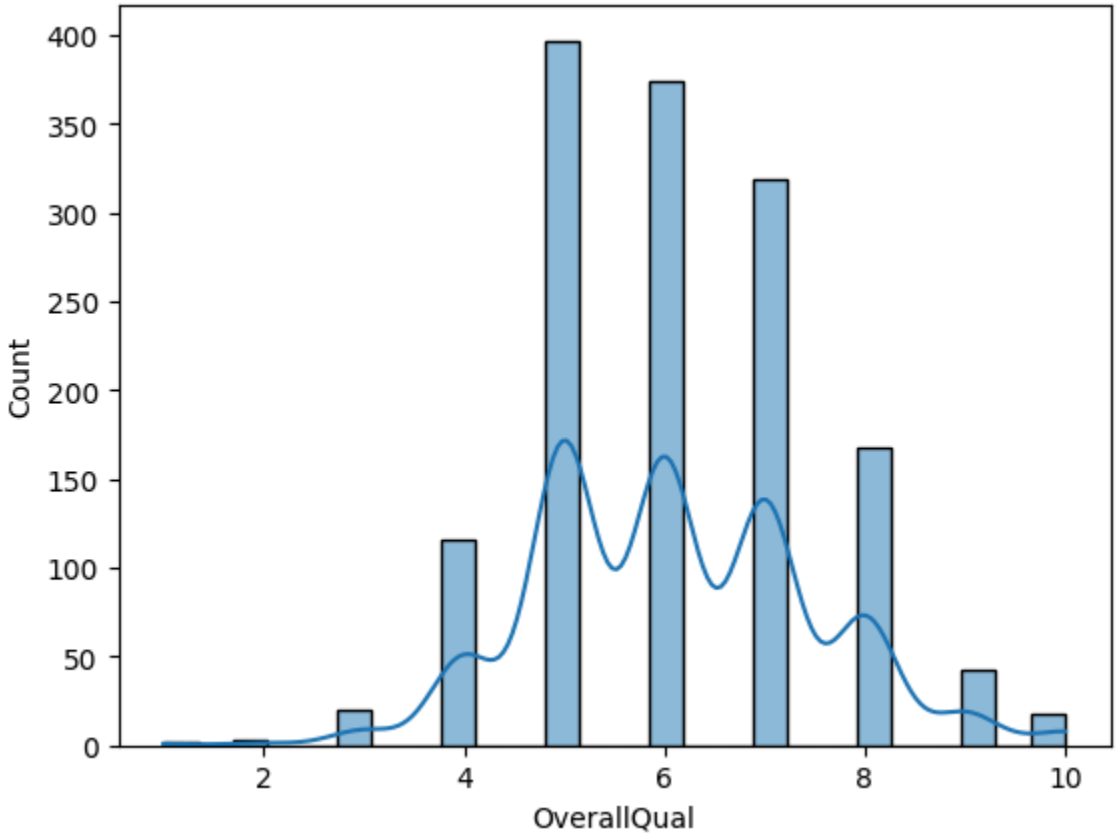
LotFrontage



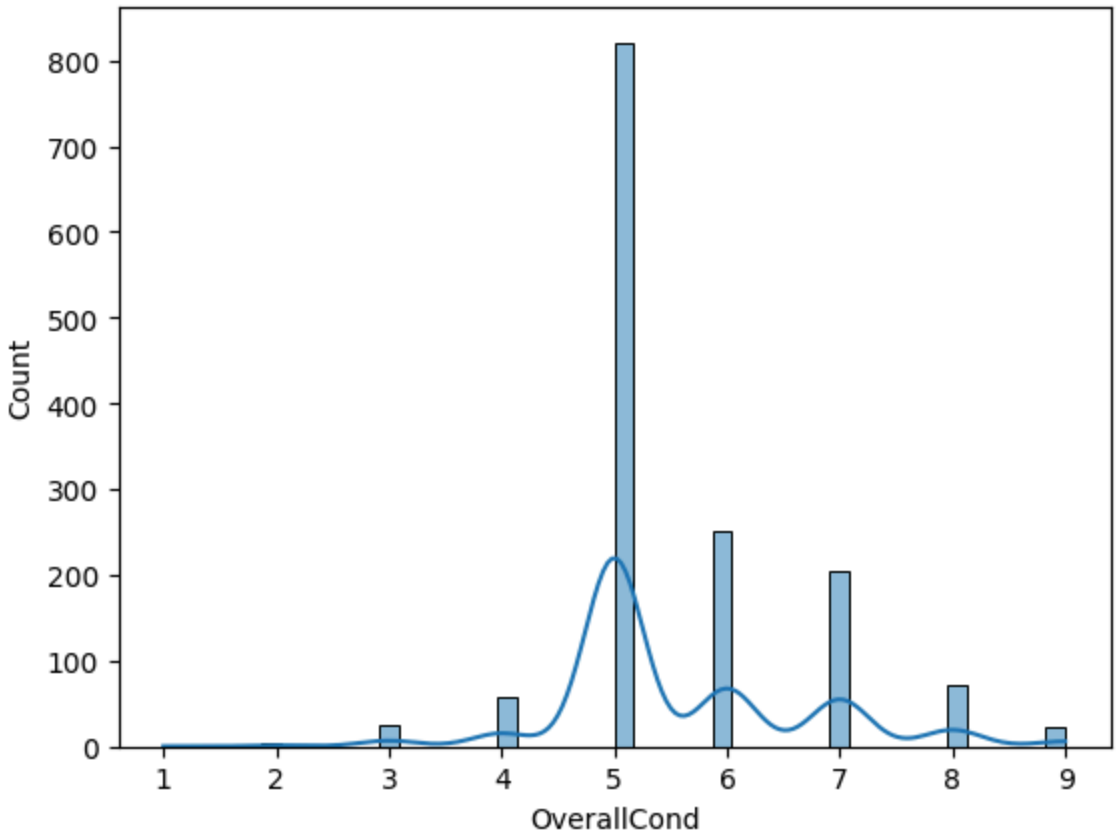
LotArea



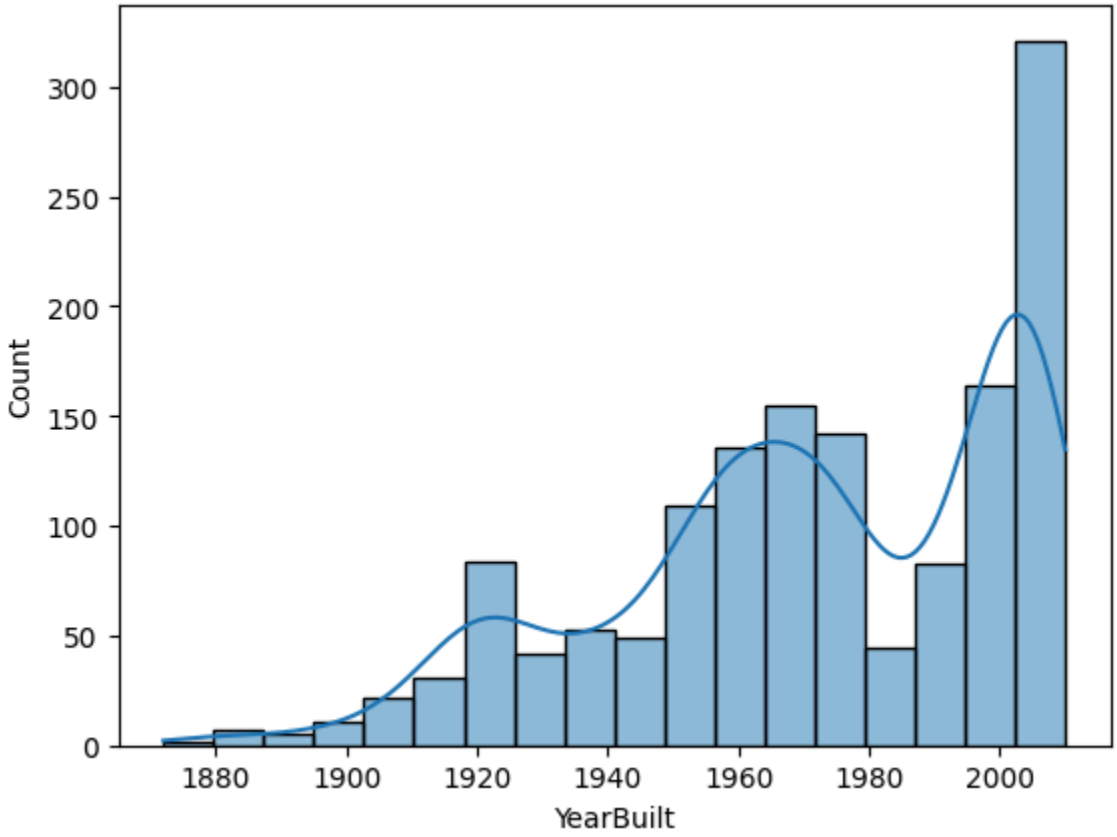
OverallQual



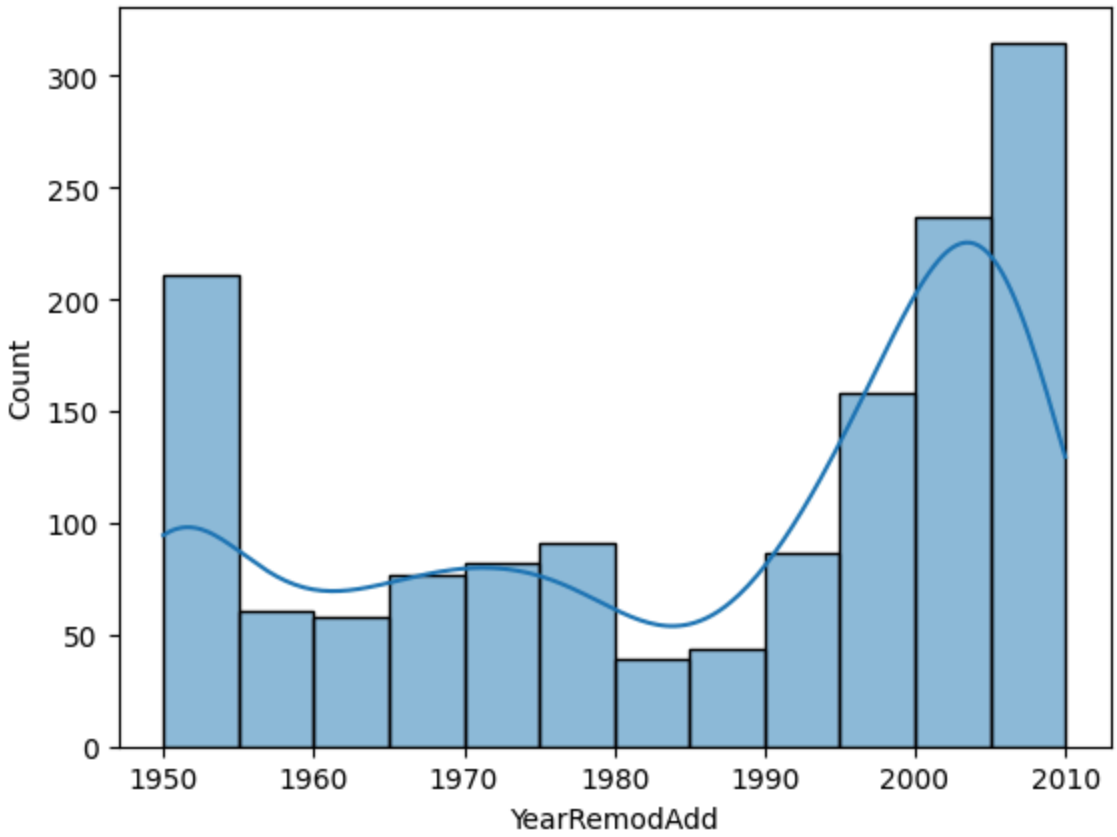
OverallCond



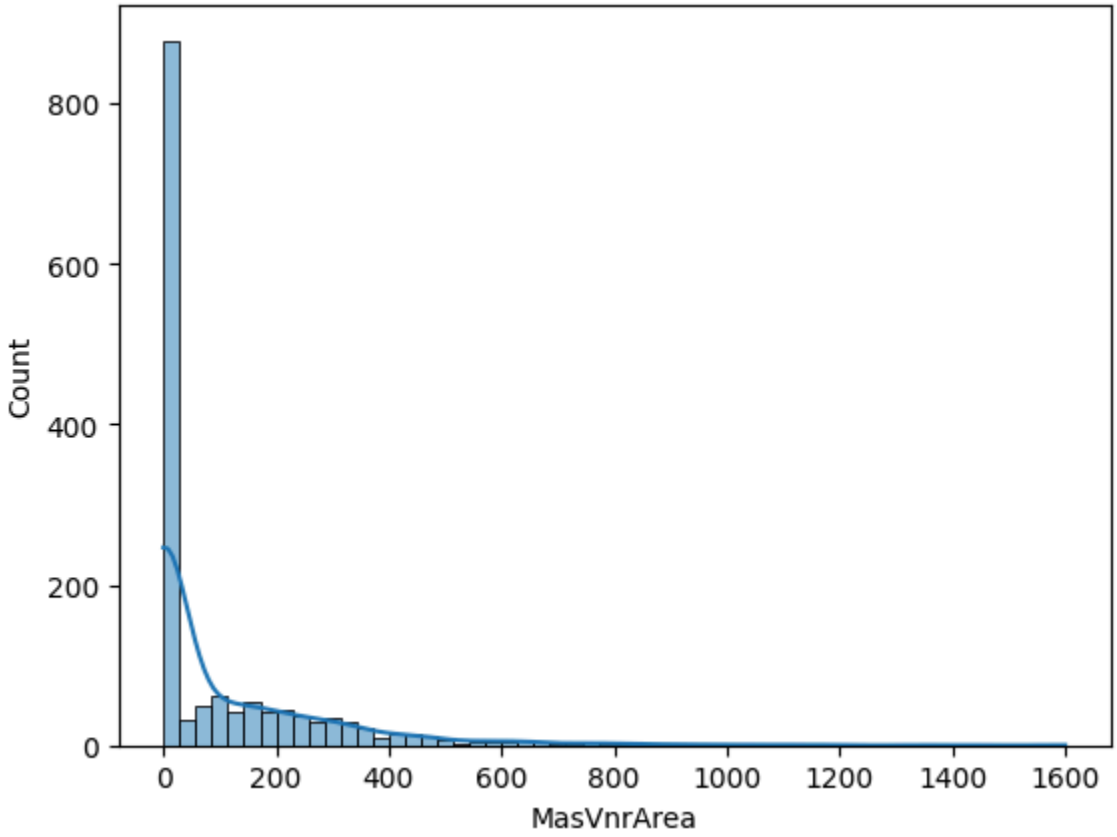
YearBuilt



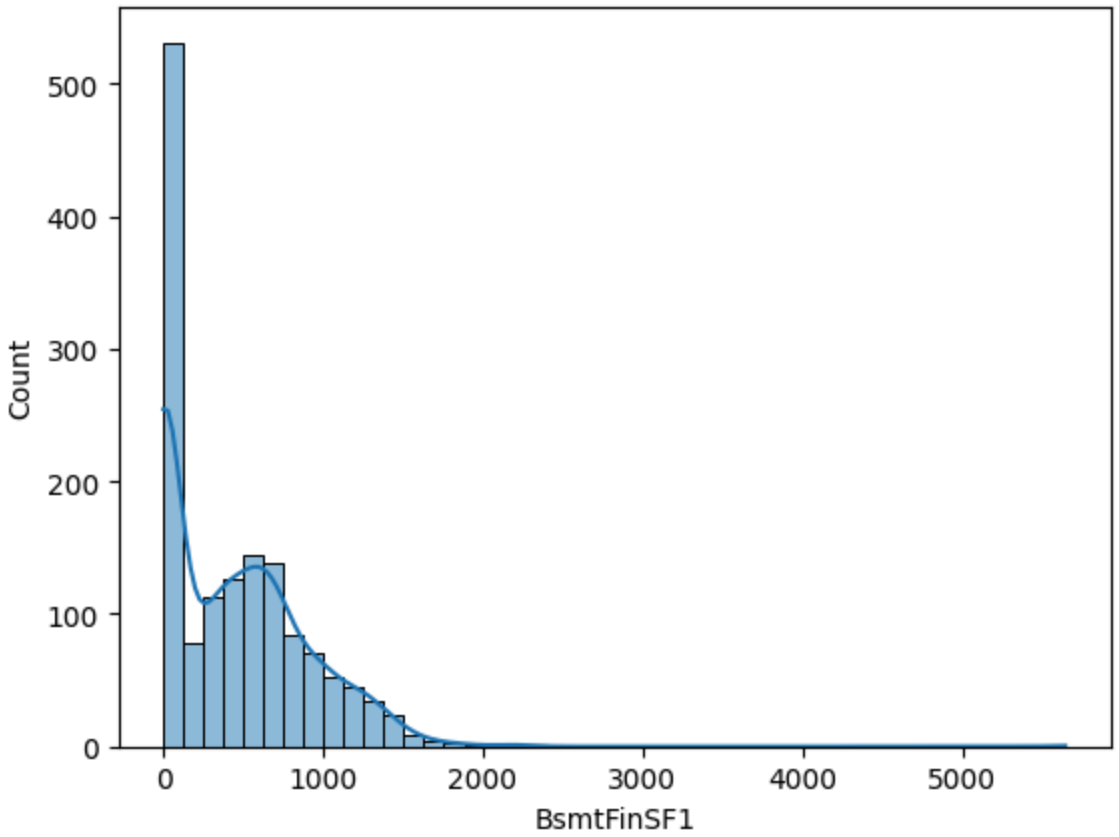
YearRemodAdd



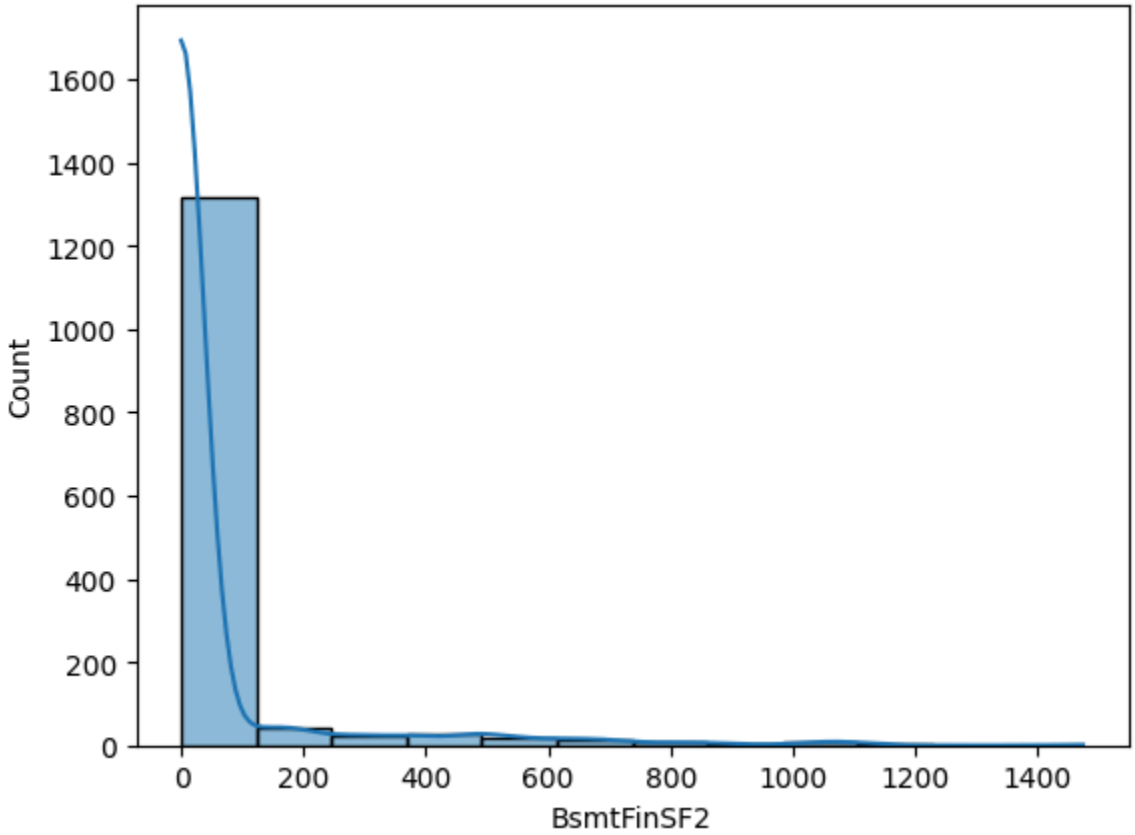
MasVnrArea



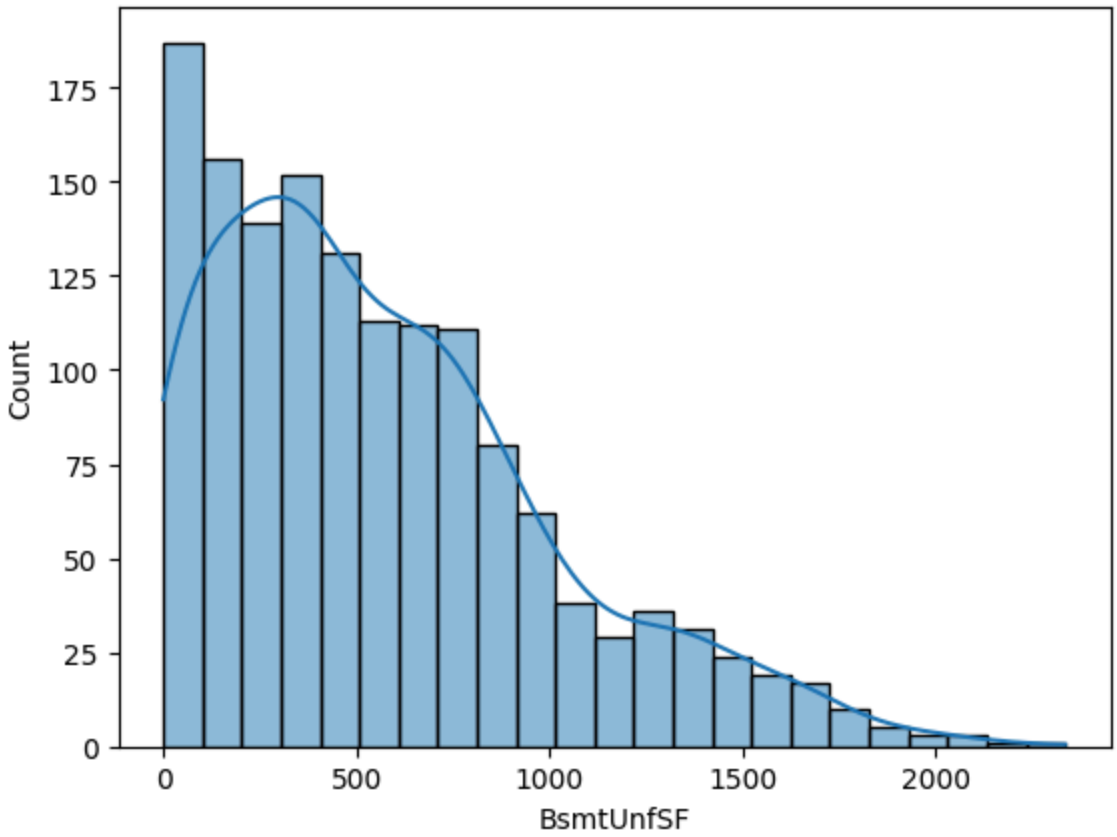
BsmtFinSF1



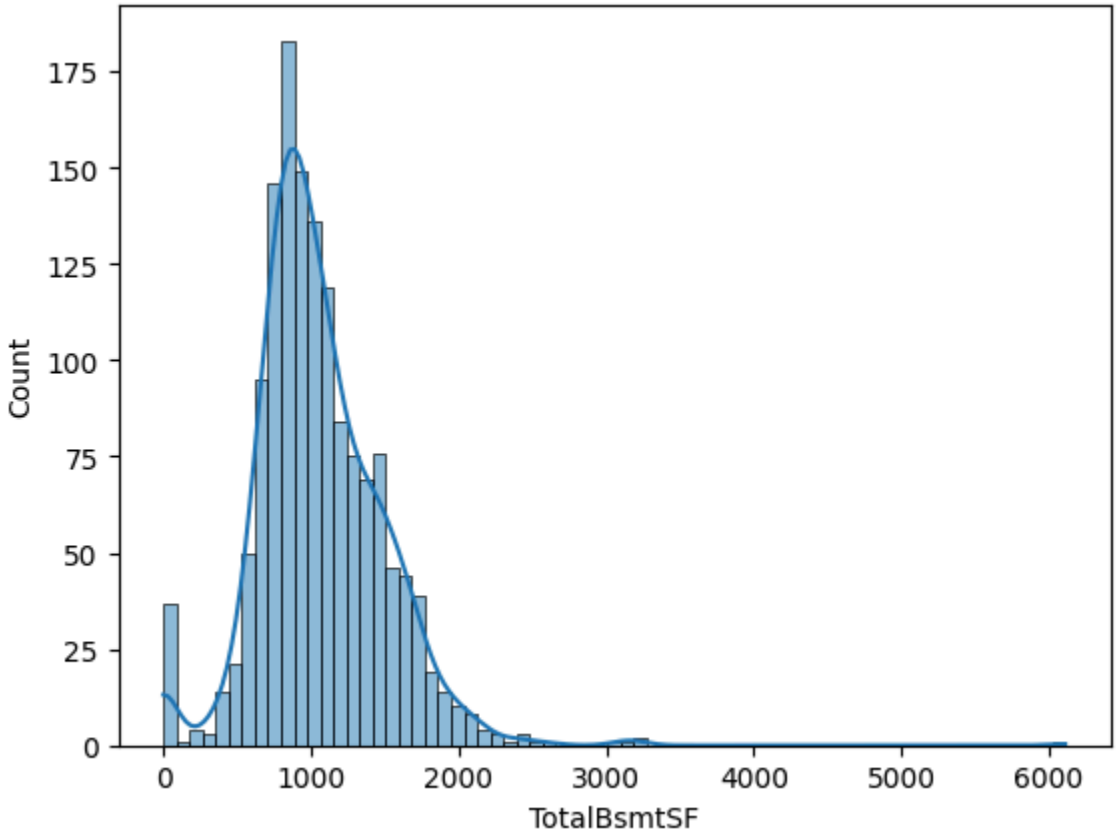
BsmtFinSF2



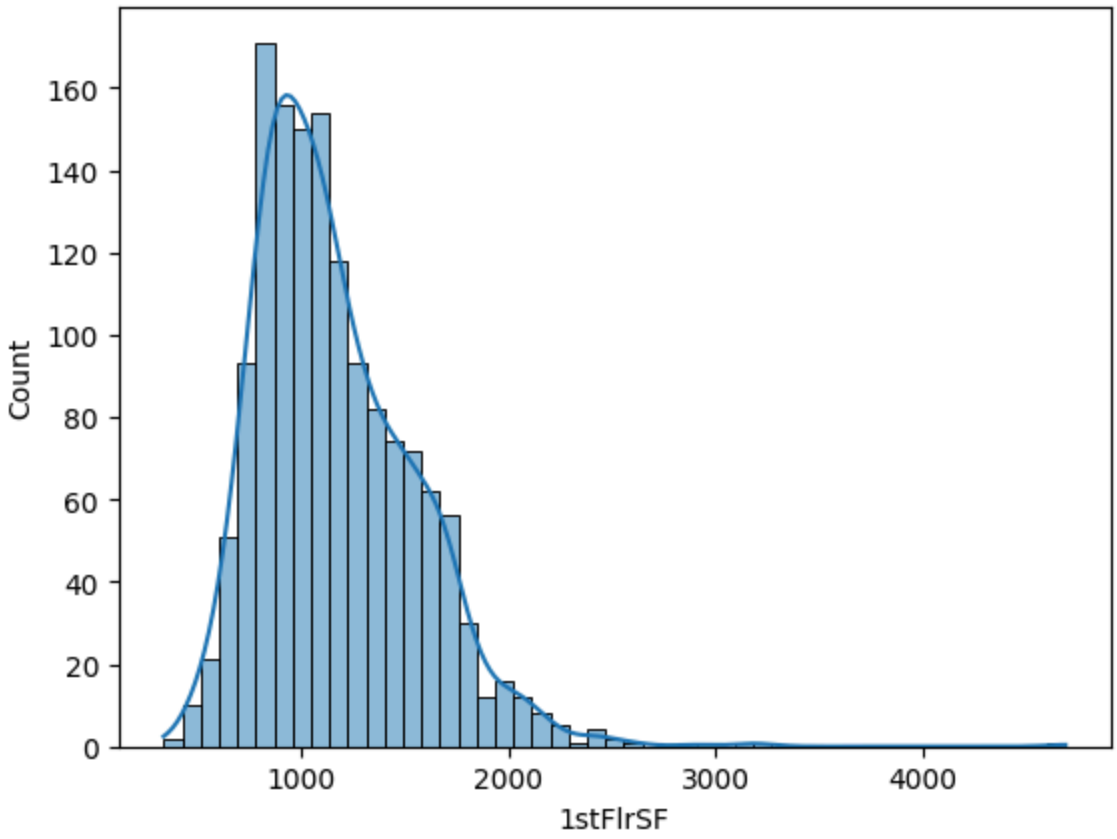
BsmtUnfSF



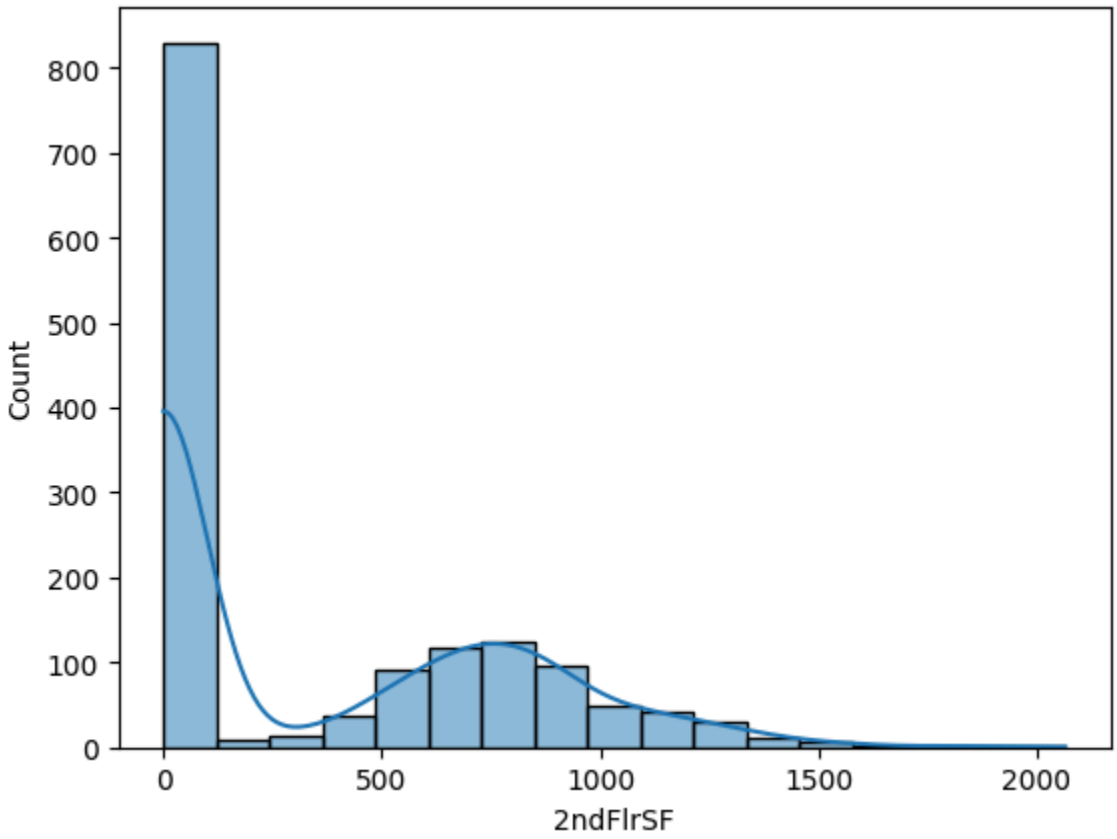
TotalBsmtSF



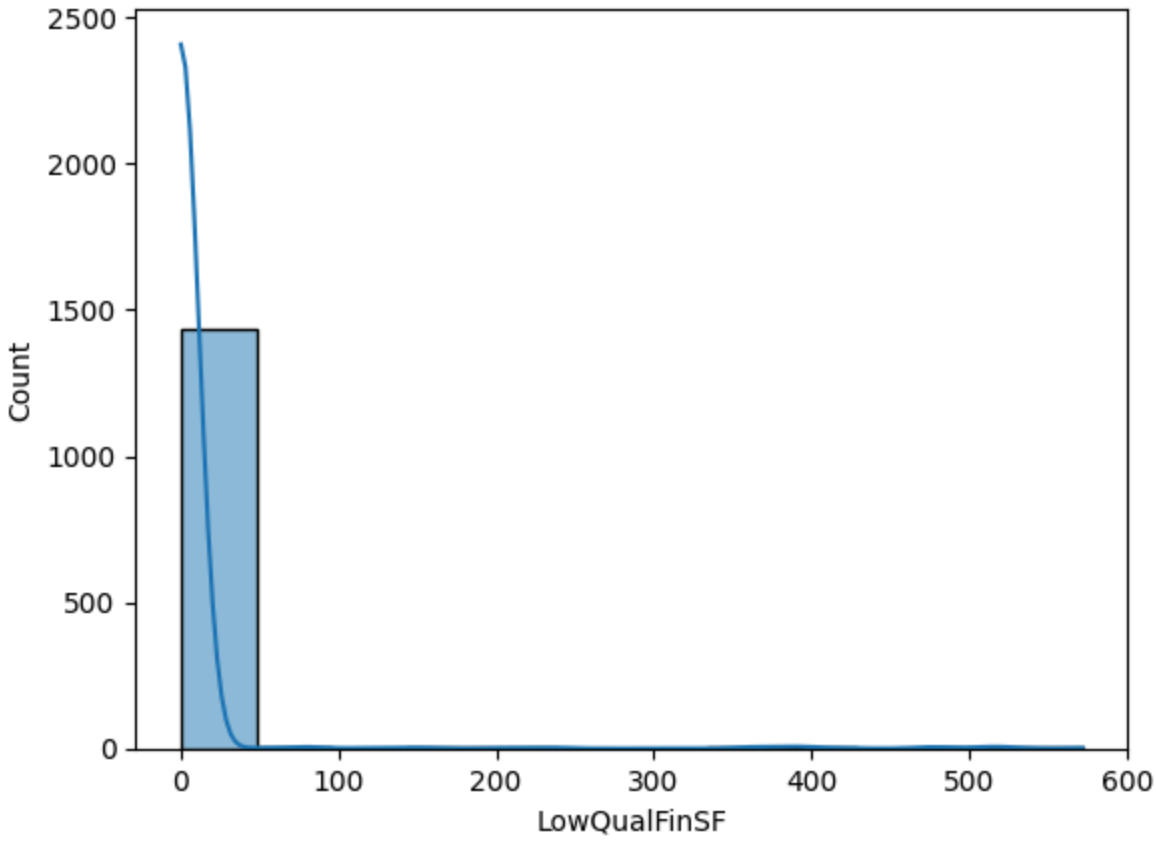
1stFlrSF



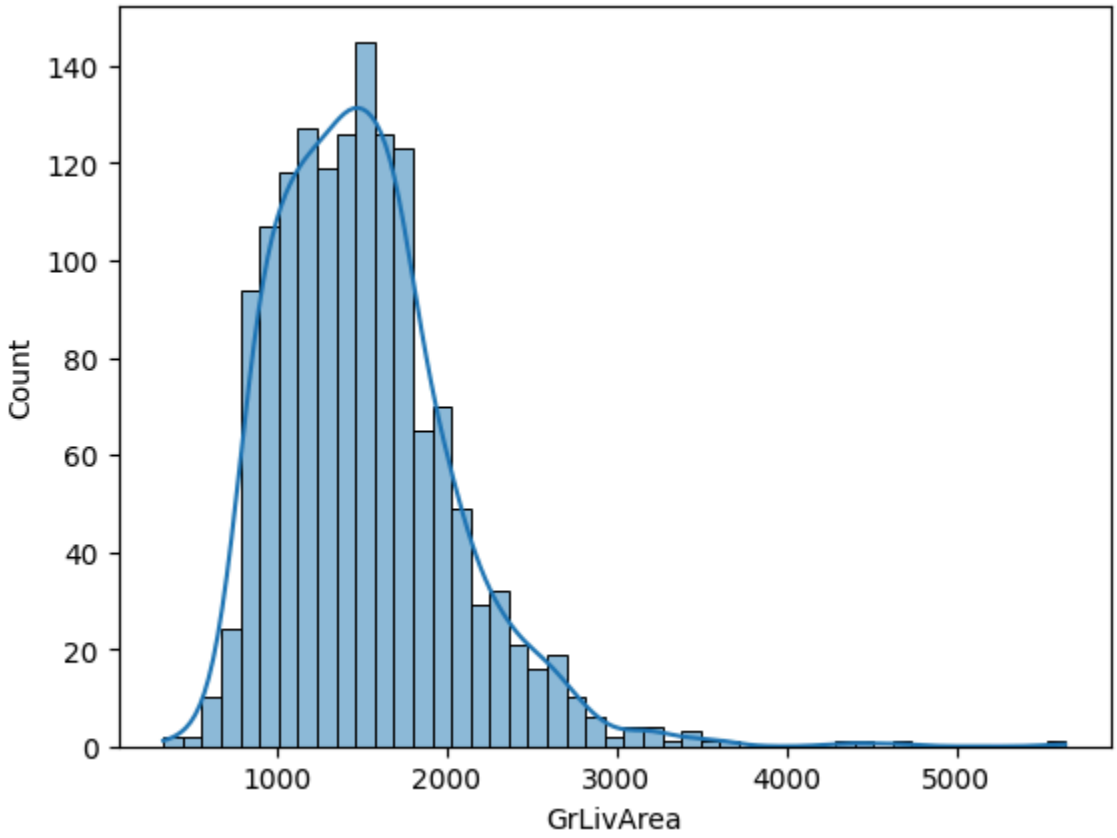
2ndFlrSF



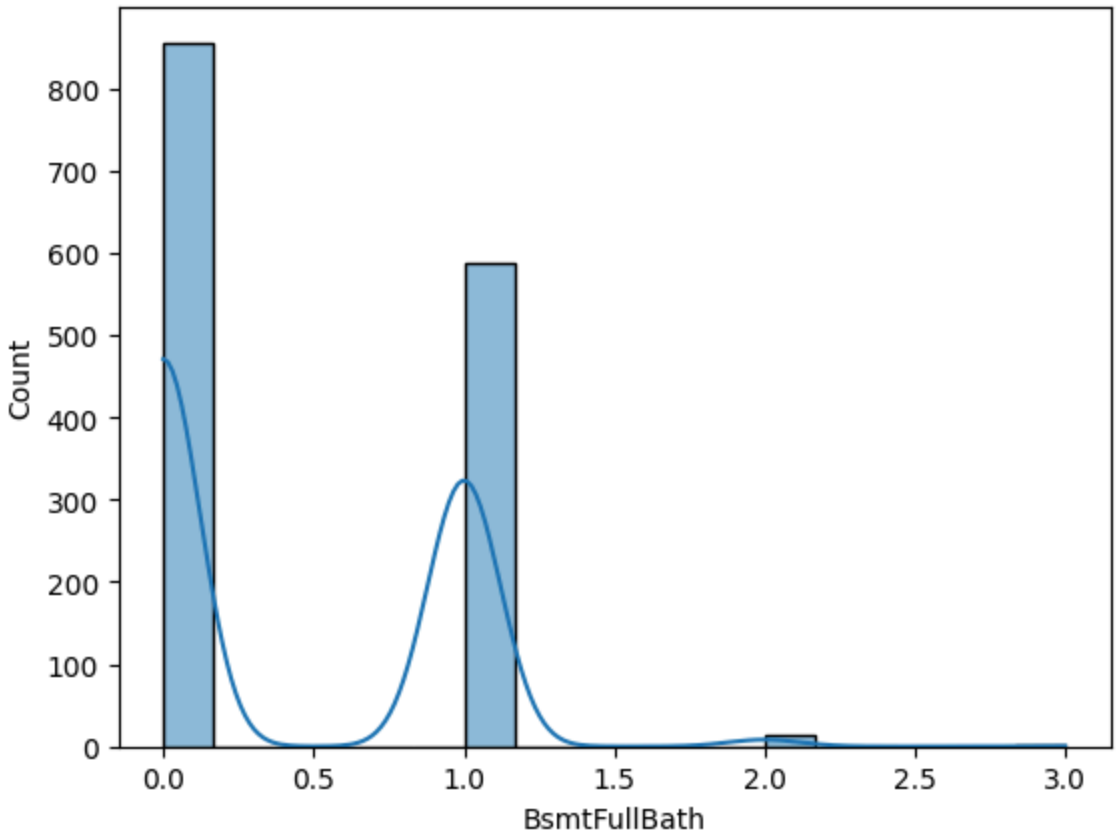
LowQualFinSF



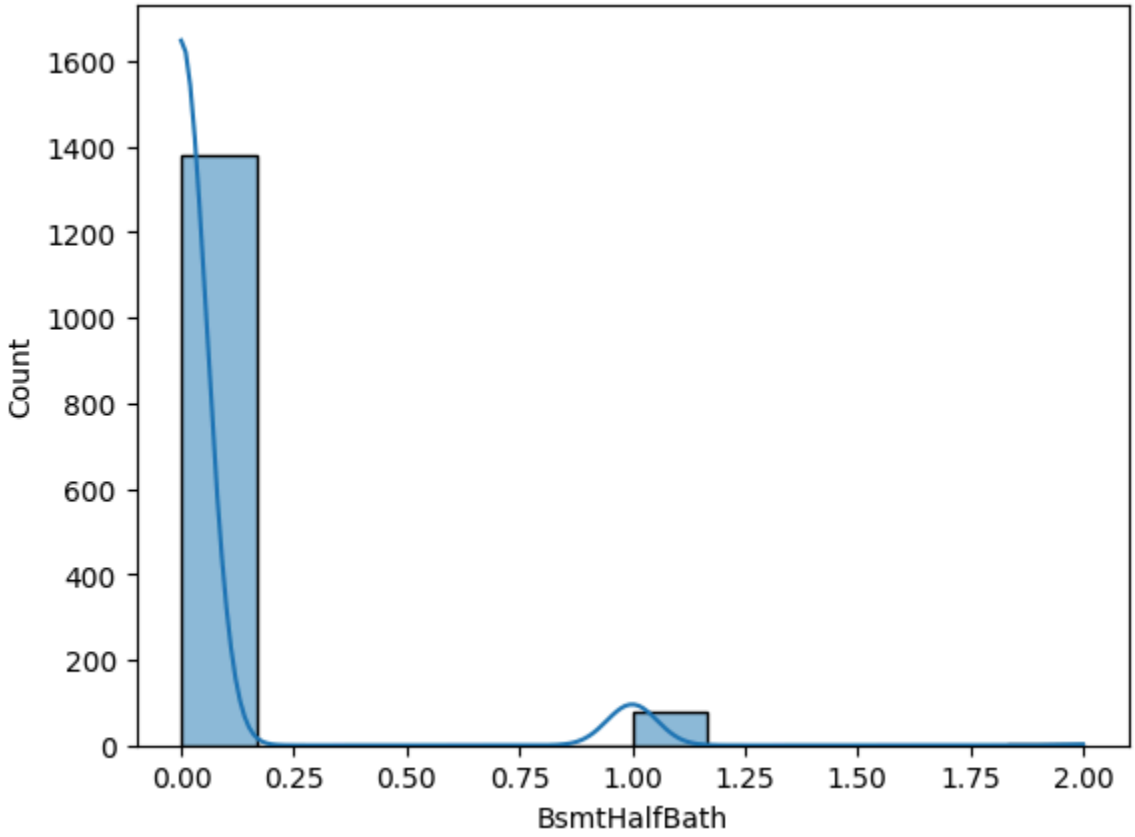
GrLivArea



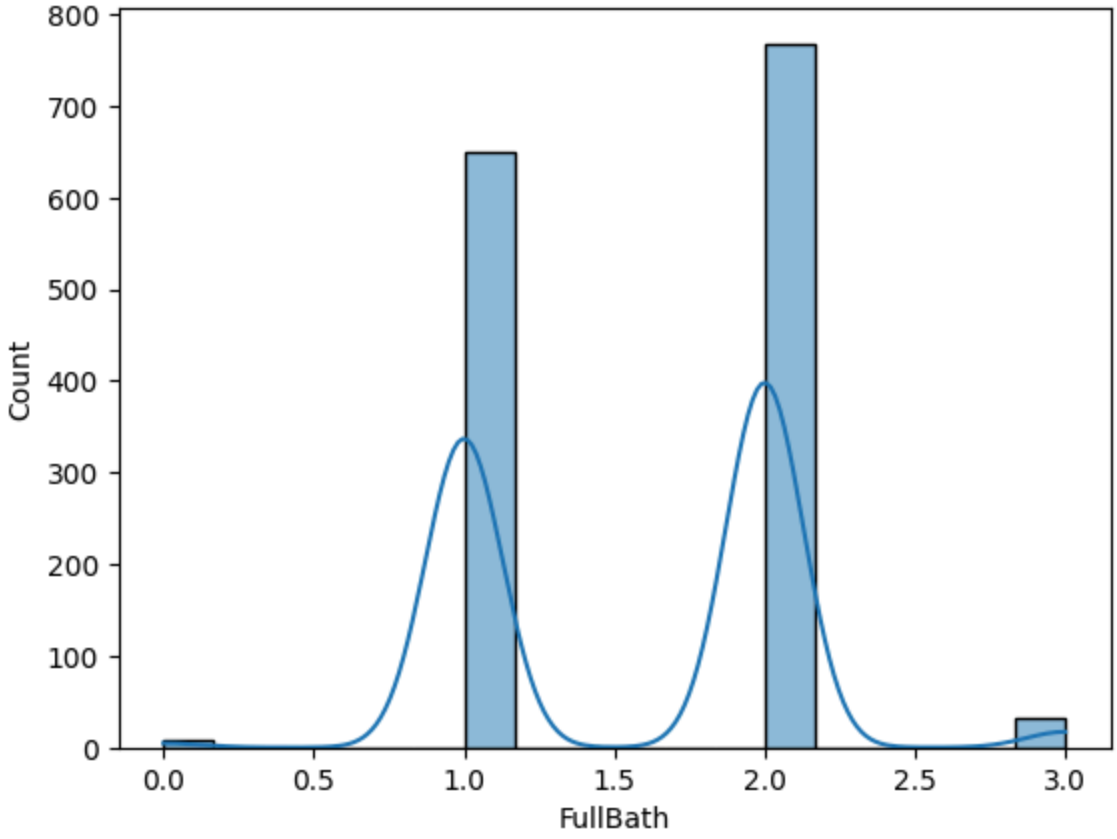
BsmtFullBath



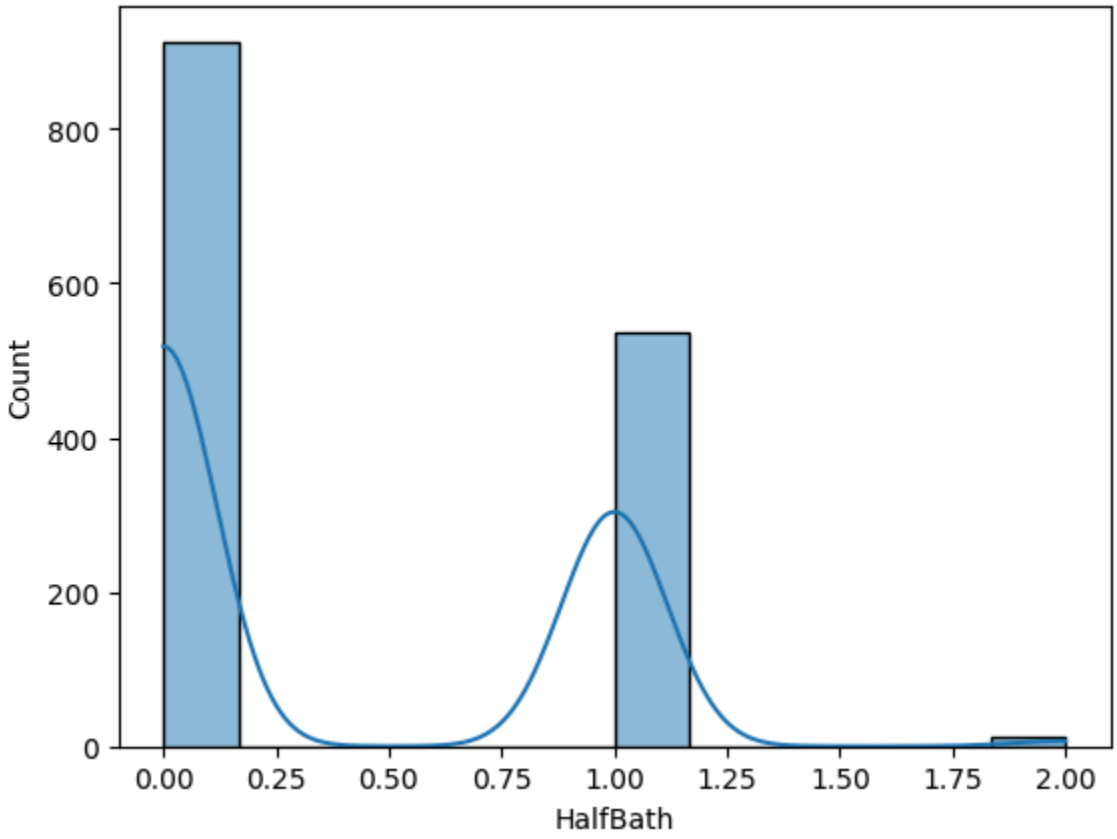
BsmtHalfBath



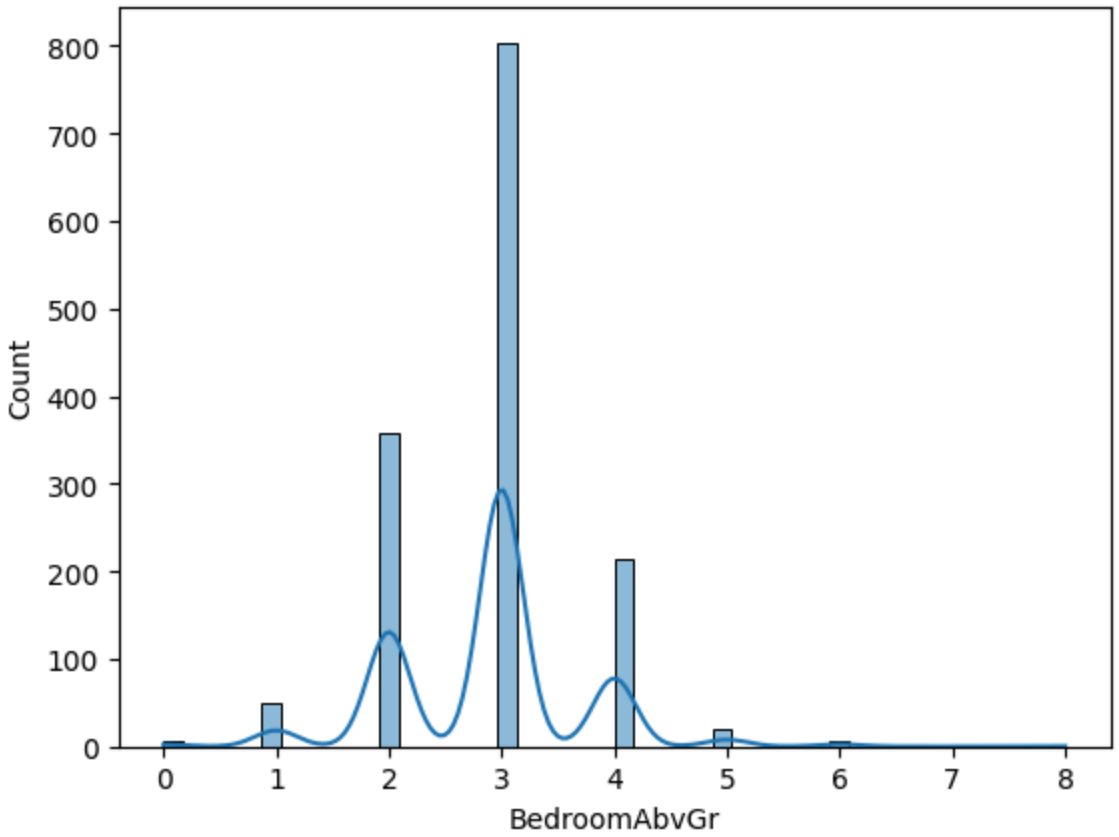
FullBath



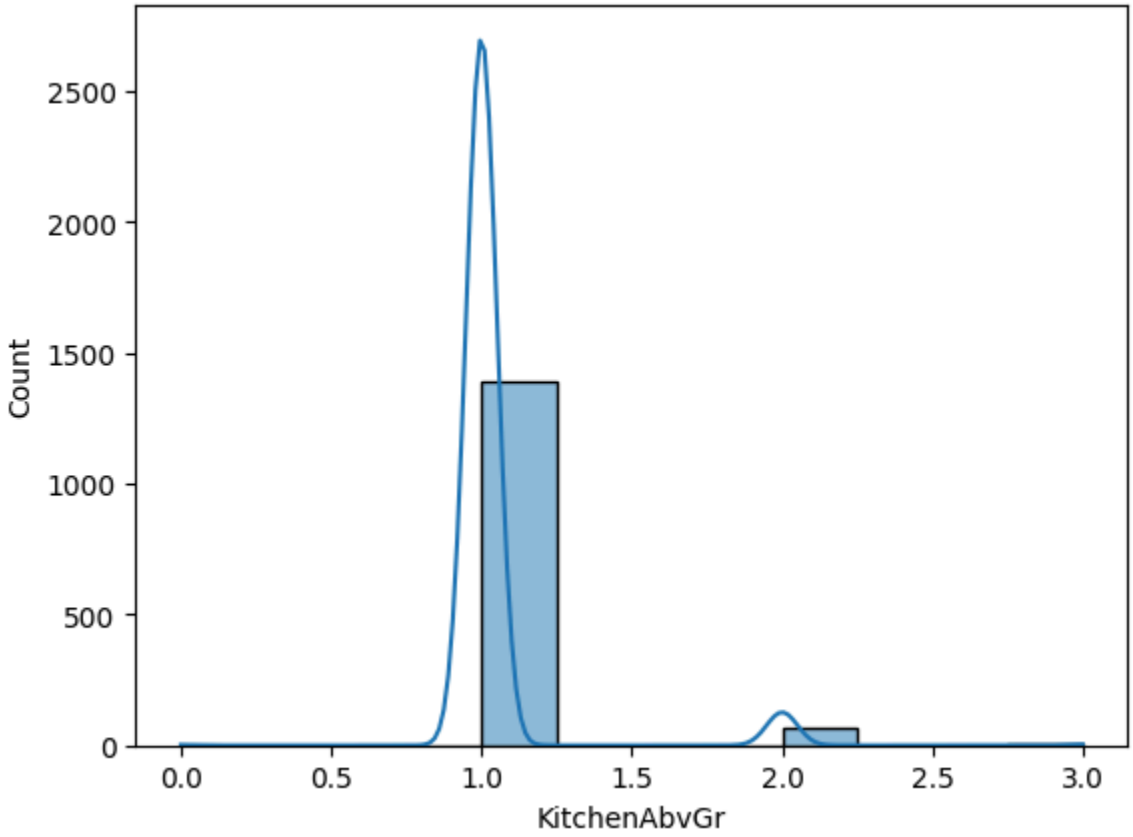
HalfBath



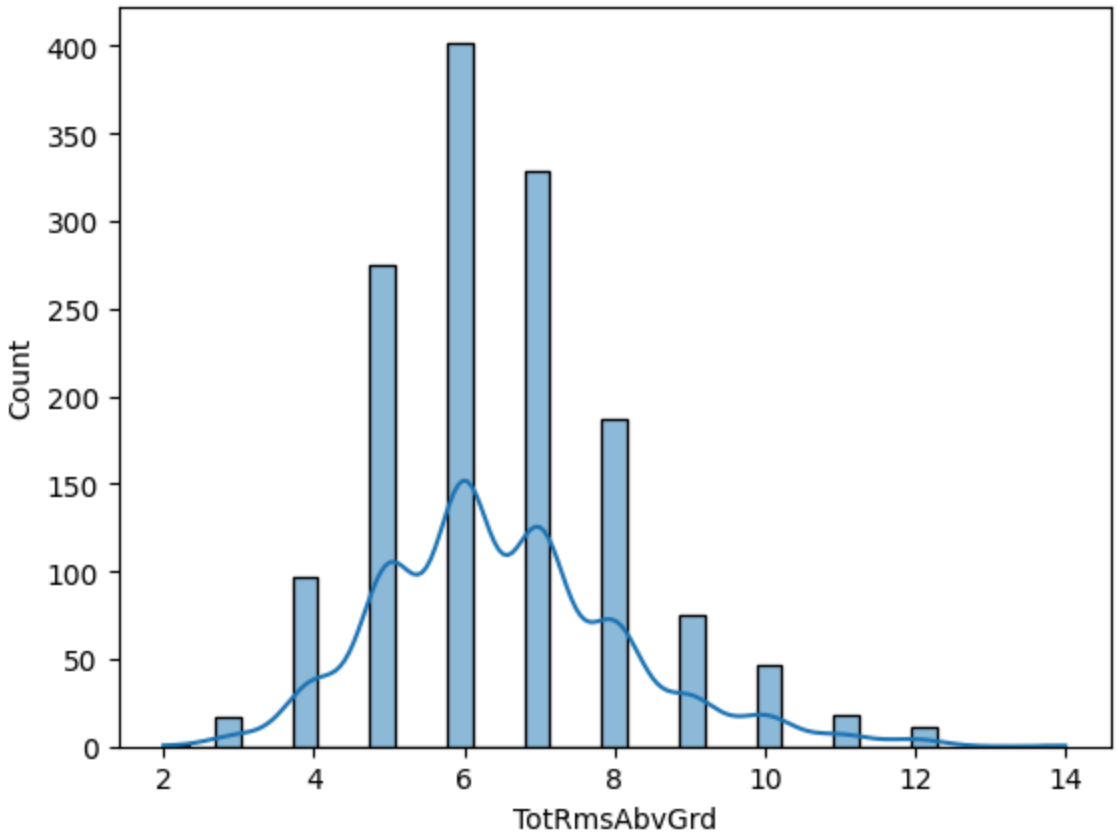
BedroomAbvGr



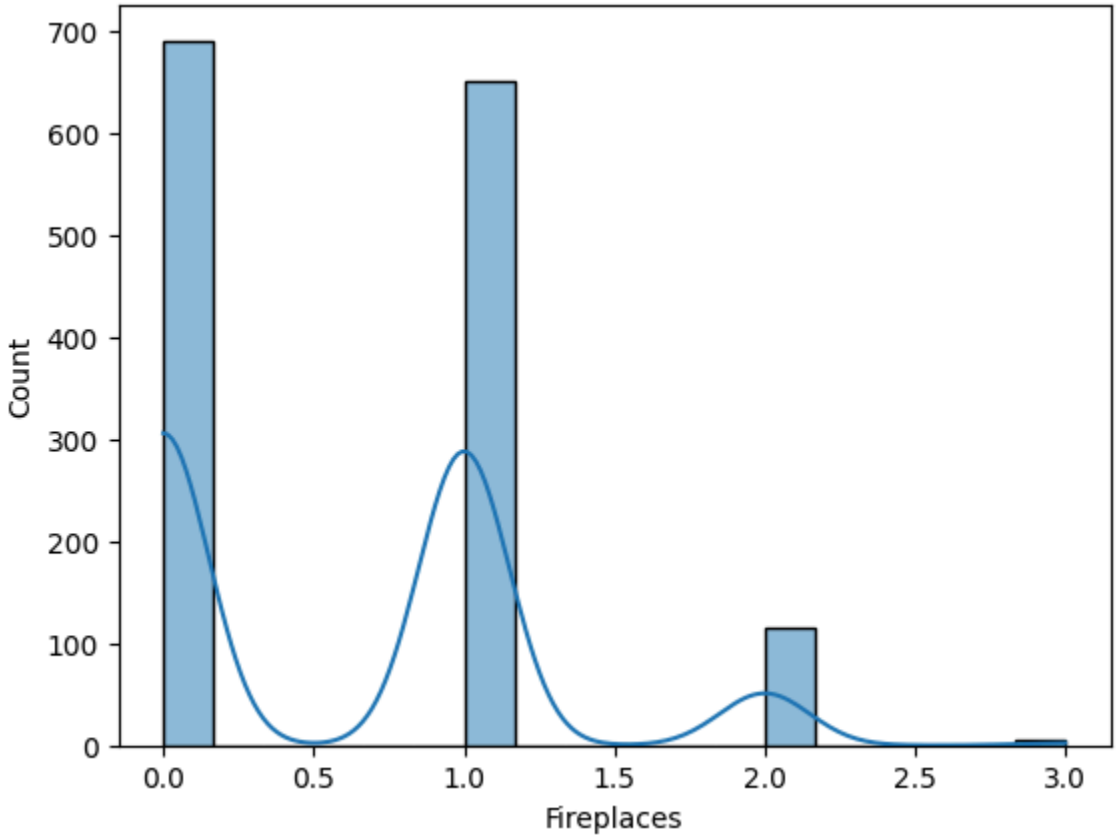
KitchenAbvGr



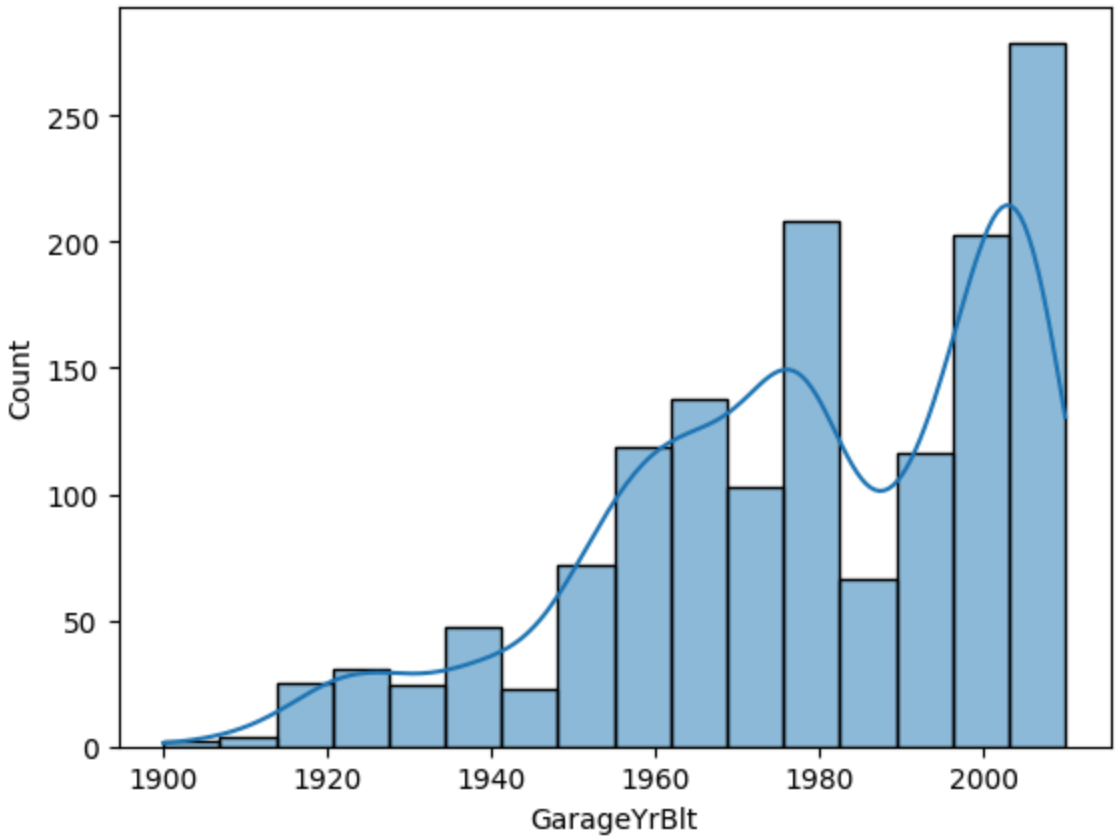
TotRmsAbvGrd



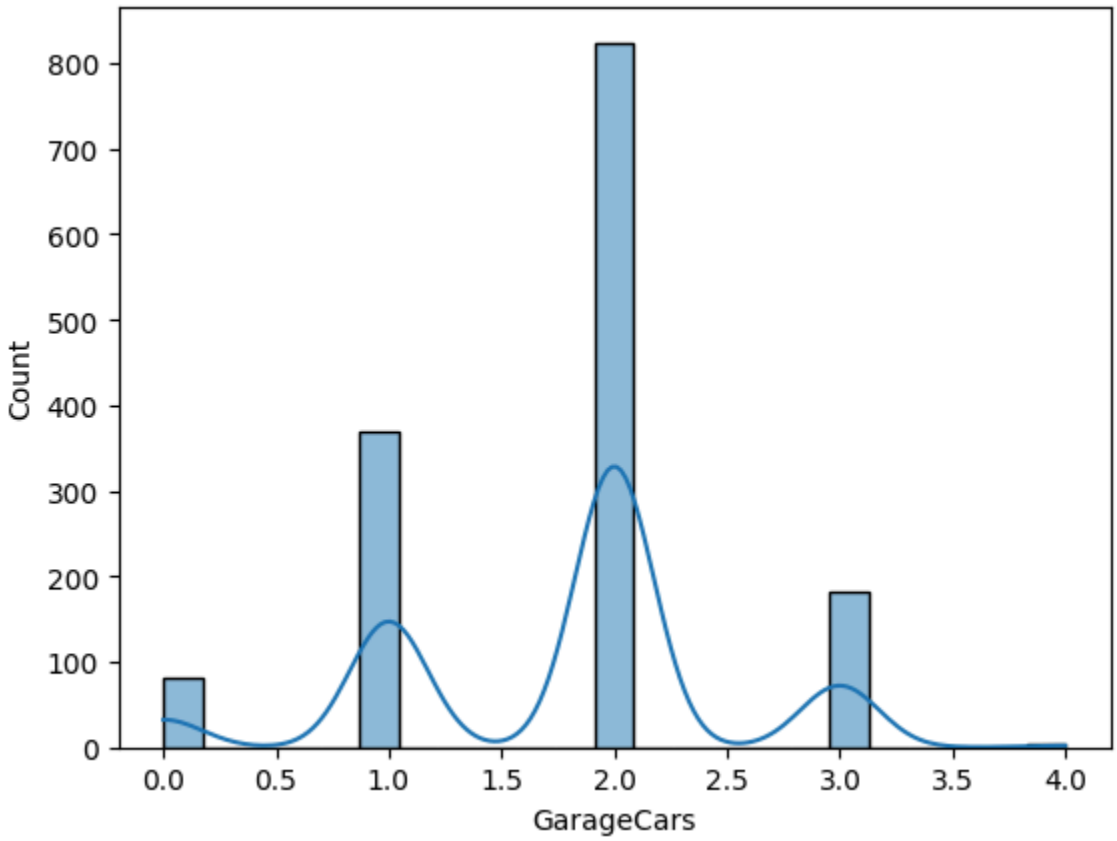
Fireplaces



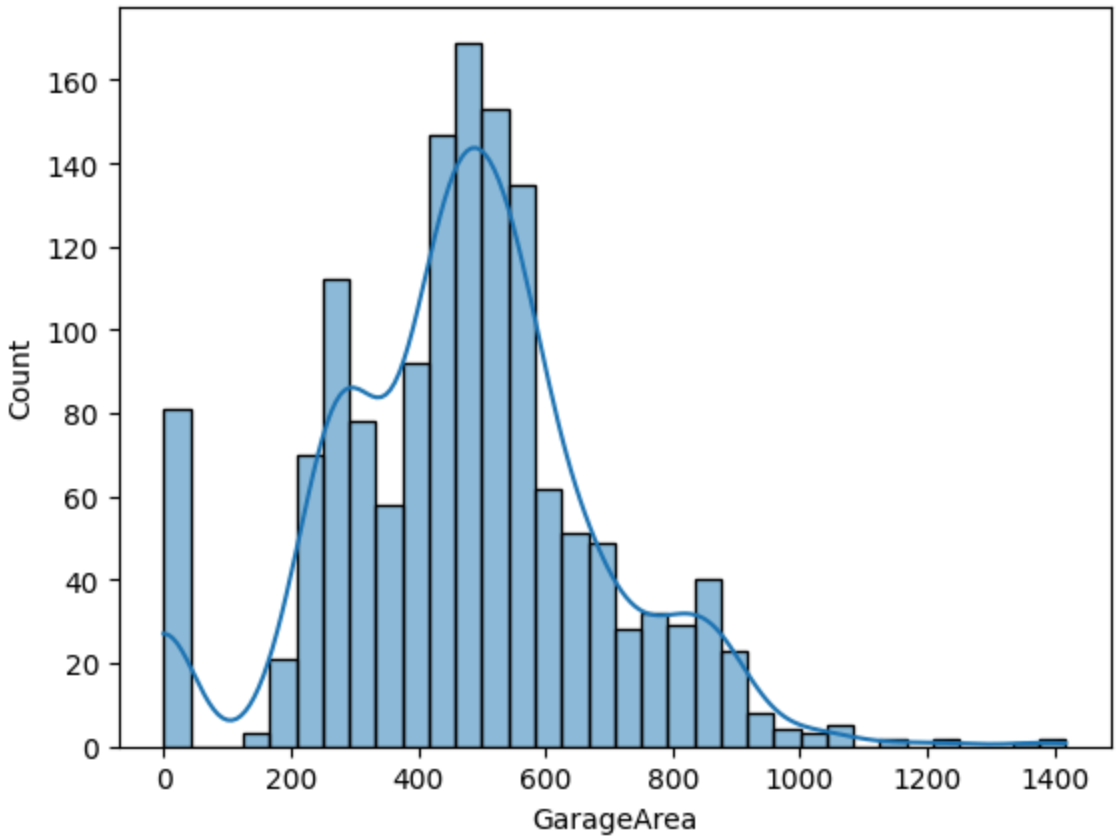
GarageYrBlt



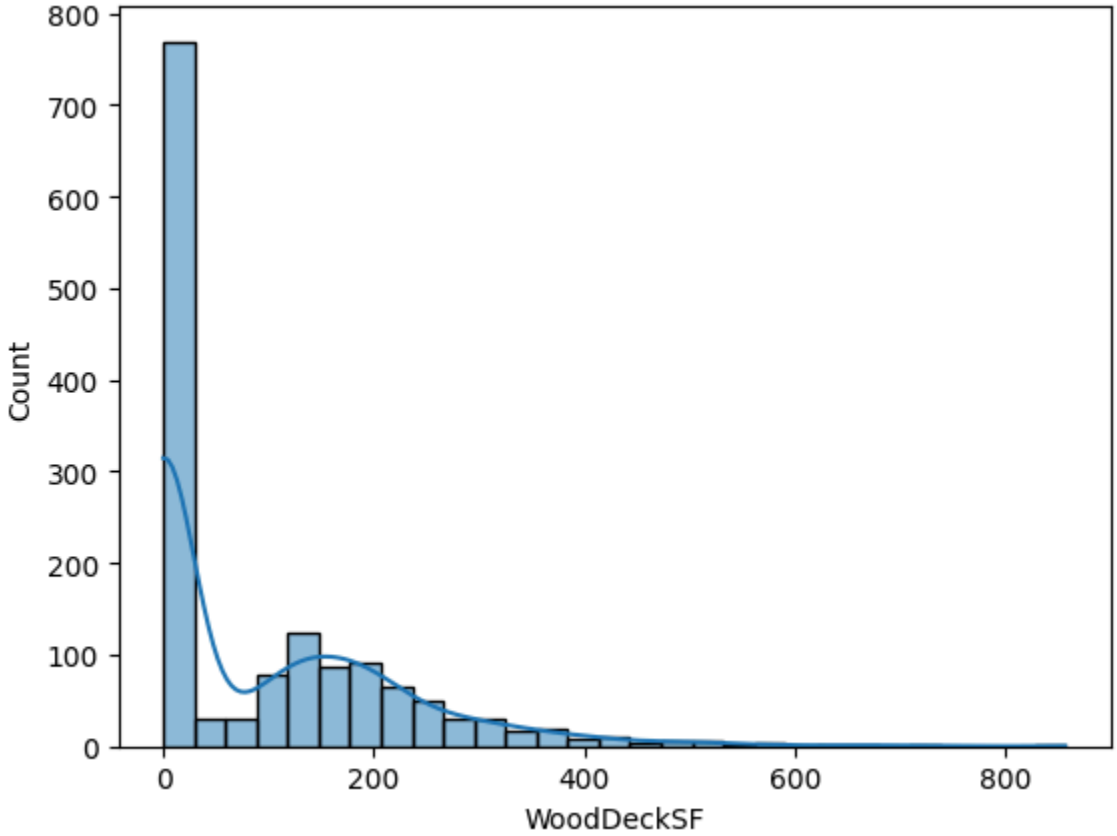
GarageCars



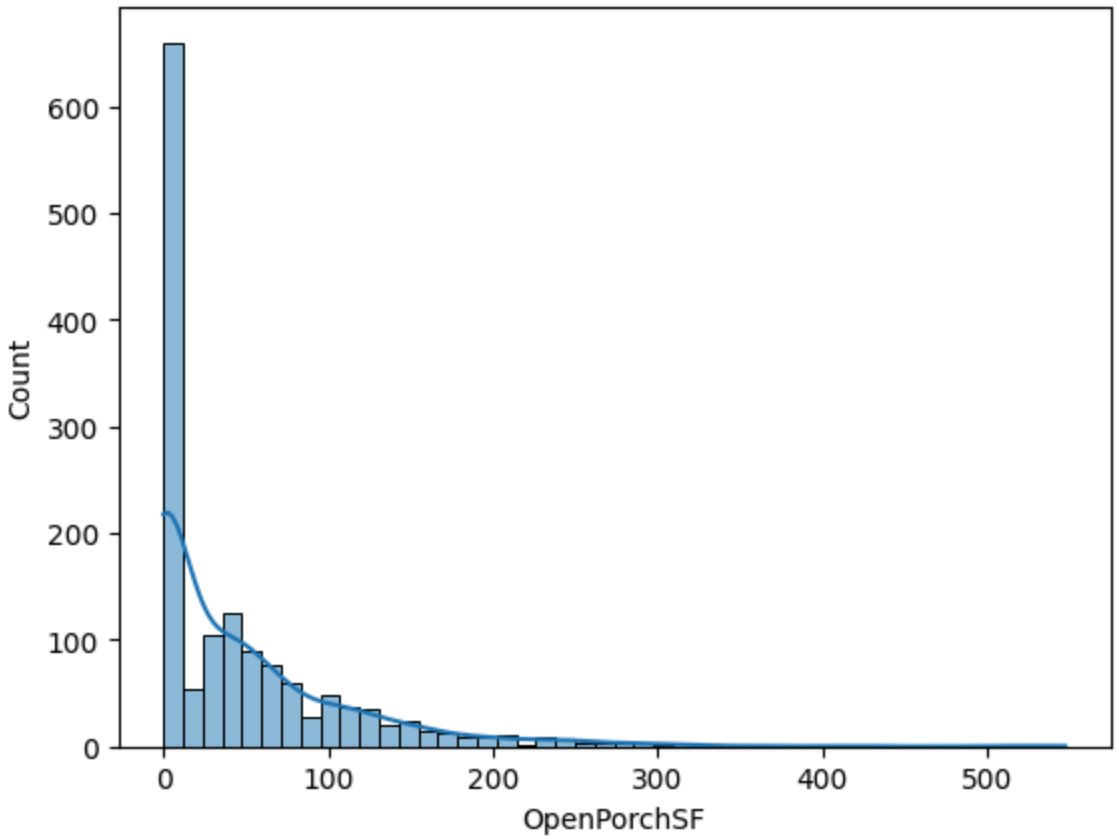
GarageArea



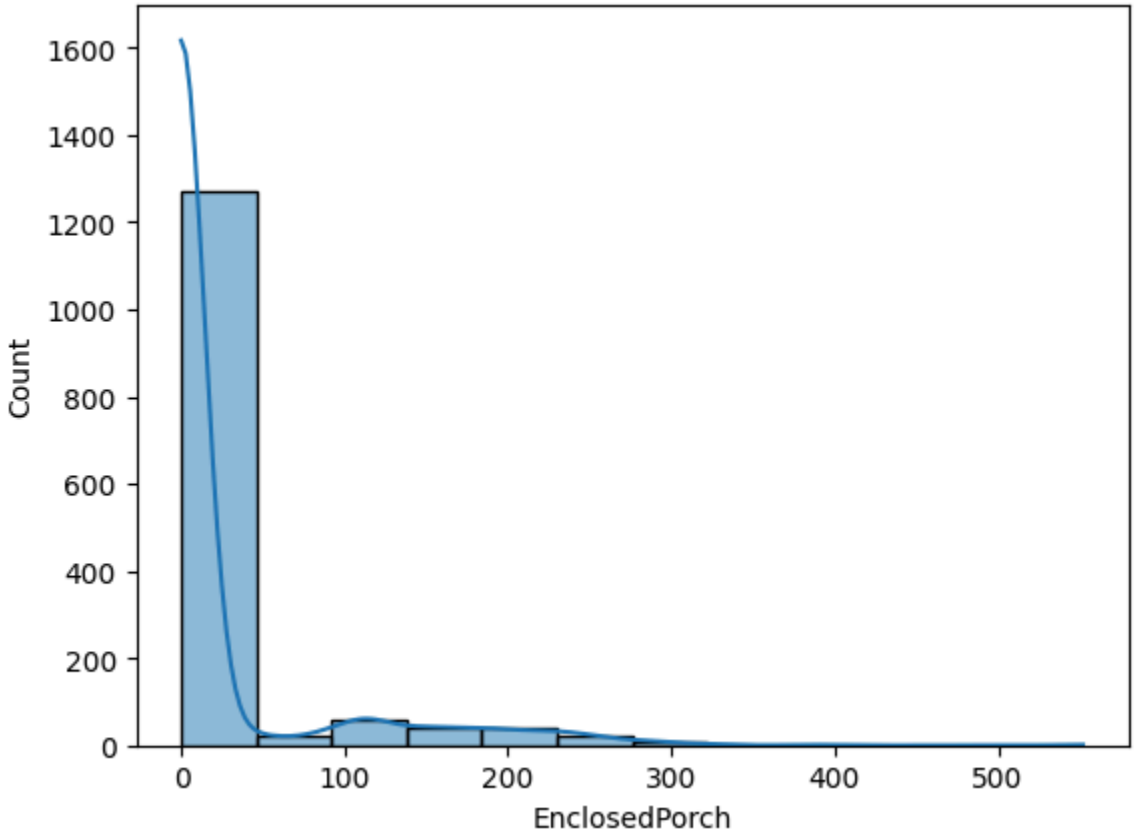
WoodDeckSF



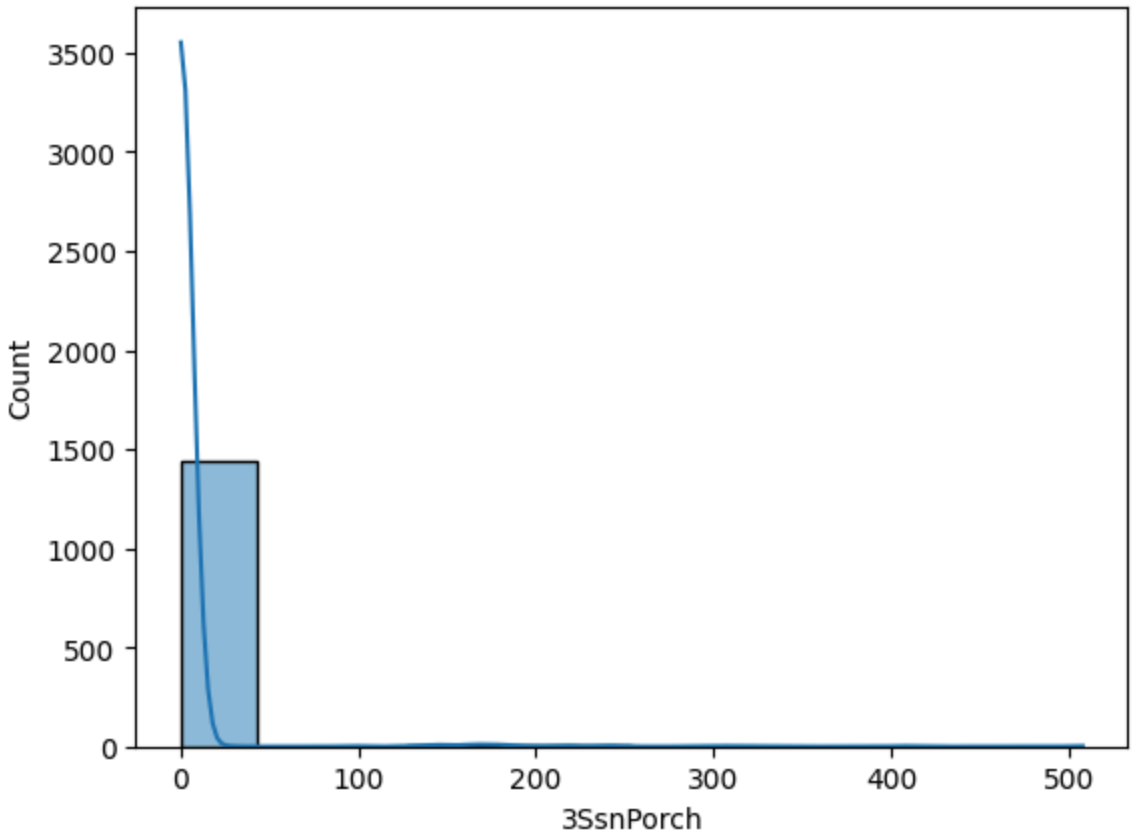
OpenPorchSF



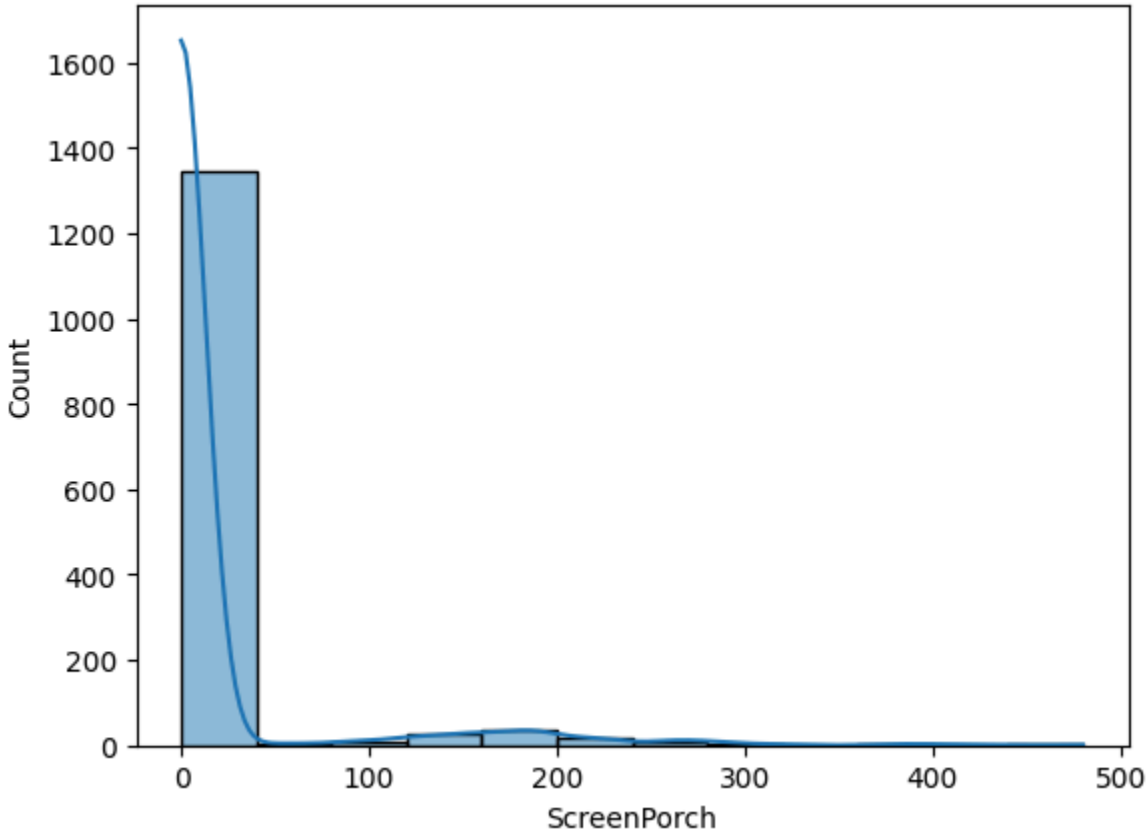
EnclosedPorch



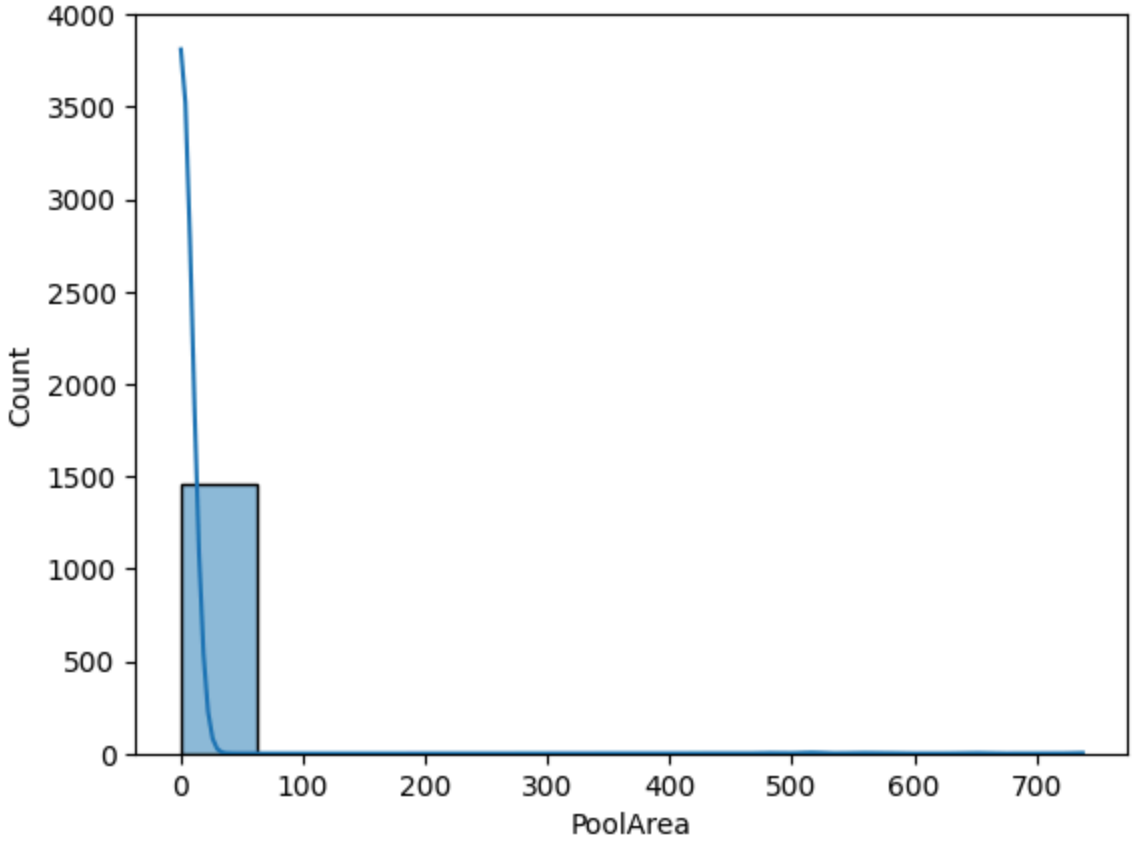
3SsnPorch



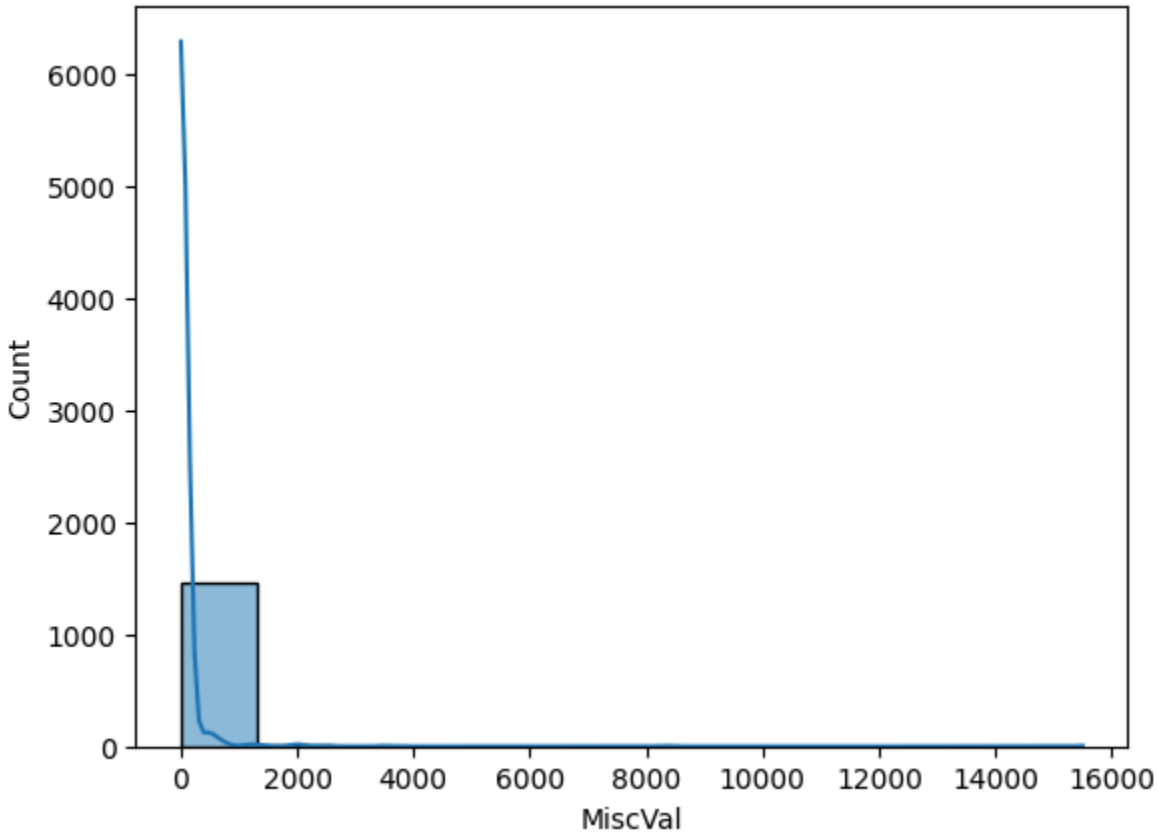
ScreenPorch



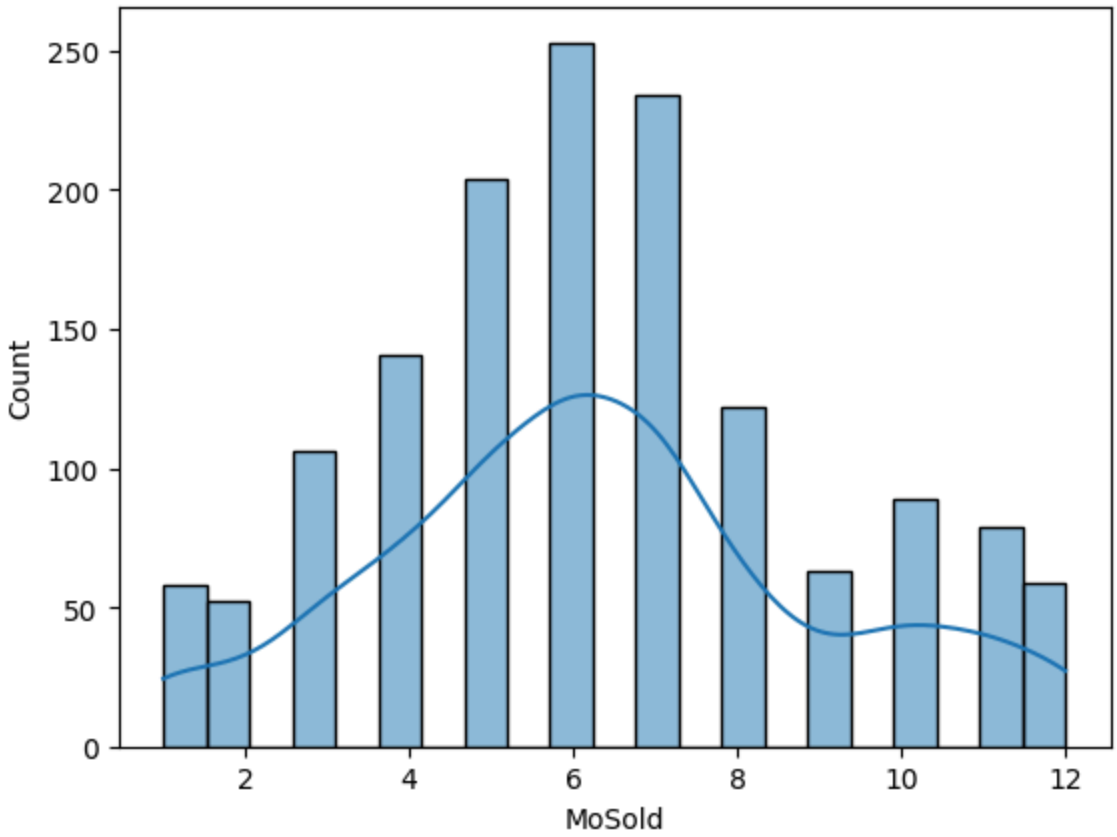
PoolArea



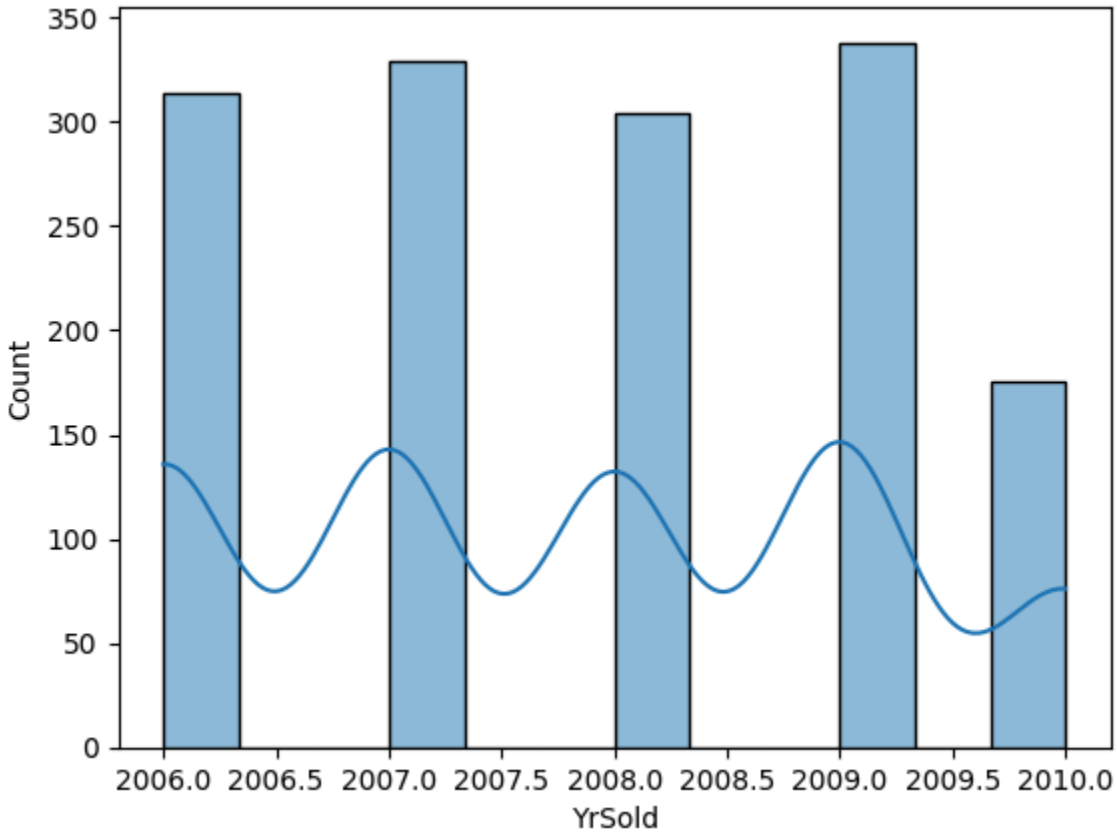
MiscVal



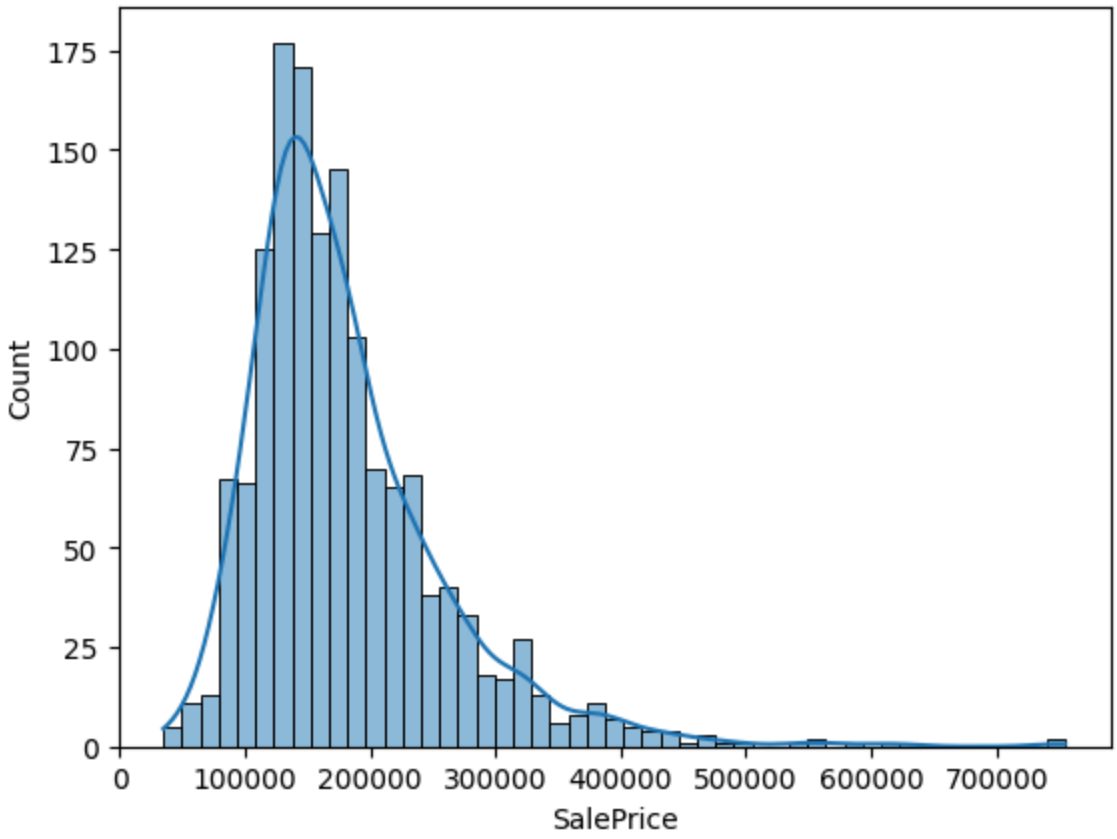
MoSold



YrSold



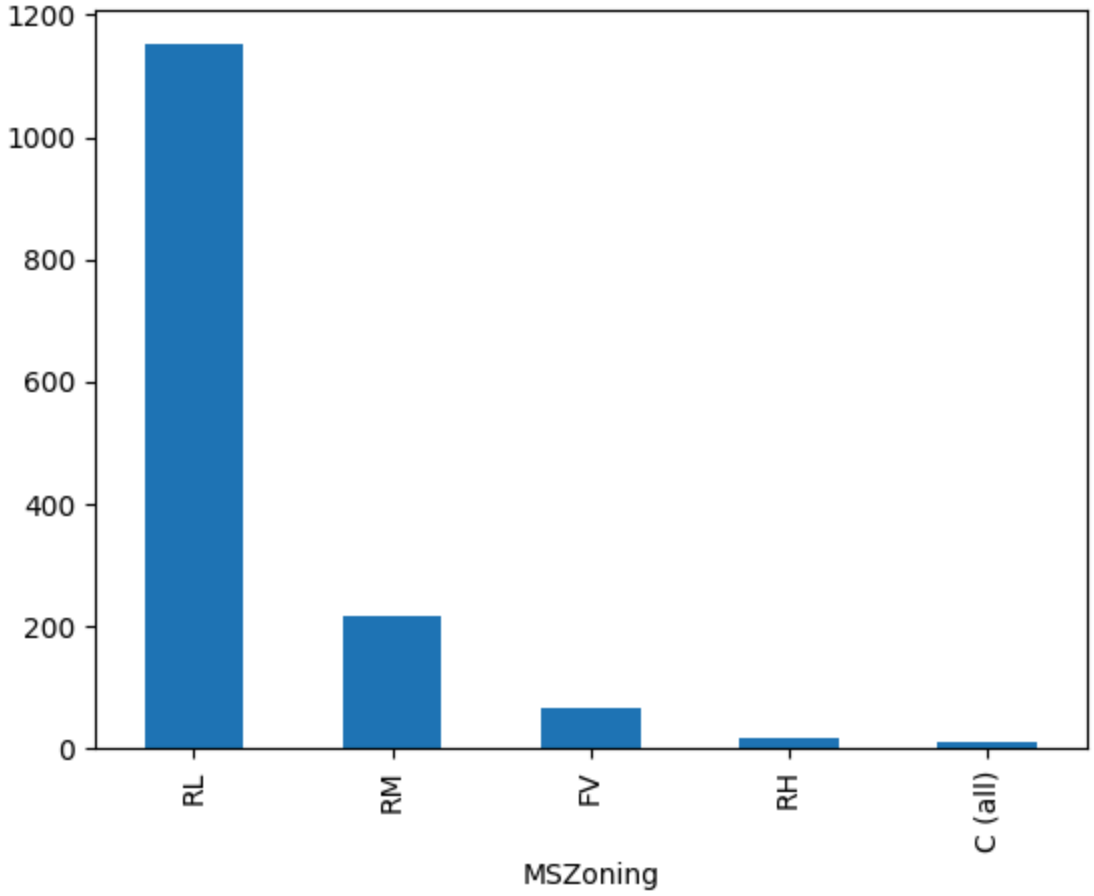
SalePrice



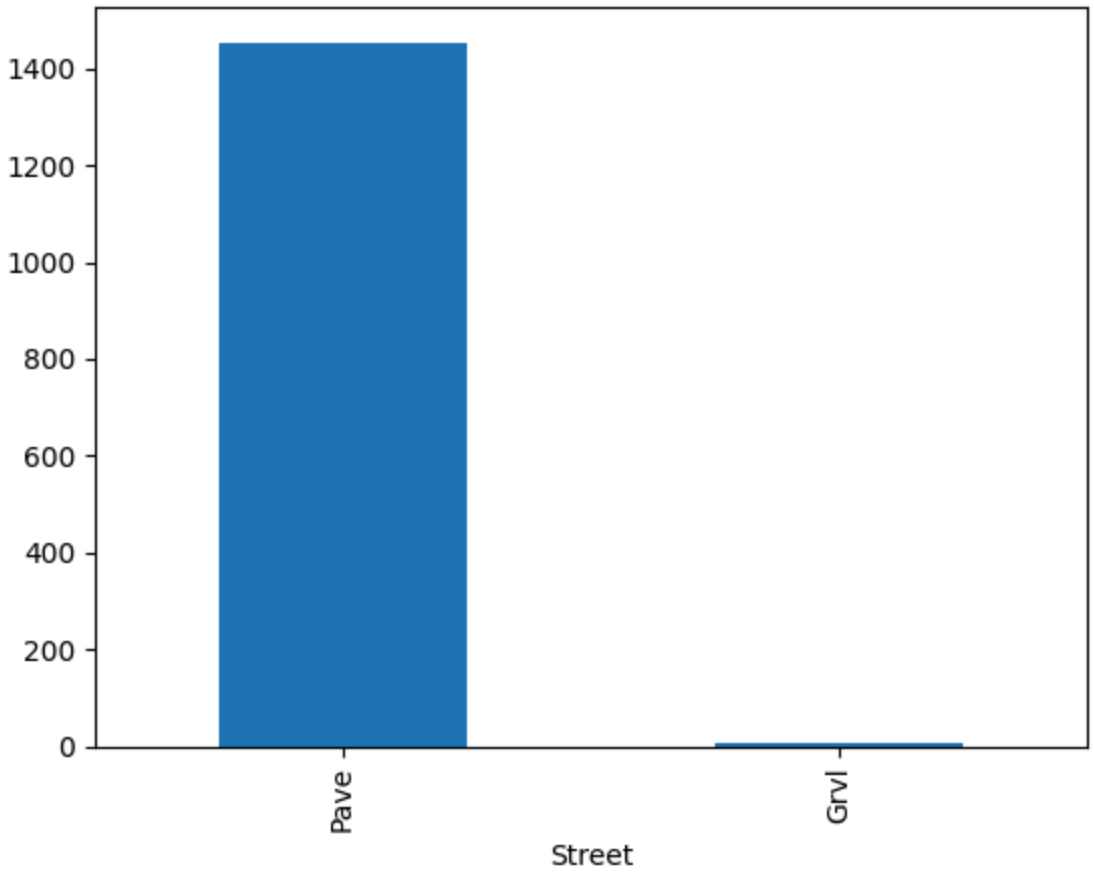
In [318…

```
for i in df[cat]:
  df[i].value_counts().plot(kind='bar')
  print(i)
  show()
```

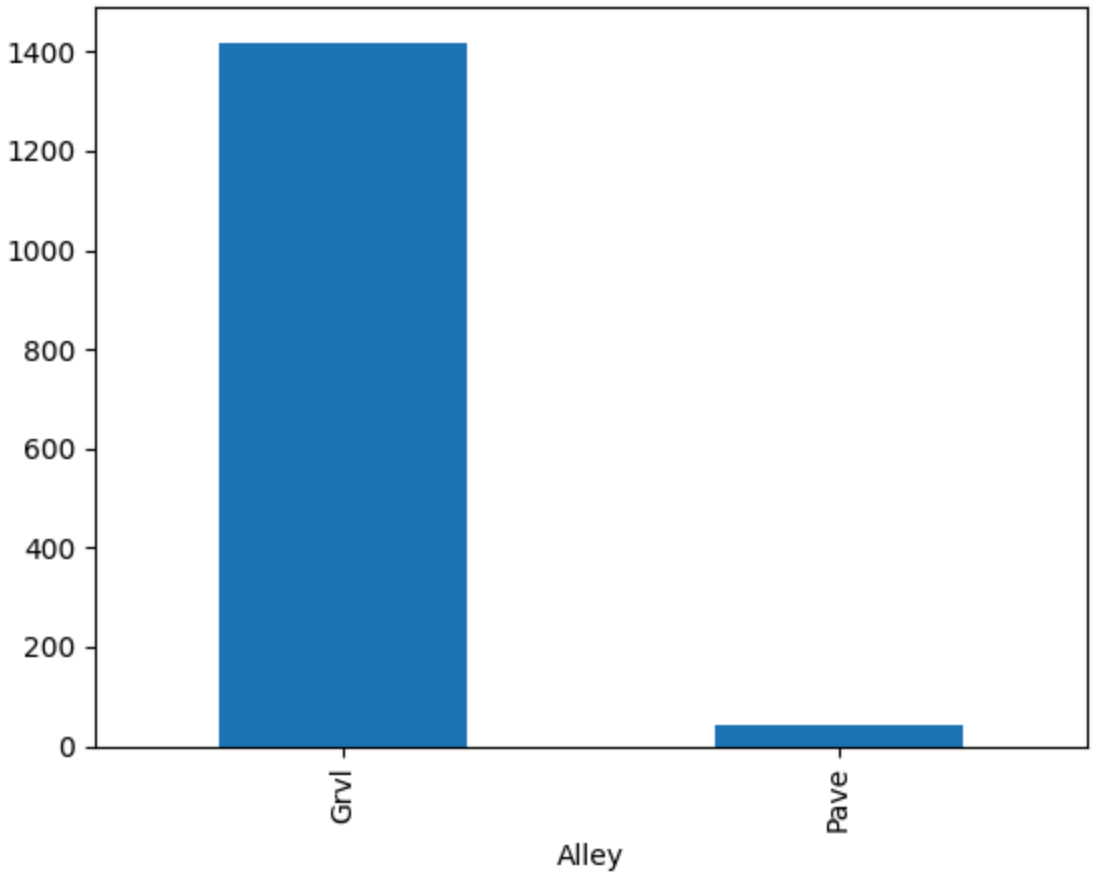
```
MSZoning
```



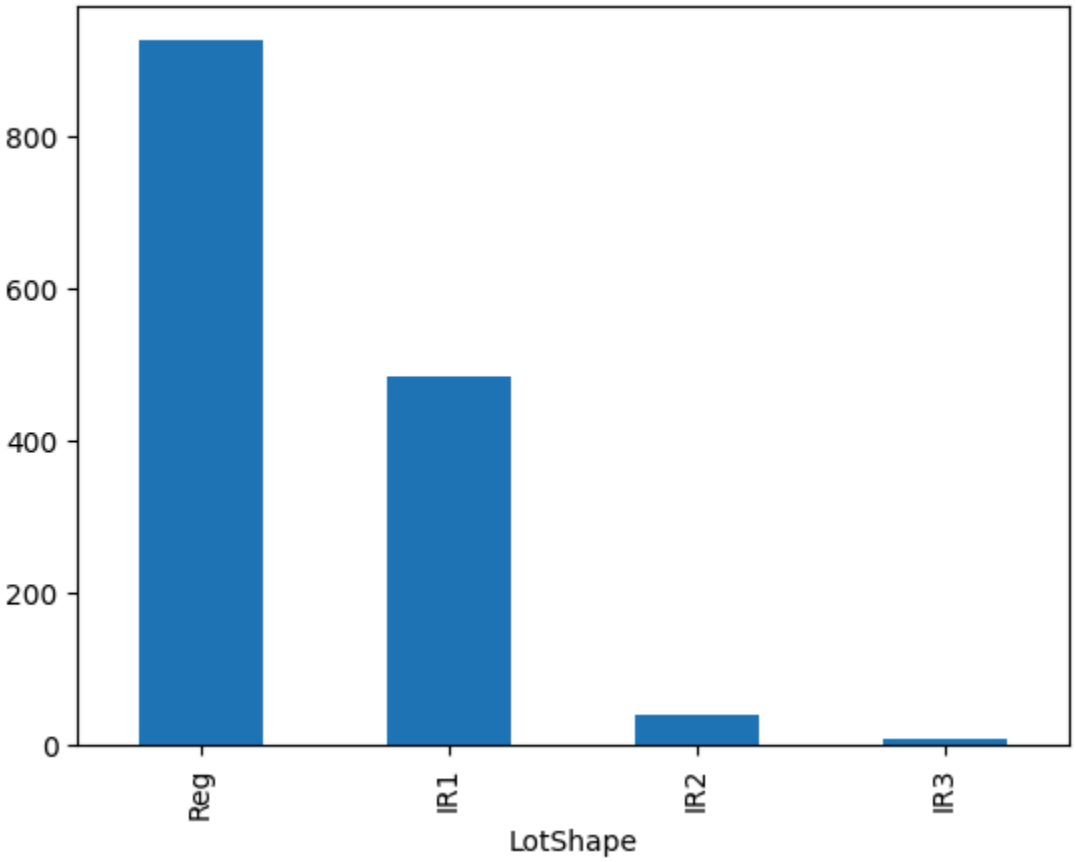
Street



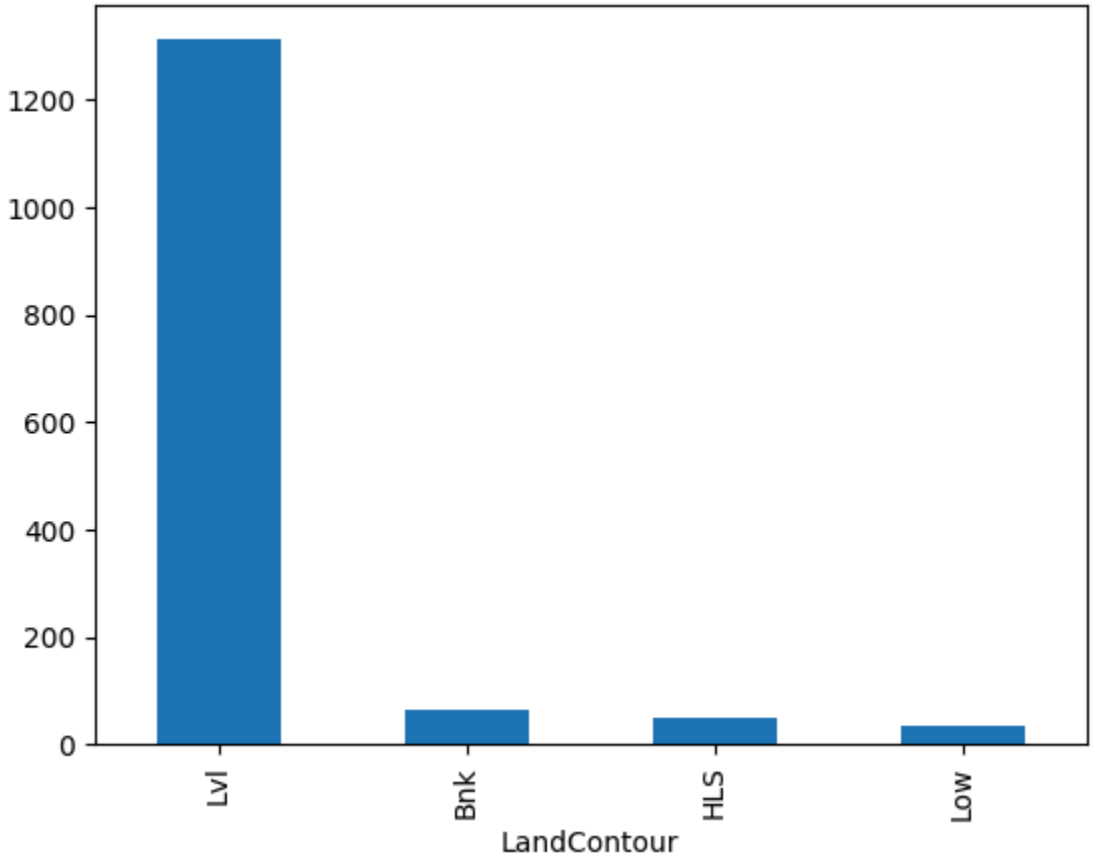

```
Alley
```


1400
1200
1000
800
600
400
200
0
Grvl
Pave
Alley

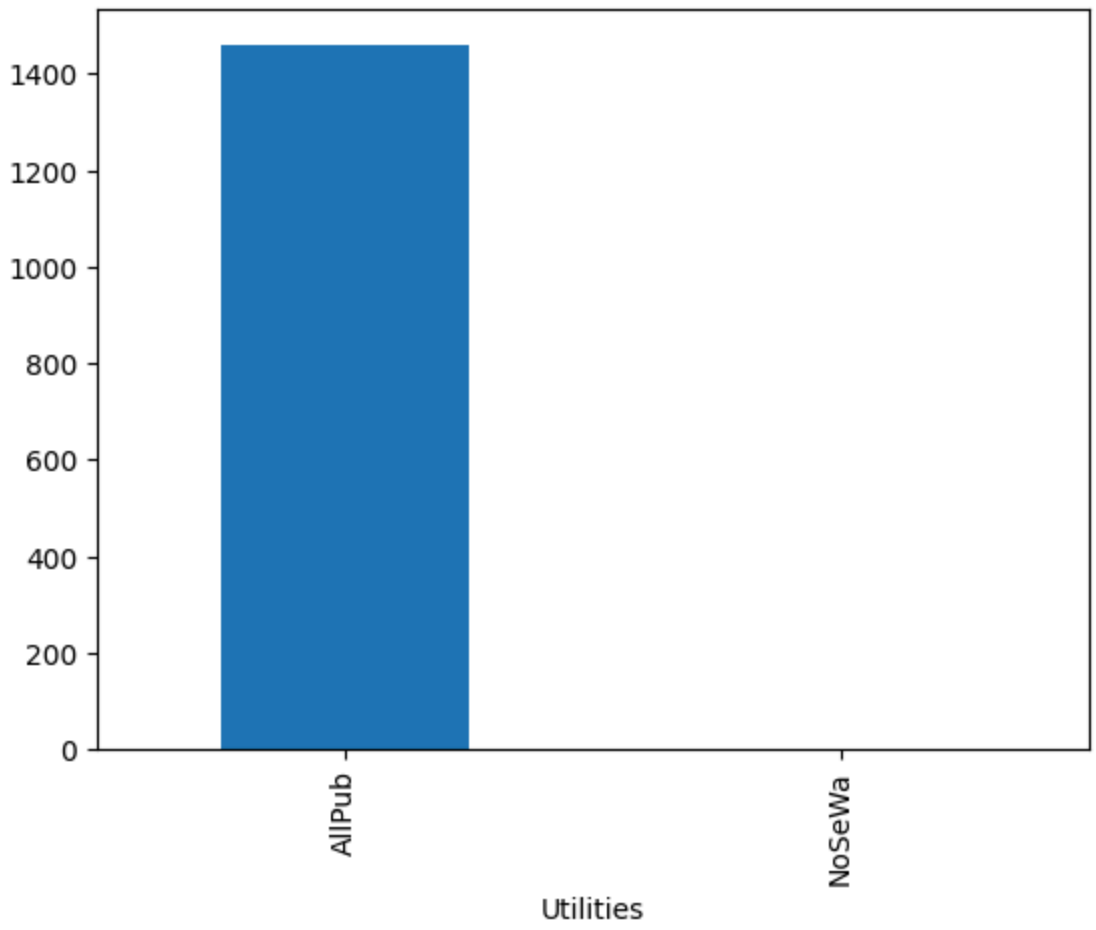
LotShape


800
600
400
200
0
Reg
IR1
IR2
IR3
LotShape

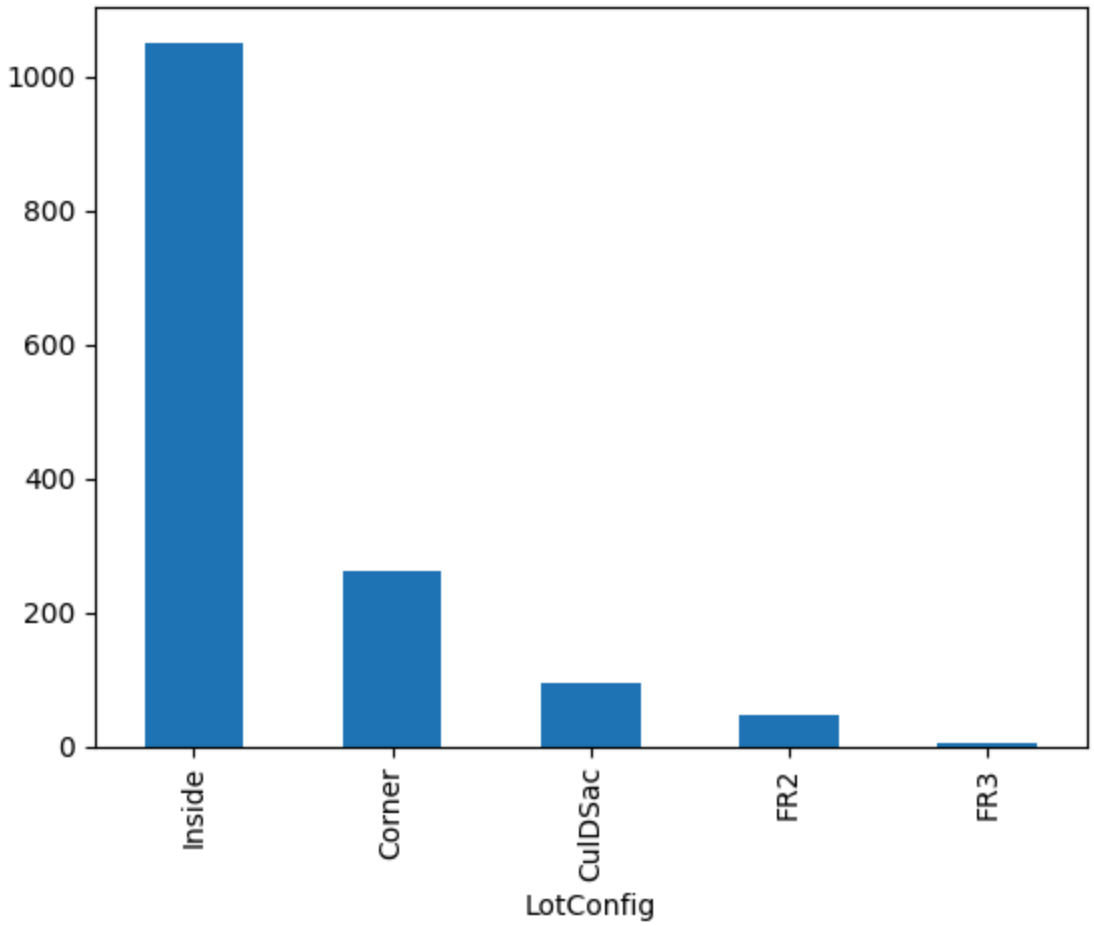
LandContour



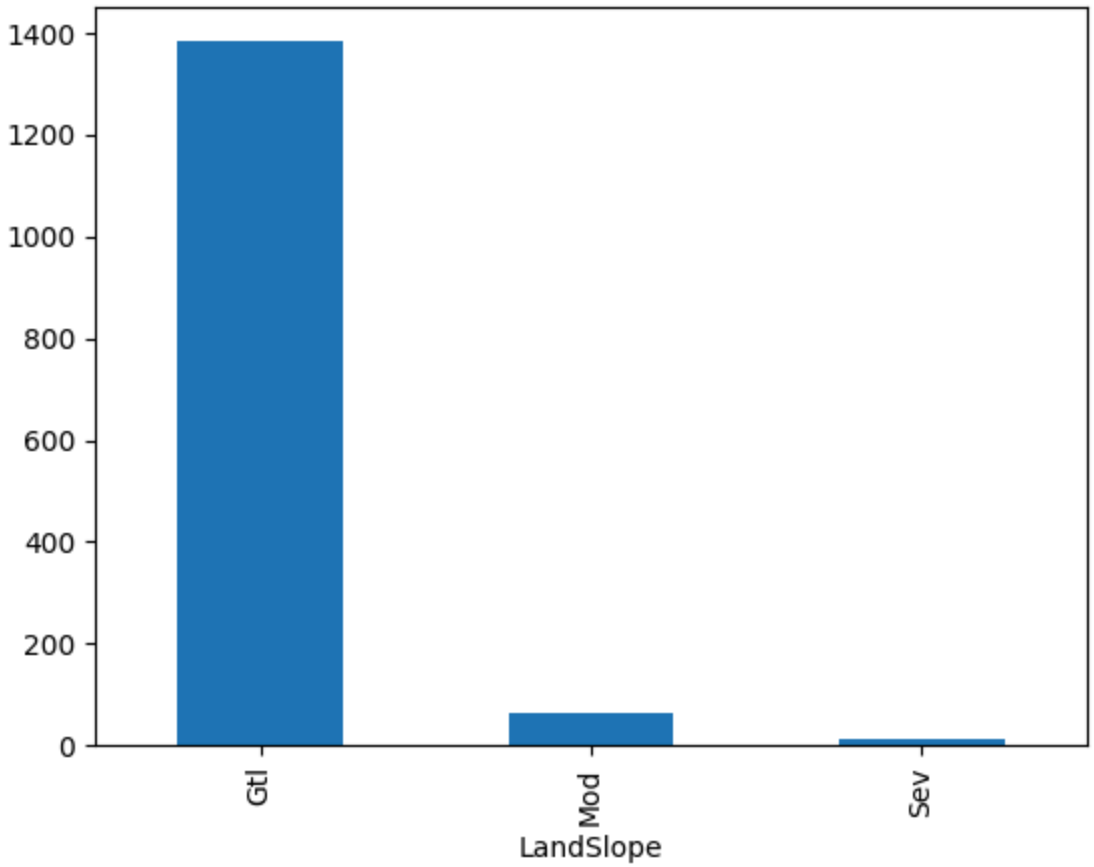
Utilities



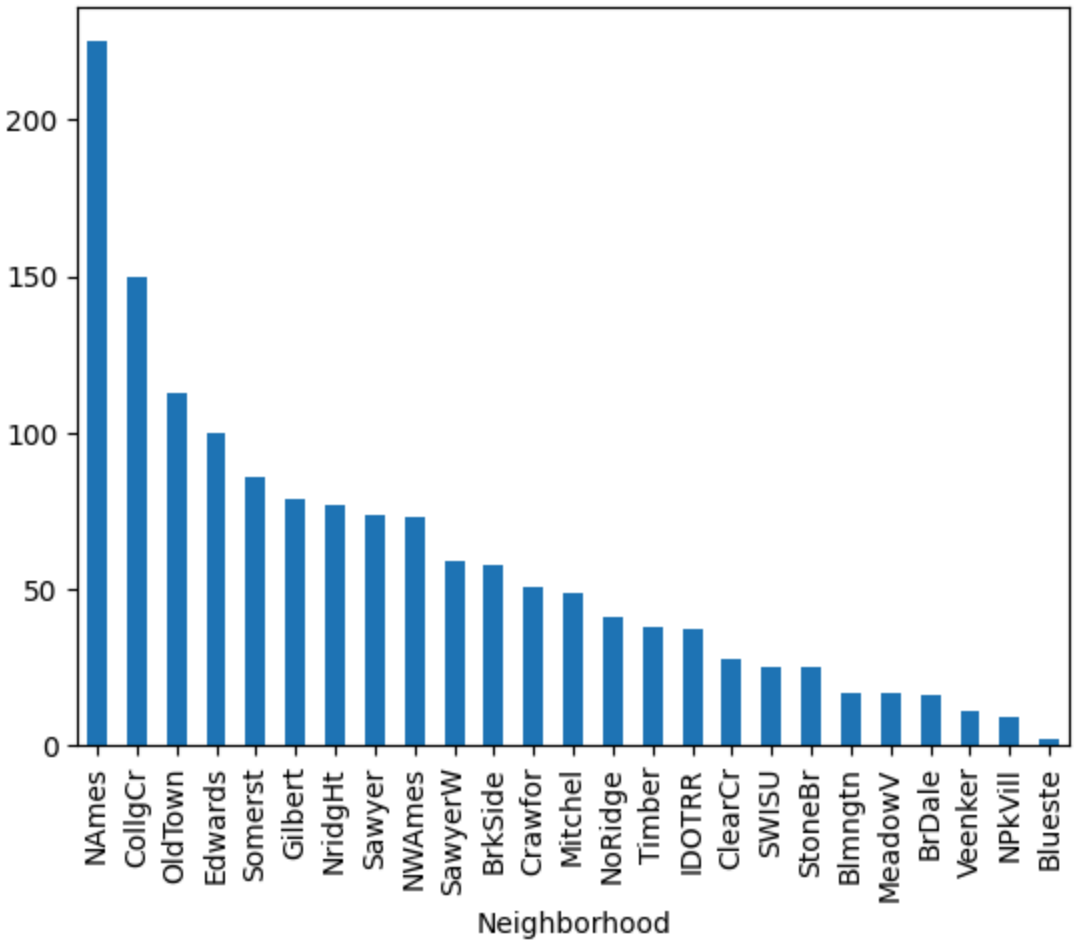
LotConfig


1000
800
600
400
200
0
Inside
Corner
CulDSac
FR2
FR3
LotConfig

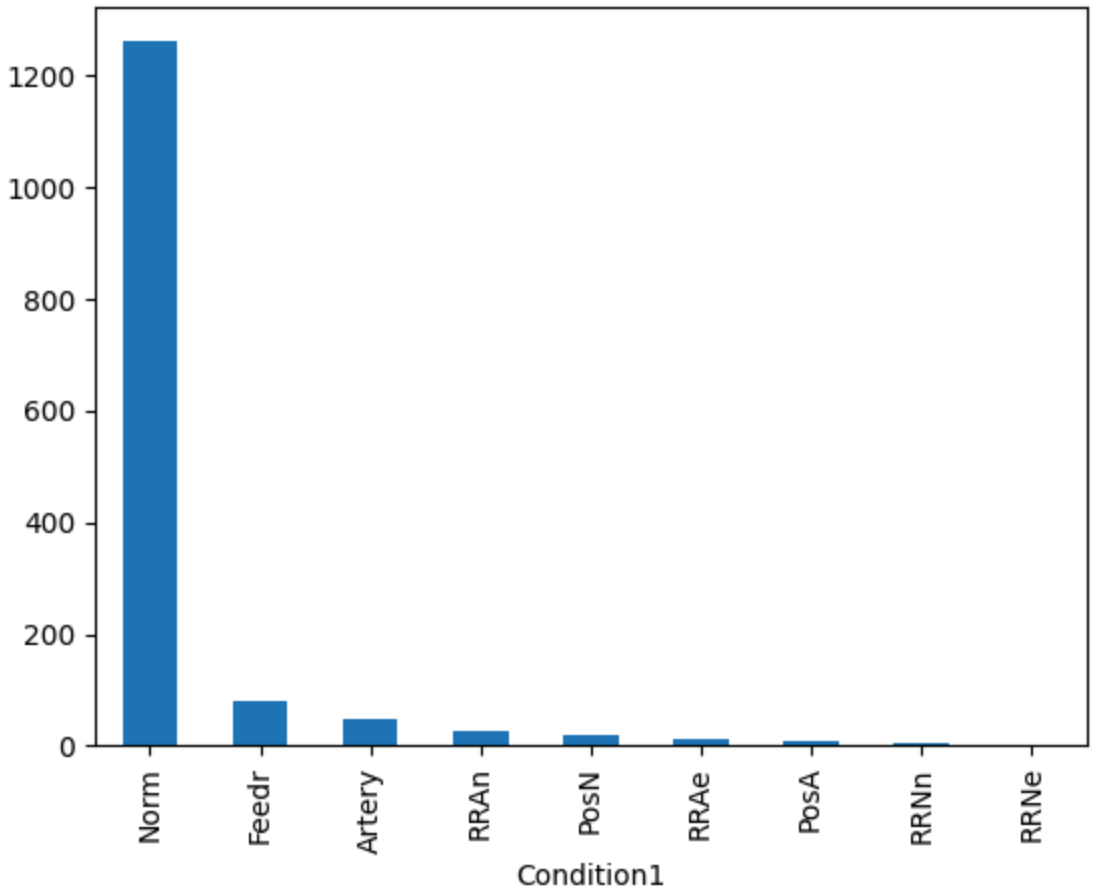
LandSlope



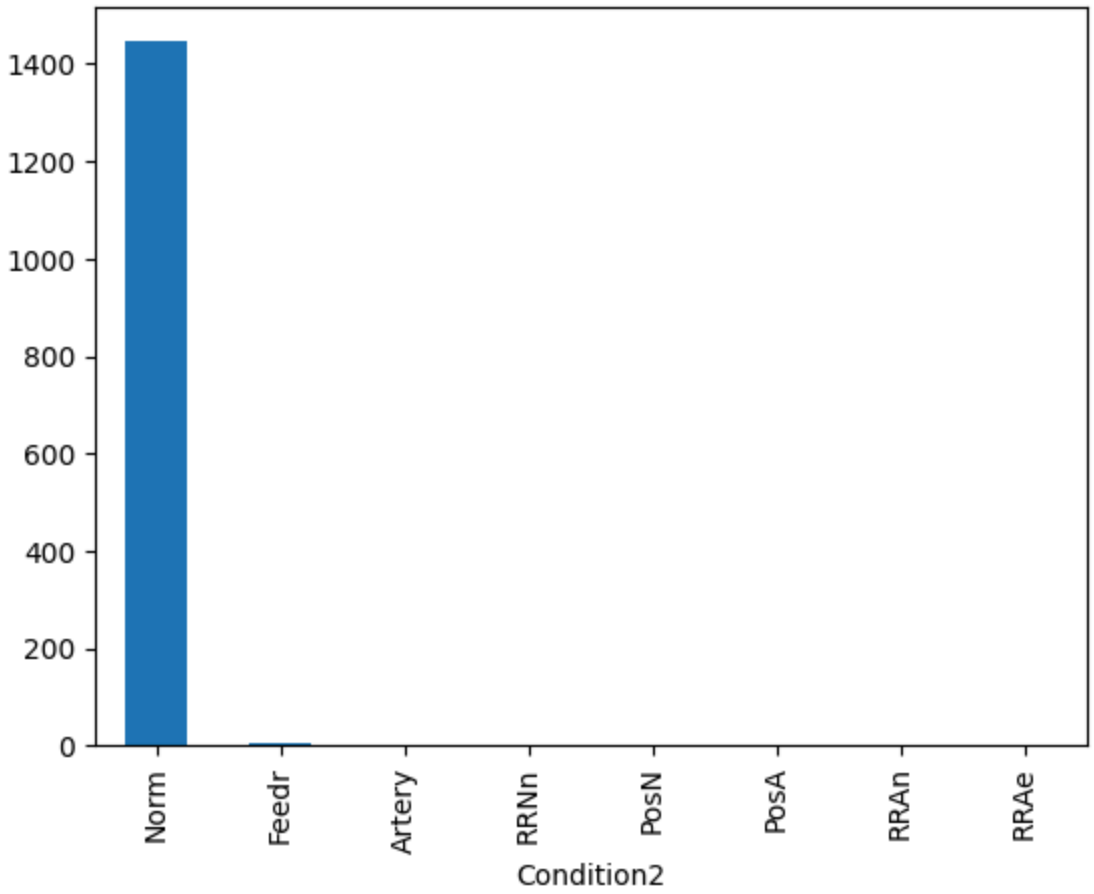

```
Neighborhood
```


200
150
100
50
0
NAmes
CollgCr
OldTown
Edwards
Somerst
Gilbert
NridgHt
Sawyer
NWAmes
SawyerW
BrkSide
Crawfor
Mitchel
NoRidge
Timber
IDOTRR
ClearCr
SWISU
StoneBr
Blmngtn
MeadowV
BrDale
Veenker
NPkVill
Blueste
Neighborhood

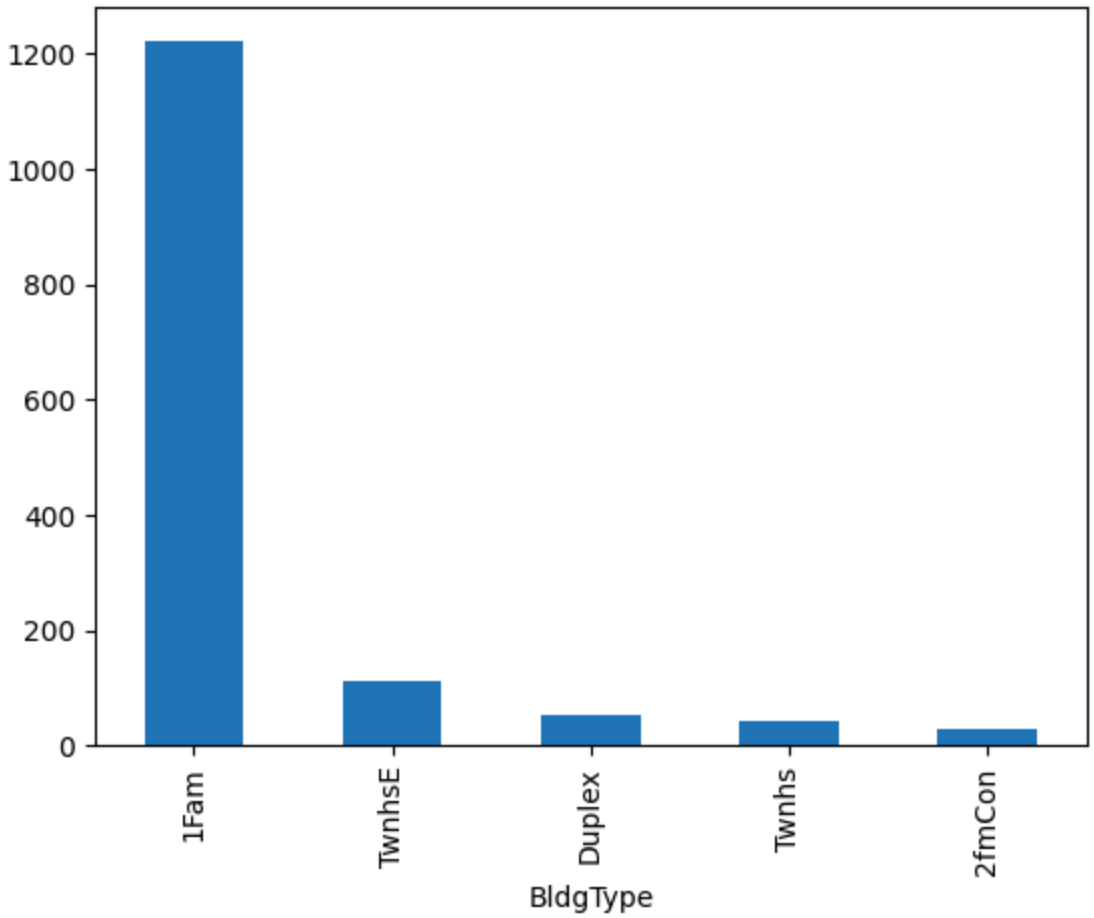
```
Condition1
```


1200
1000
800
600
400
200
0
Norm
Feedr
Artery
RRAn
PosN
RRAe
PosA
RRNn
RRNe
Condition1

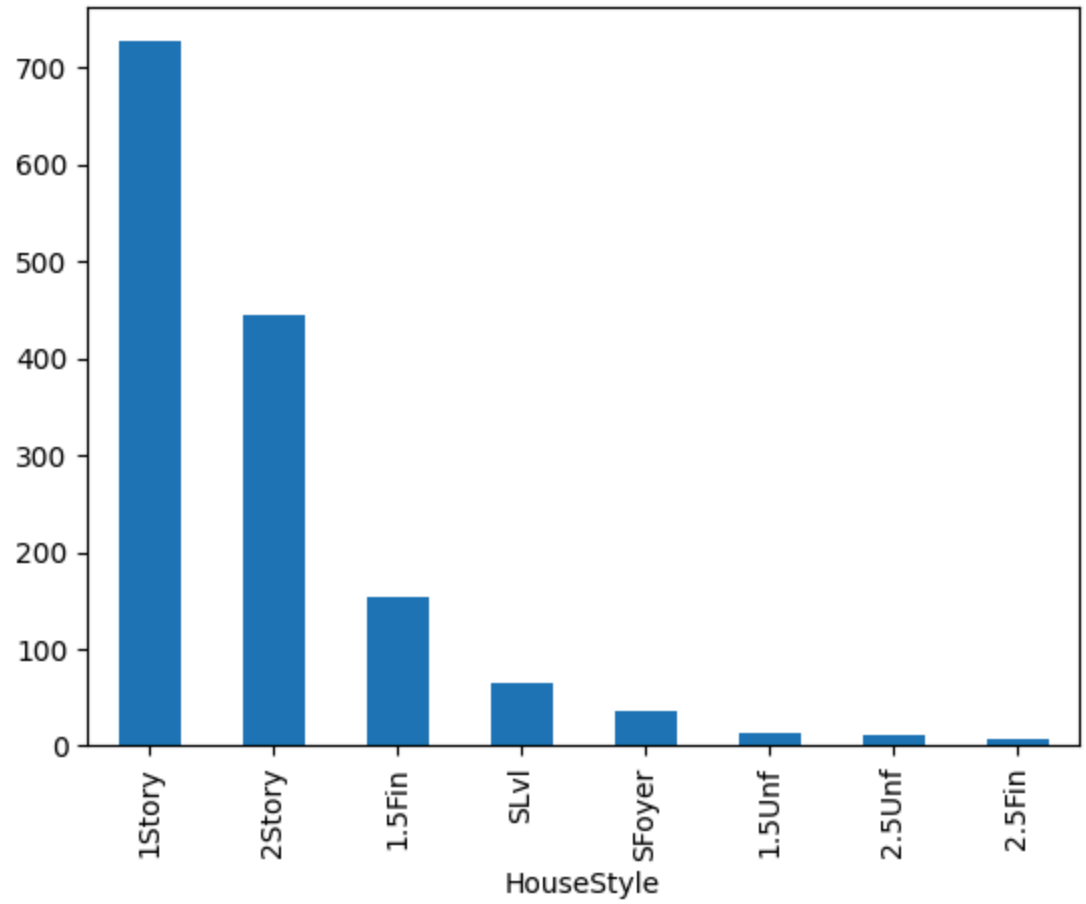
Condition2


1400
1200
1000
800
600
400
200
0
Norm
Feedr
Artery
RRNn
PosN
PosA
RRAn
RRAe
Condition2

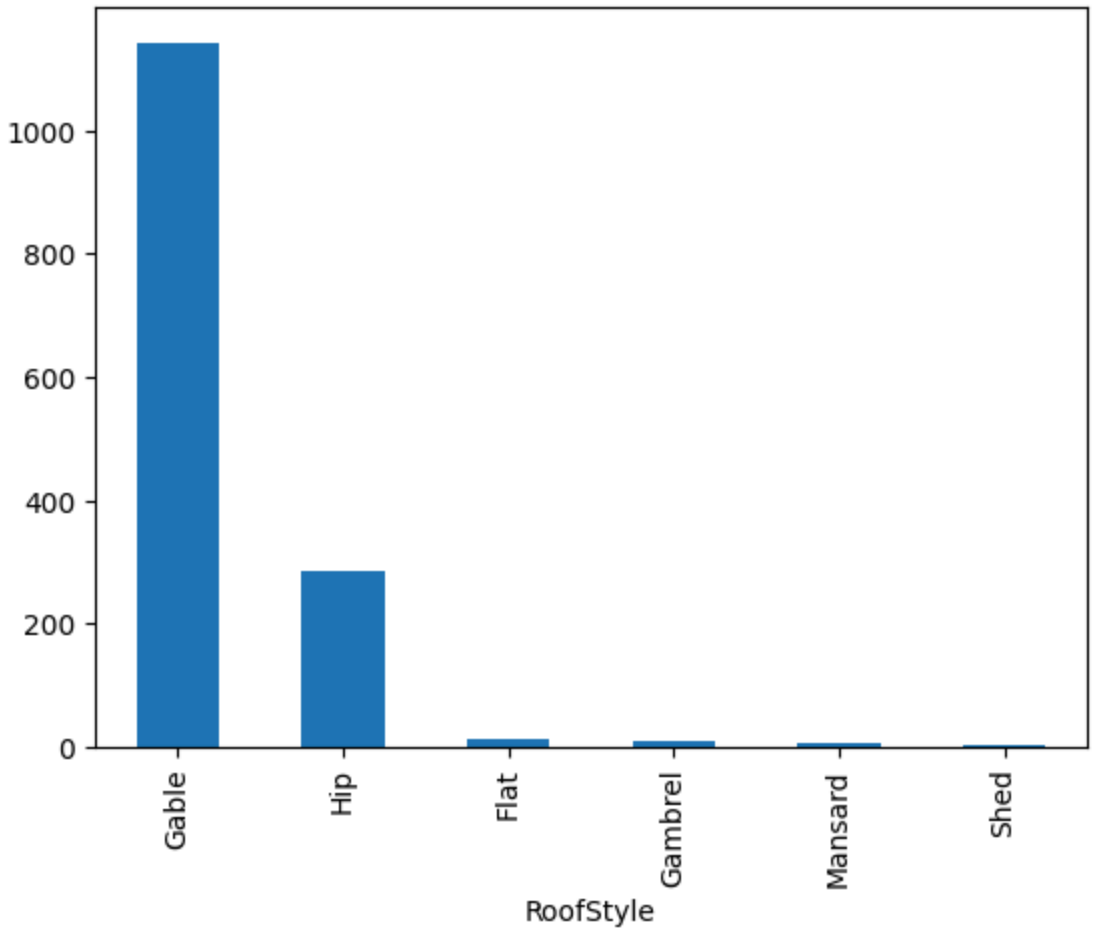
BldgType


1200
1000
800
600
400
200
0
1Fam
TwnhsE
Duplex
Twnhs
2fmCon
BldgType

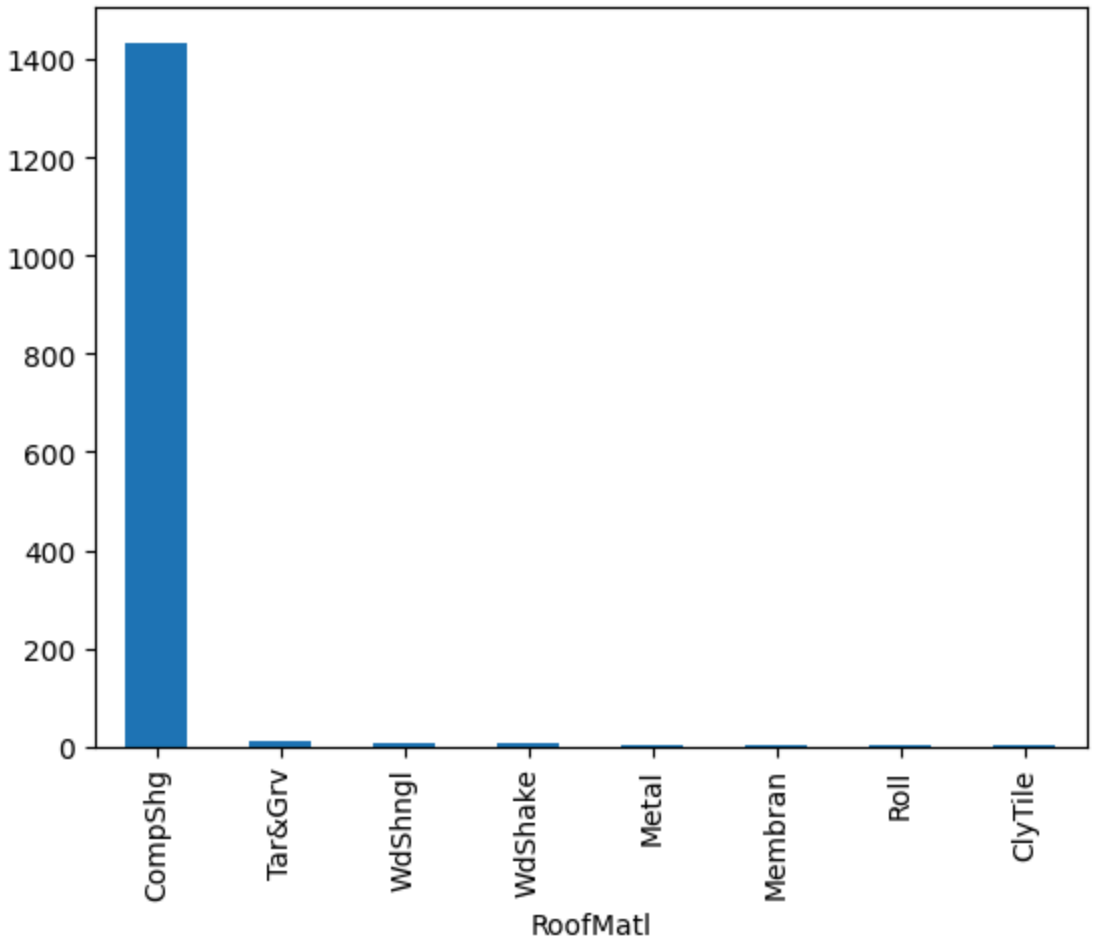
HouseStyle


700
600
500
400
300
200
100
0
1Story
2Story
1.5Fin
SLvl
SFoyer
1.5Unf
2.5Unf
2.5Fin
HouseStyle

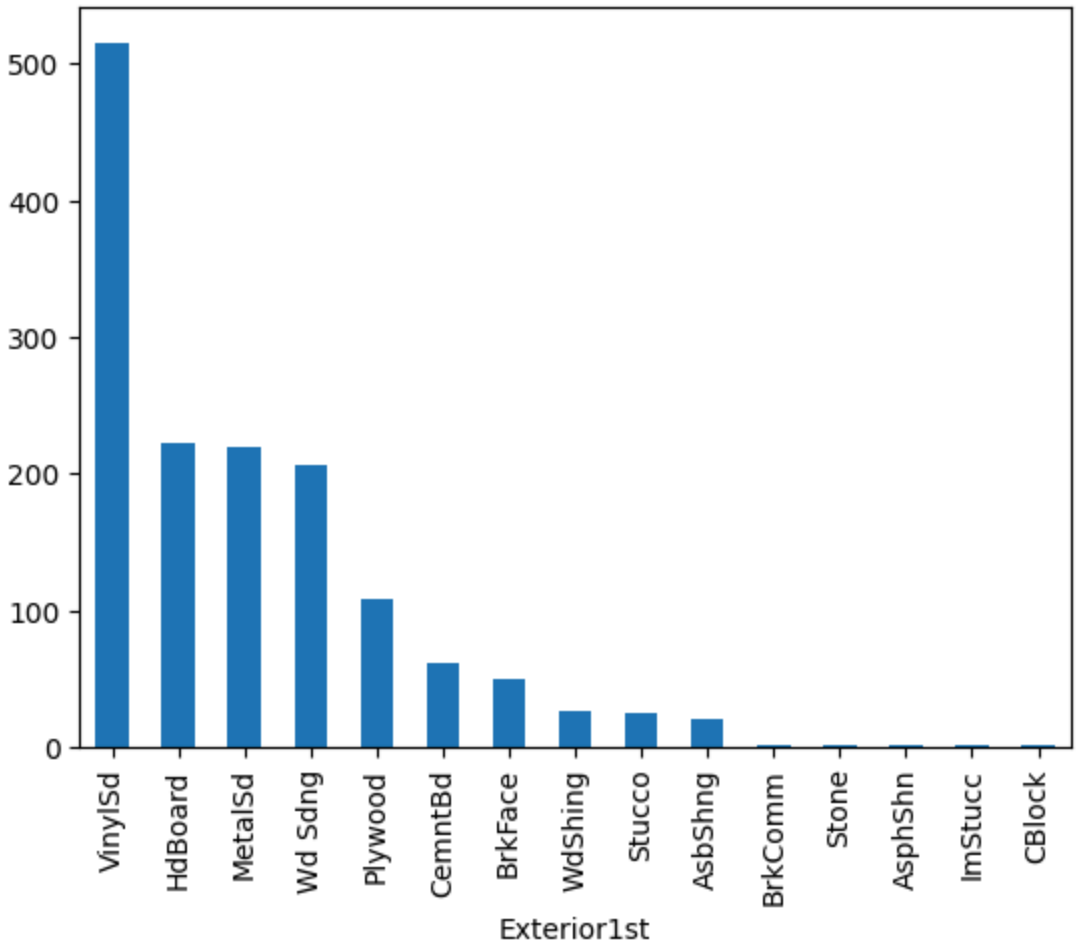
RoofStyle


1000
800
600
400
200
0
Gable
Hip
Flat
Gambrel
Mansard
Shed
RoofStyle

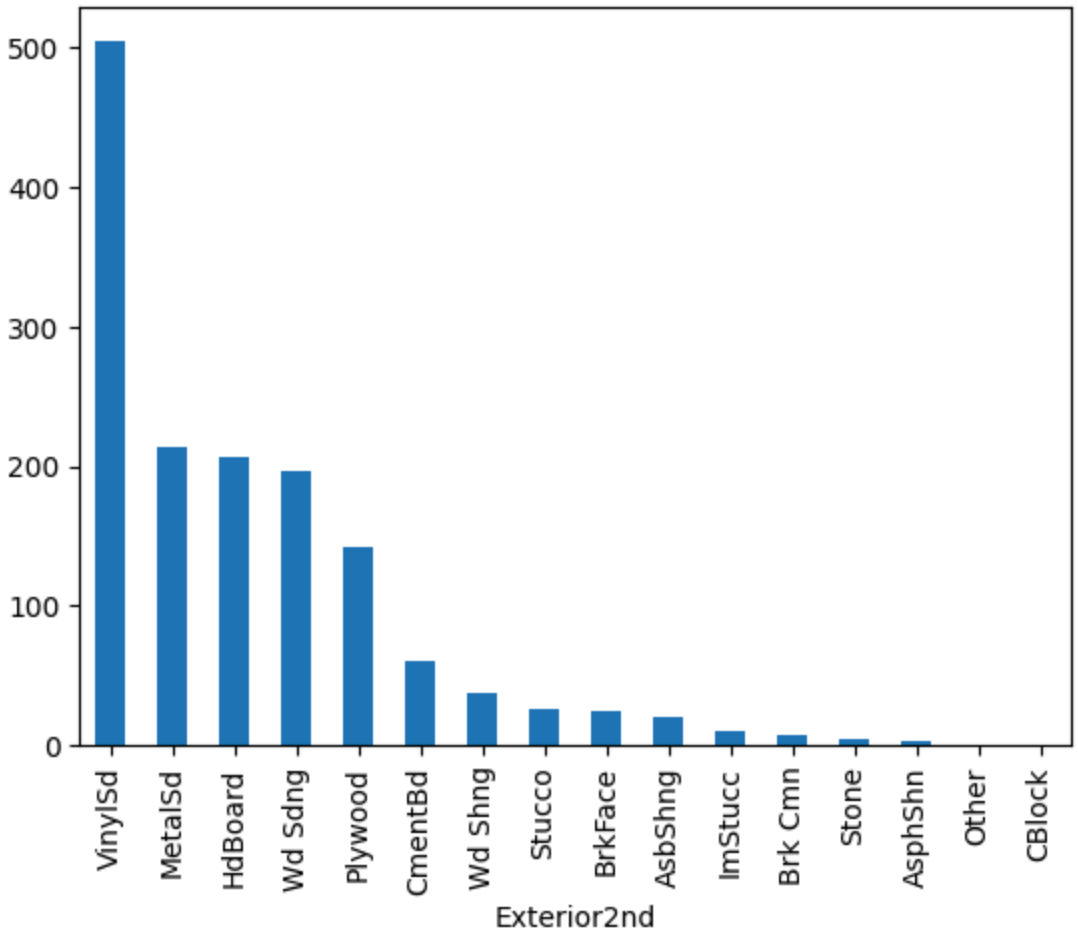
RoofMatl



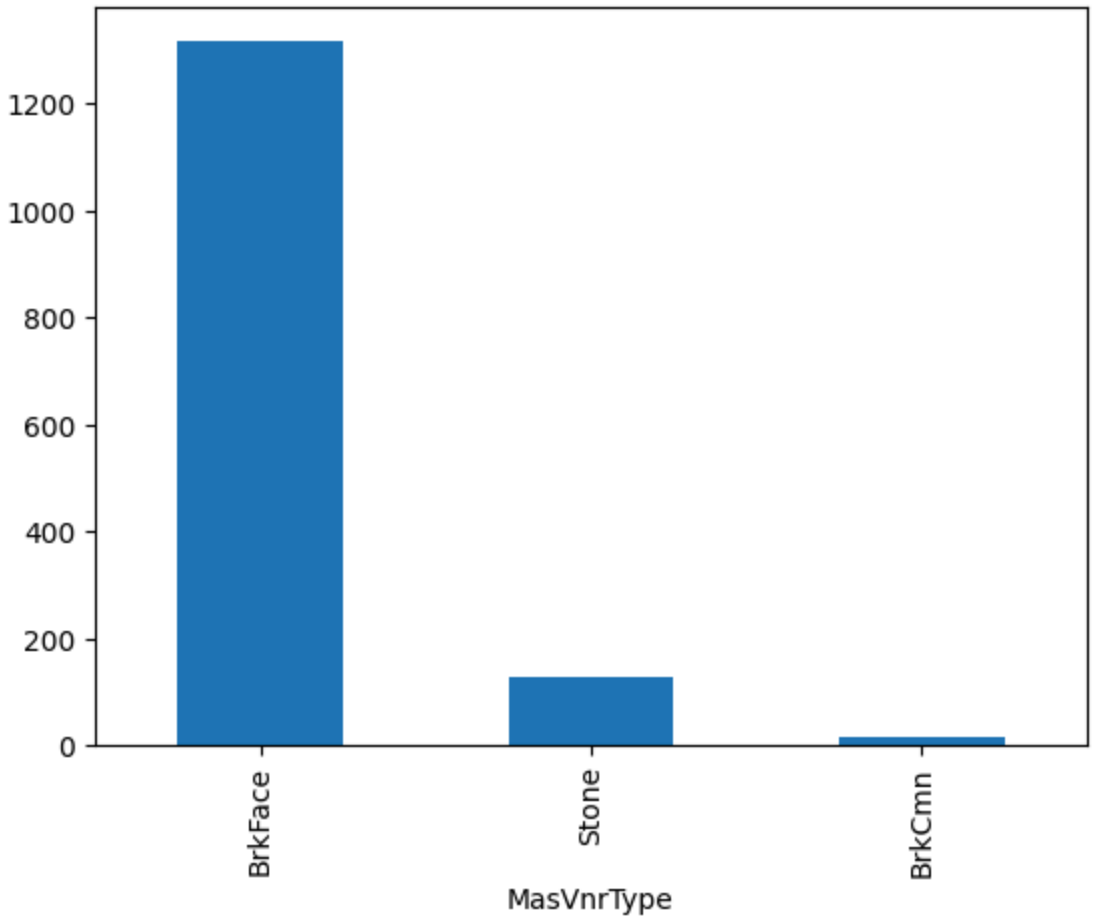
Exterior1st



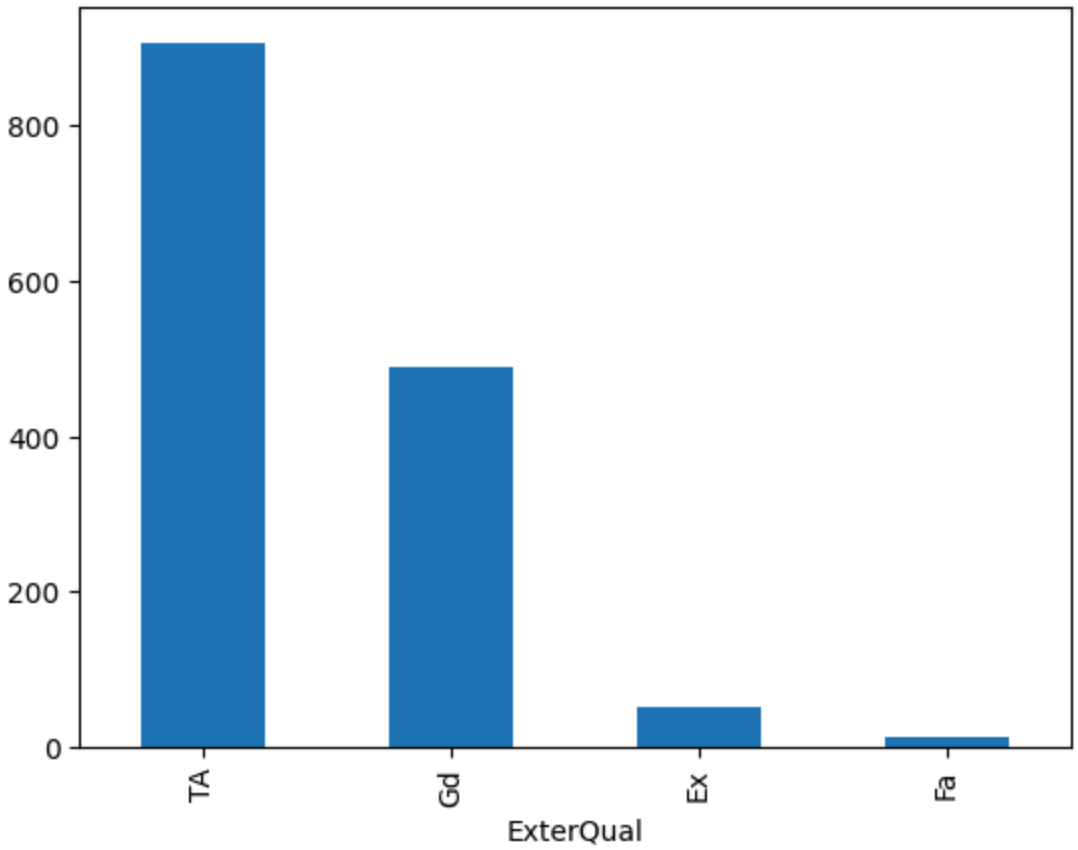
Exterior2nd


500
400
300
200
100
0
VinylSd
MetalSd
HdBoard
Wd Sdng
Plywood
CmentBd
Wd Shng
Stucco
BrkFace
AsbShng
ImStucc
Brk Cmn
Stone
AsphShn
Other
CBlock
Exterior2nd

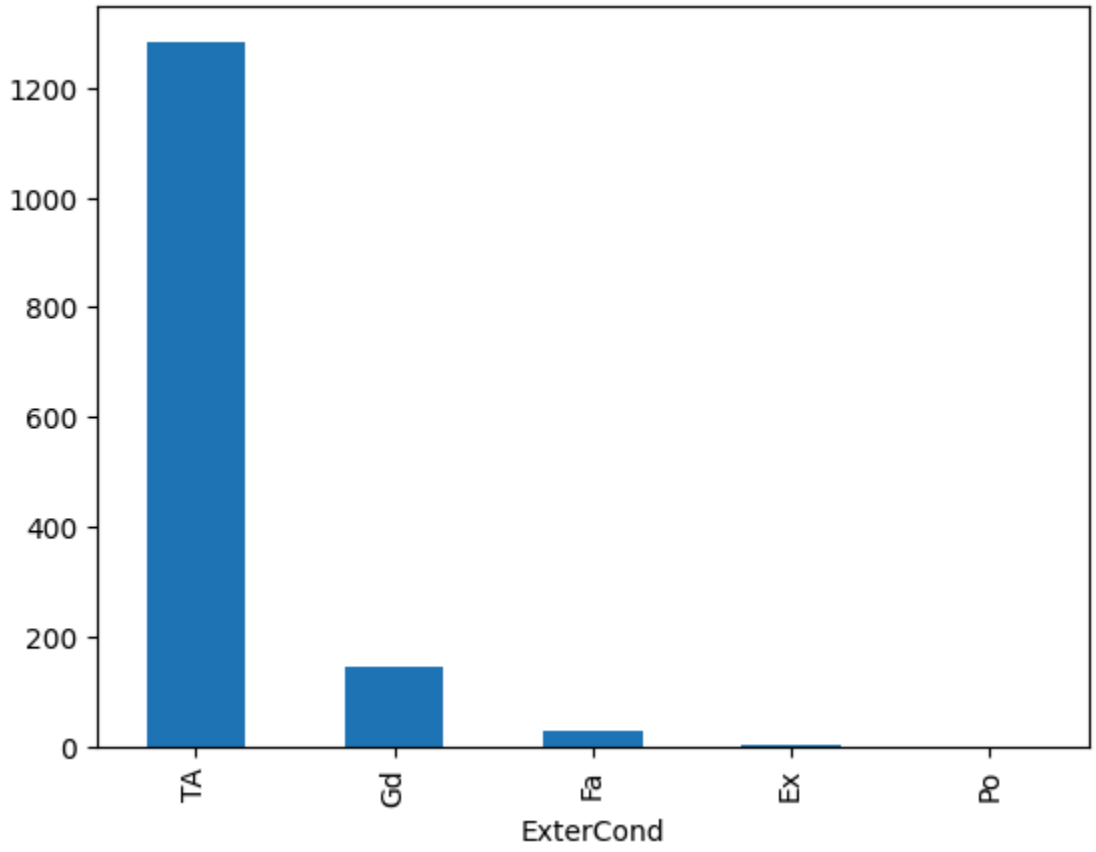
MasVnrType



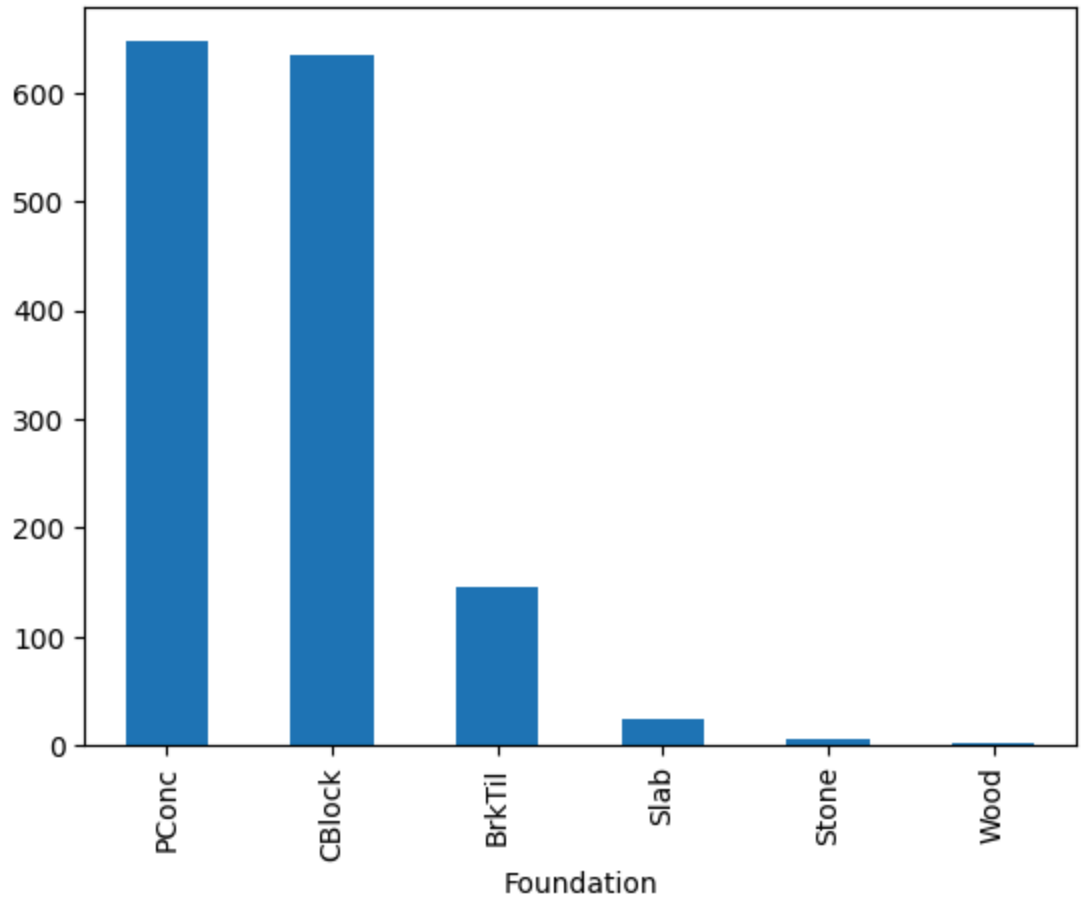
ExterQual



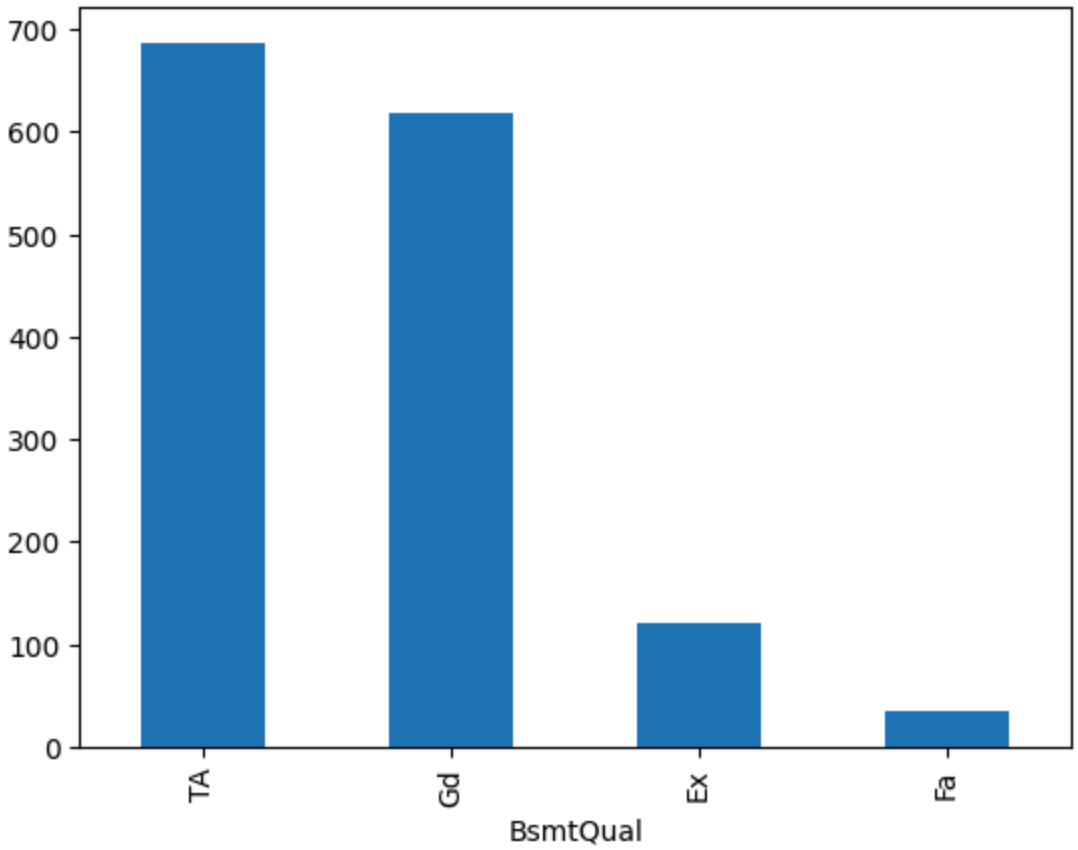
ExterCond



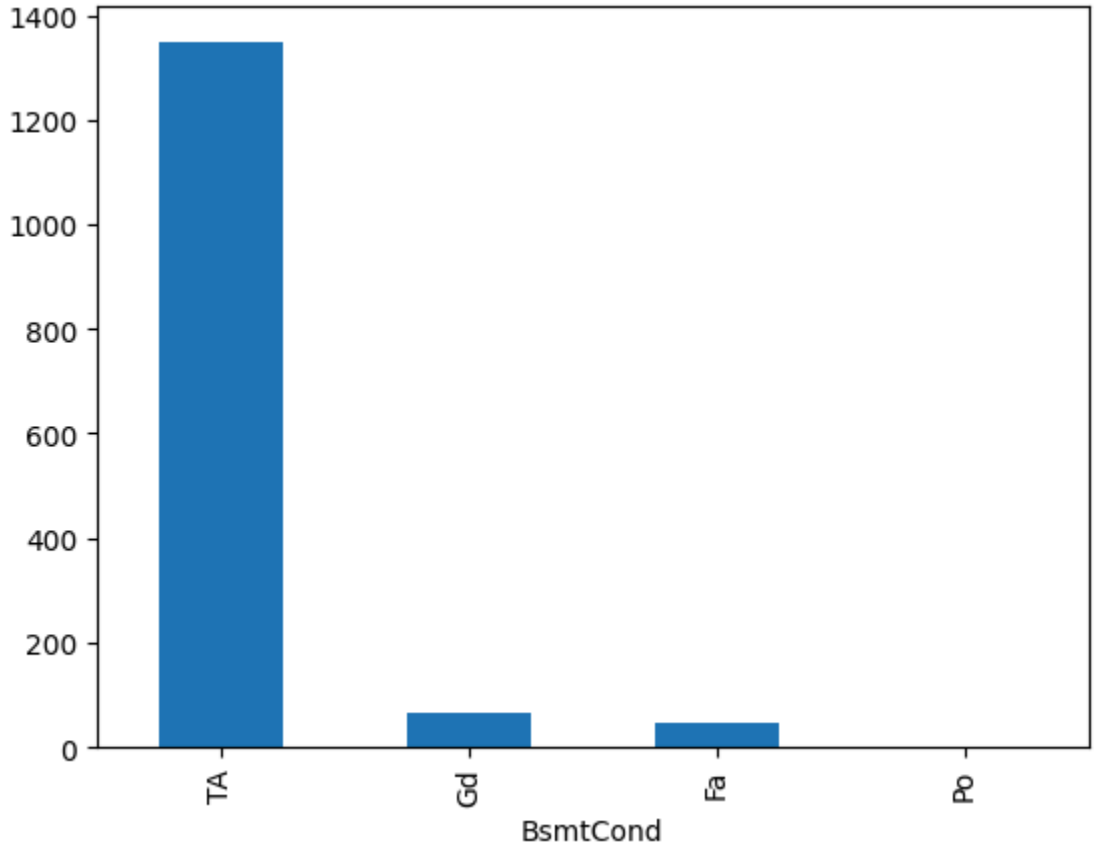
Foundation


600
500
400
300
200
100
0
PConc
CBlock
BrkTil
Slab
Stone
Wood
Foundation

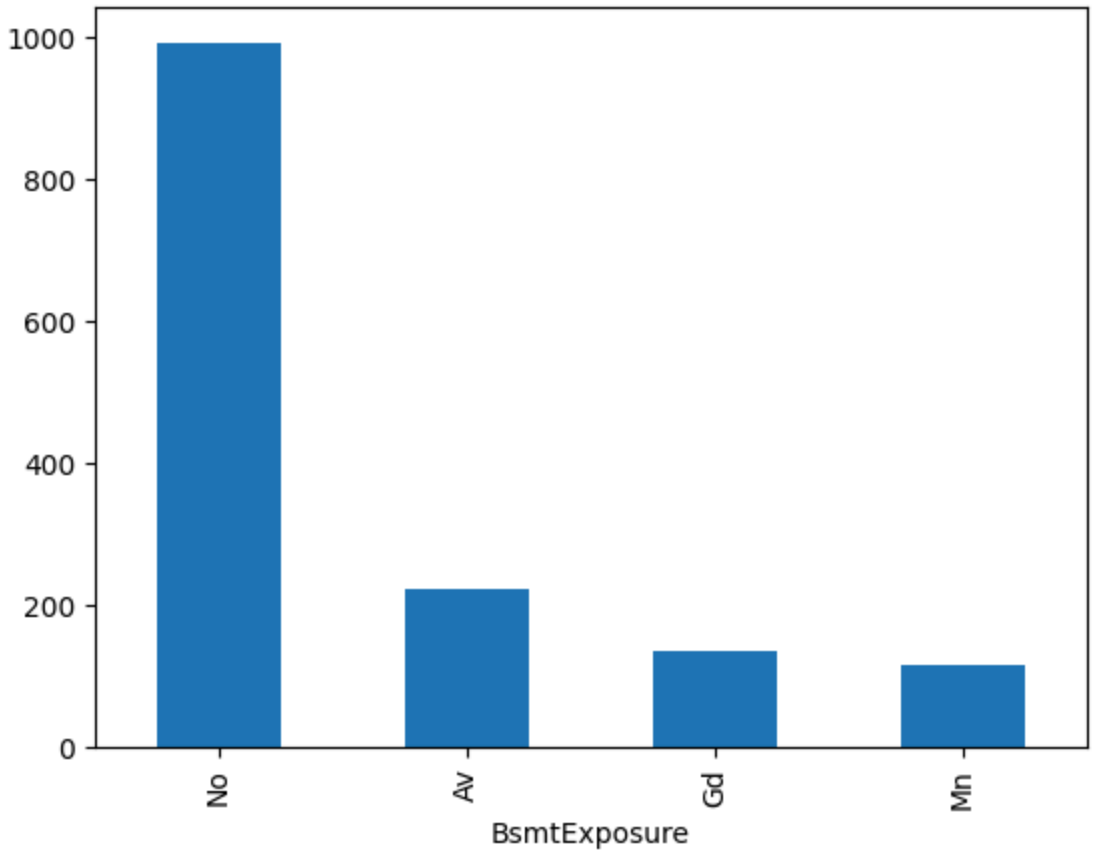
BsmtQual



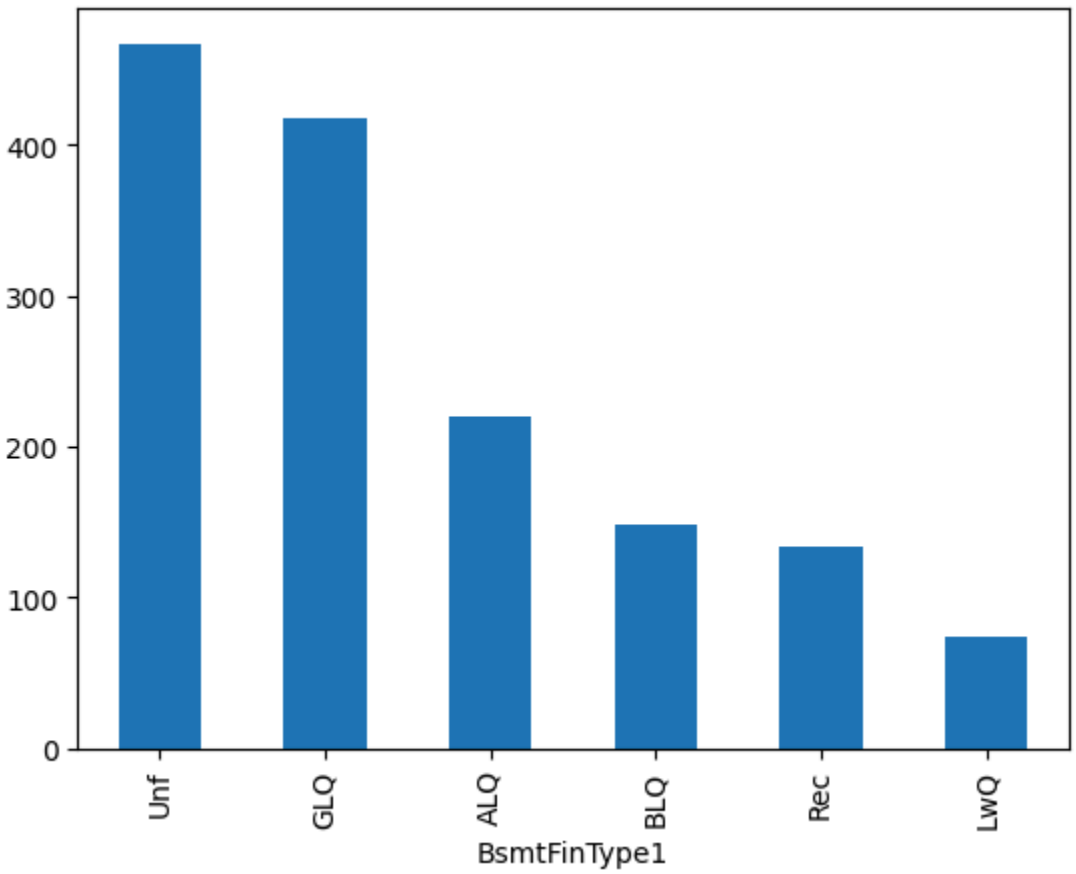
BsmtCond



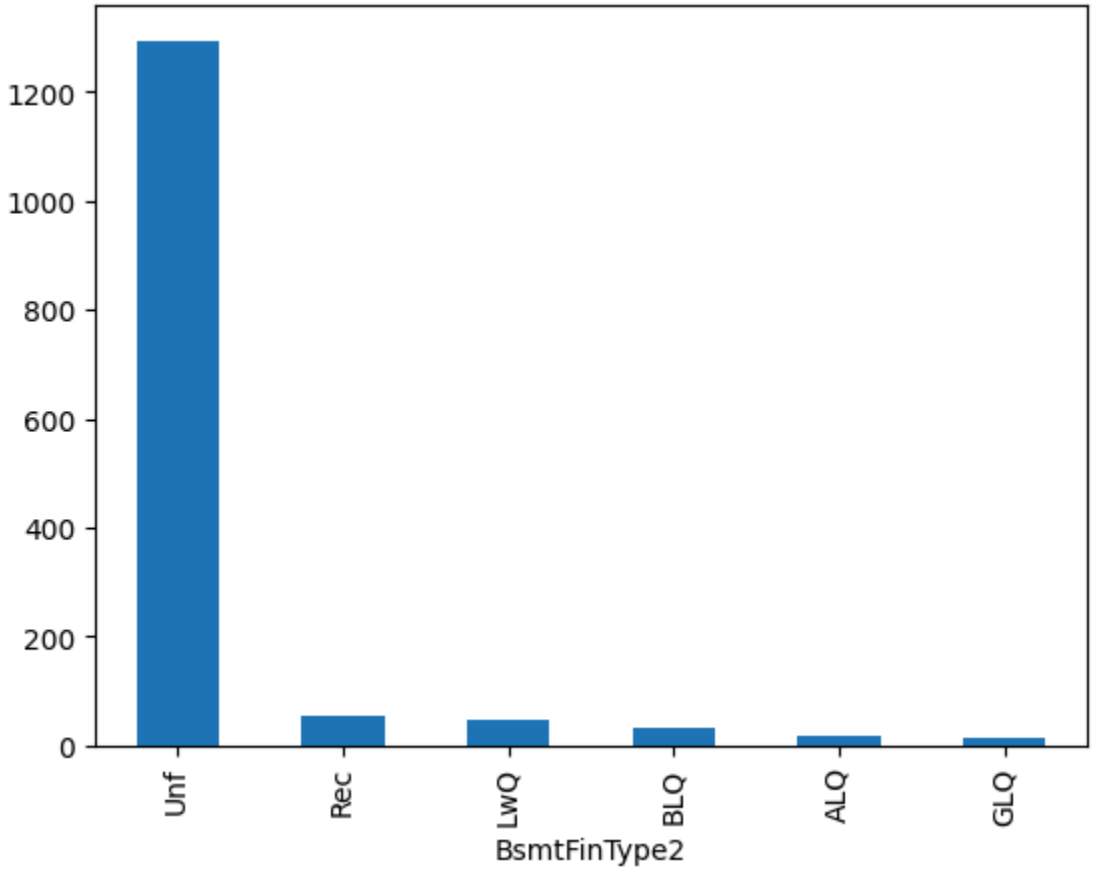
BsmtExposure



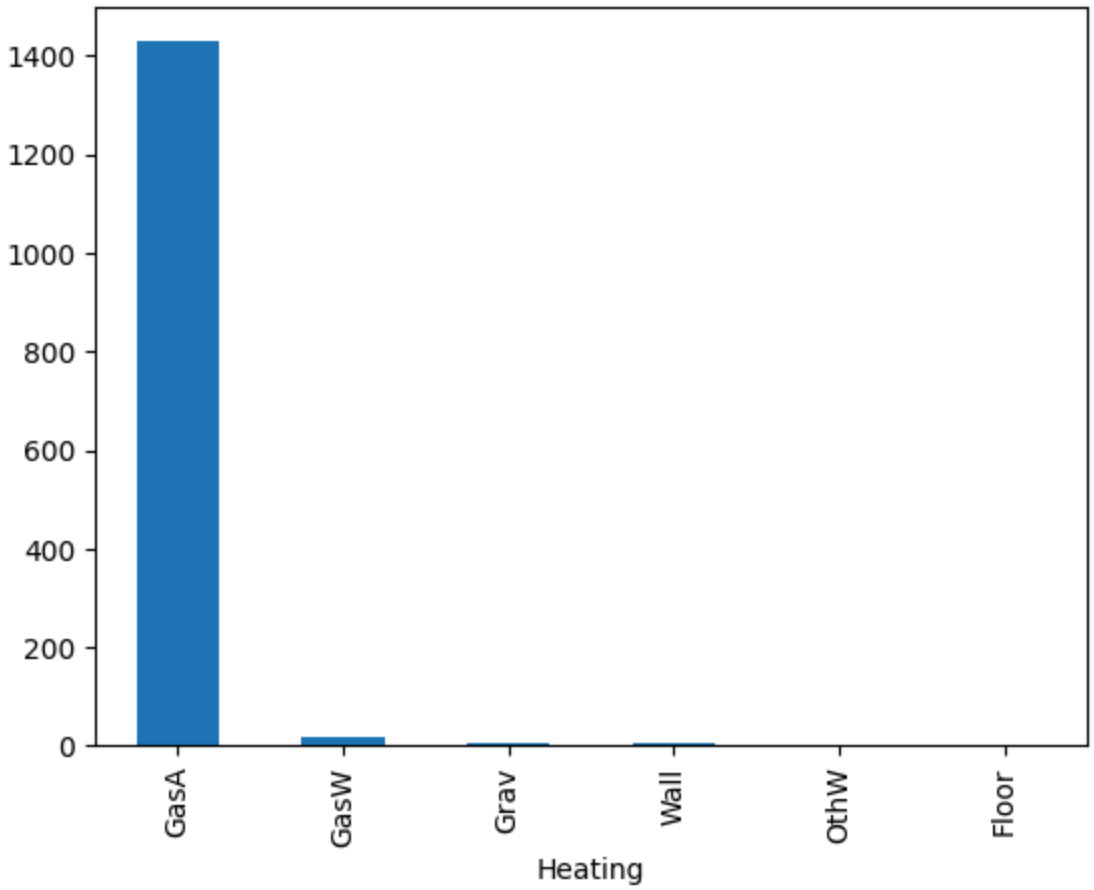
BsmtFinType1



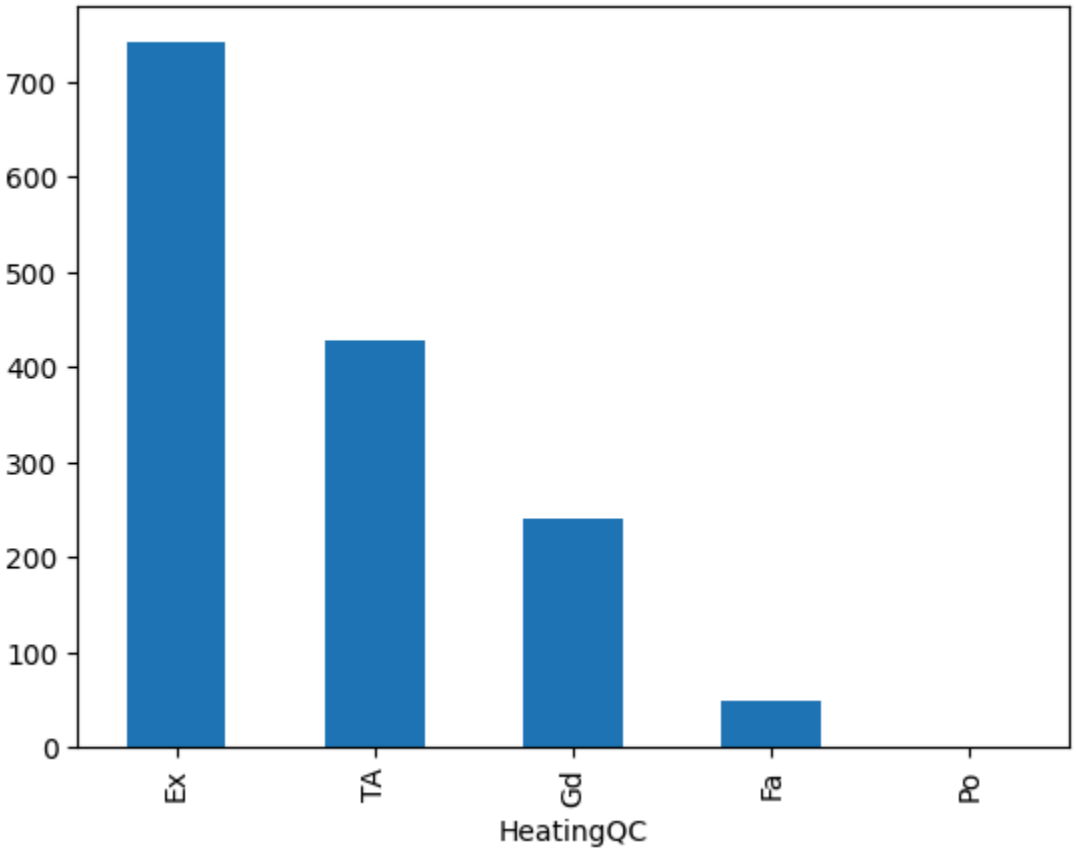
BsmtFinType2



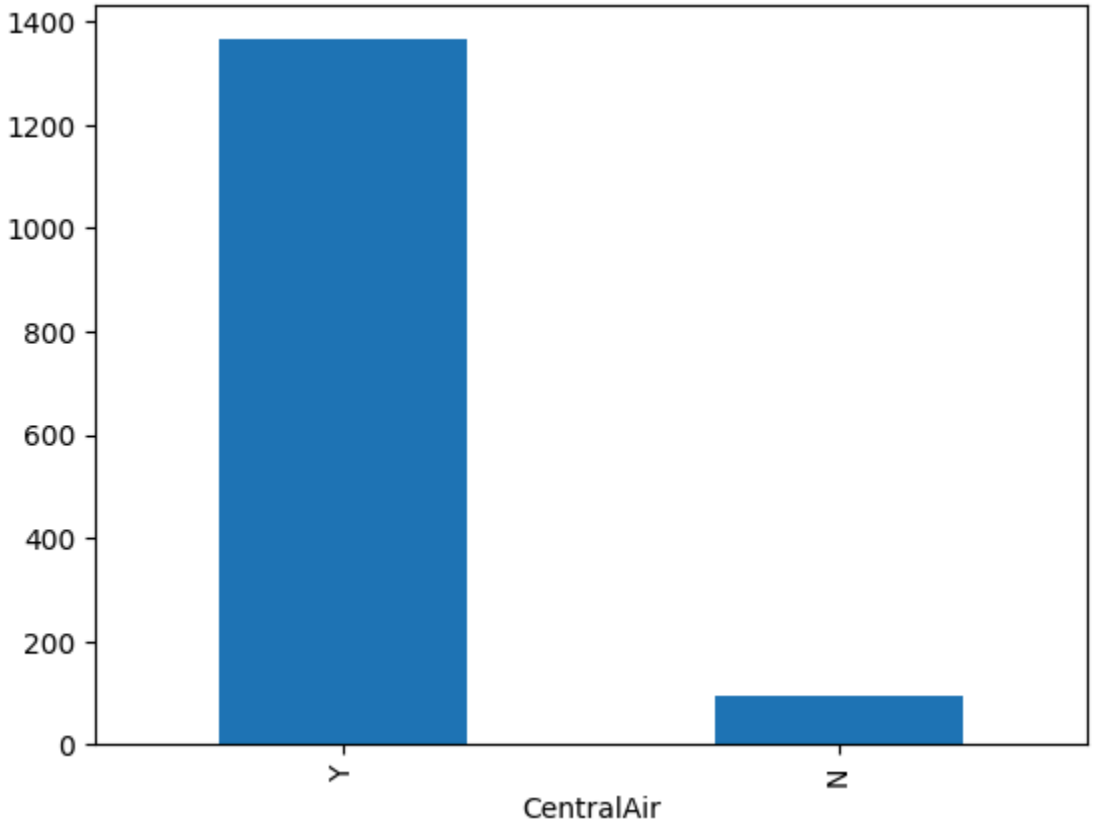
Heating


1400
1200
1000
800
600
400
200
0
GasA
GasW
Grav
Wall
OthW
Floor
Heating

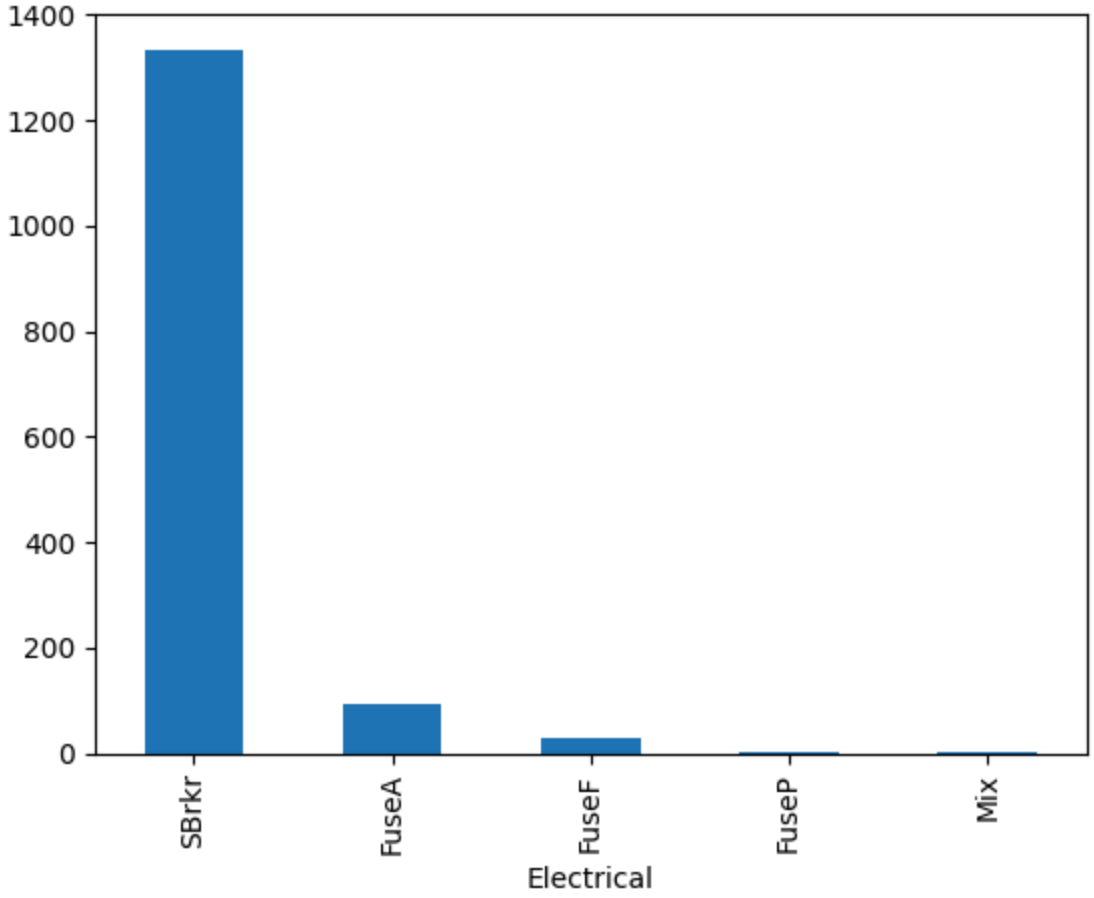
HeatingQC


700
600
500
400
300
200
100
0
Ex
TA
Gd
Fa
Po
HeatingQC

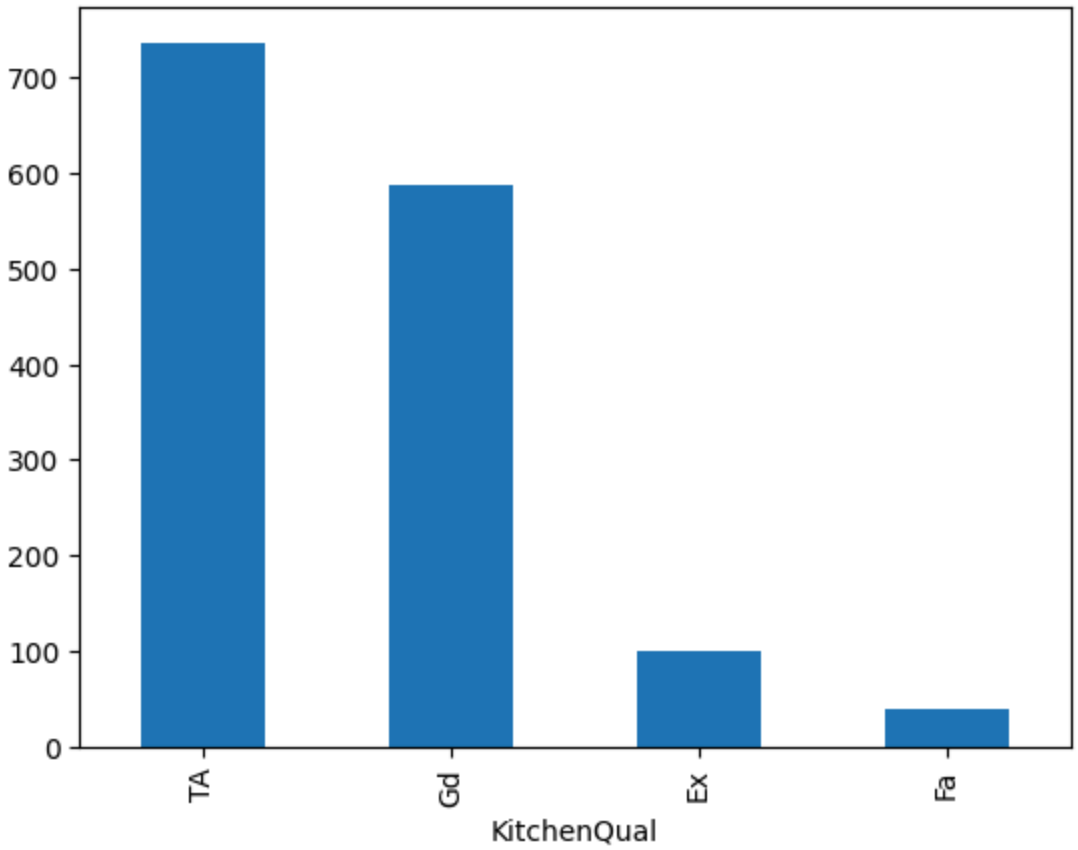
CentralAir



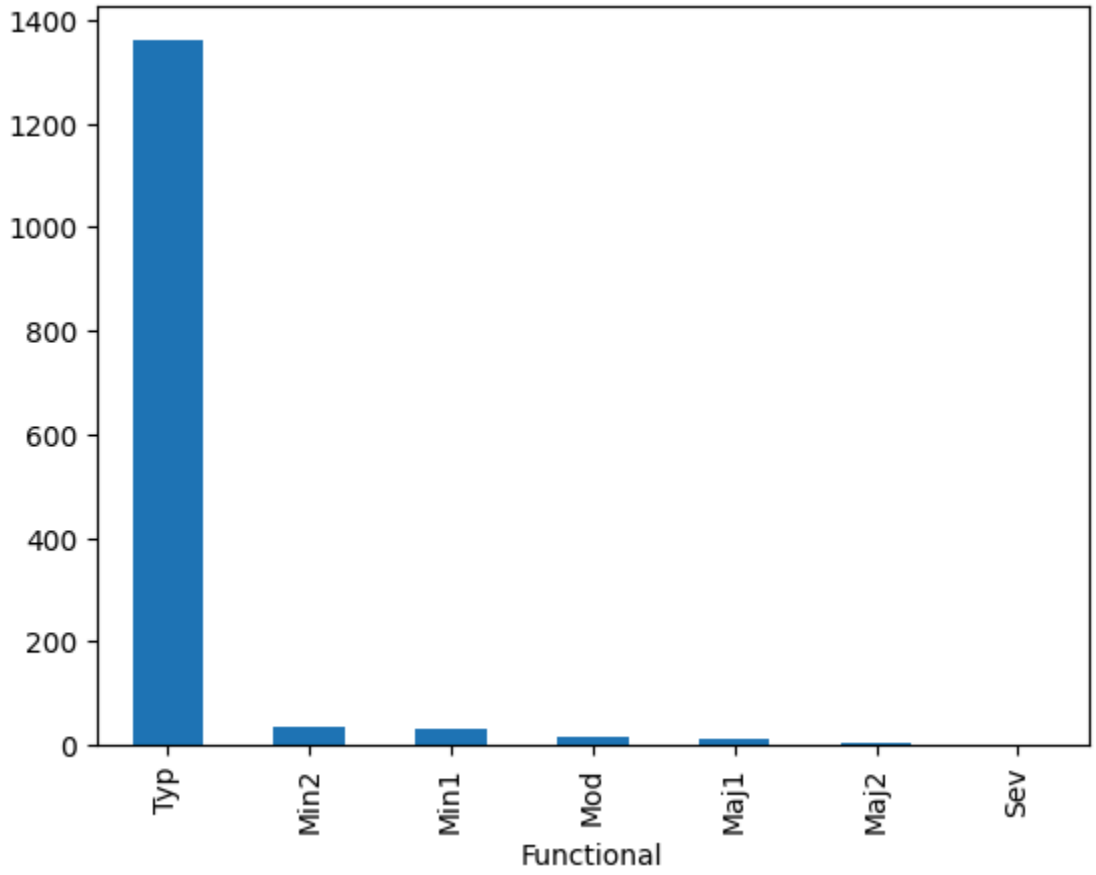
Electrical



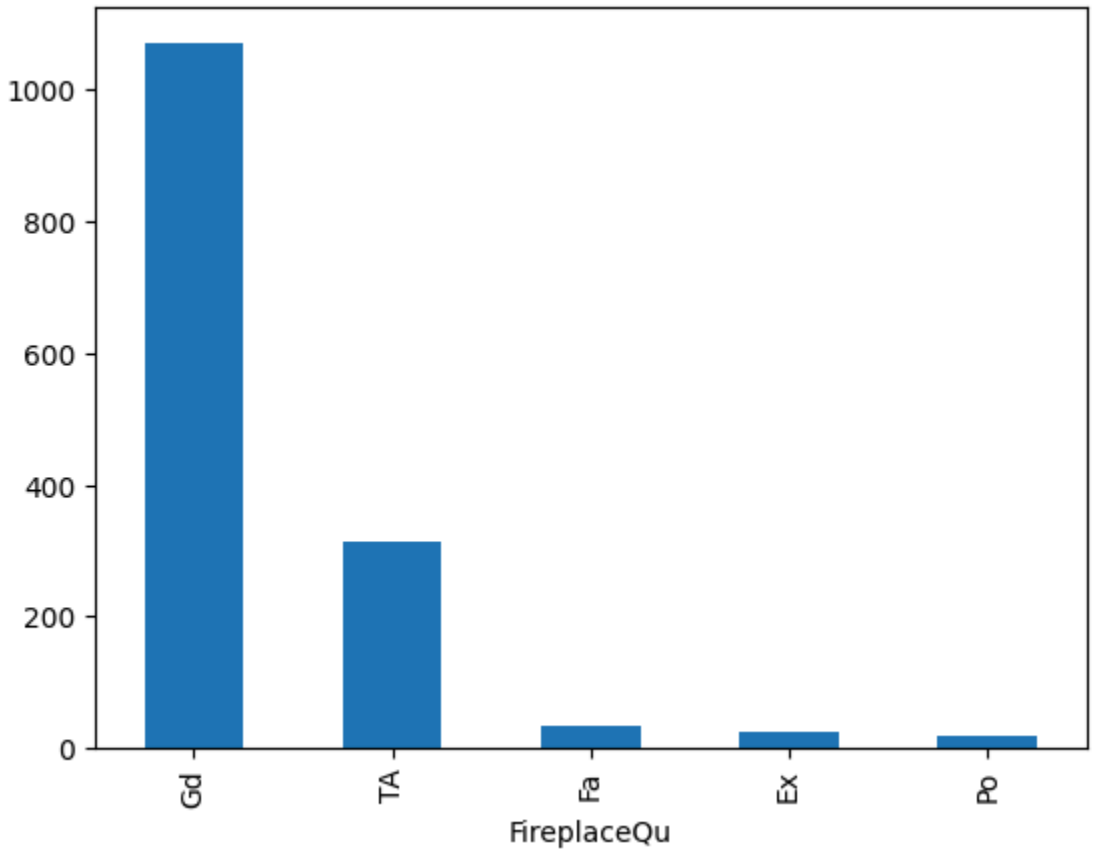
KitchenQual


700
600
500
400
300
200
100
0
TA
Gd
Ex
Fa
KitchenQual

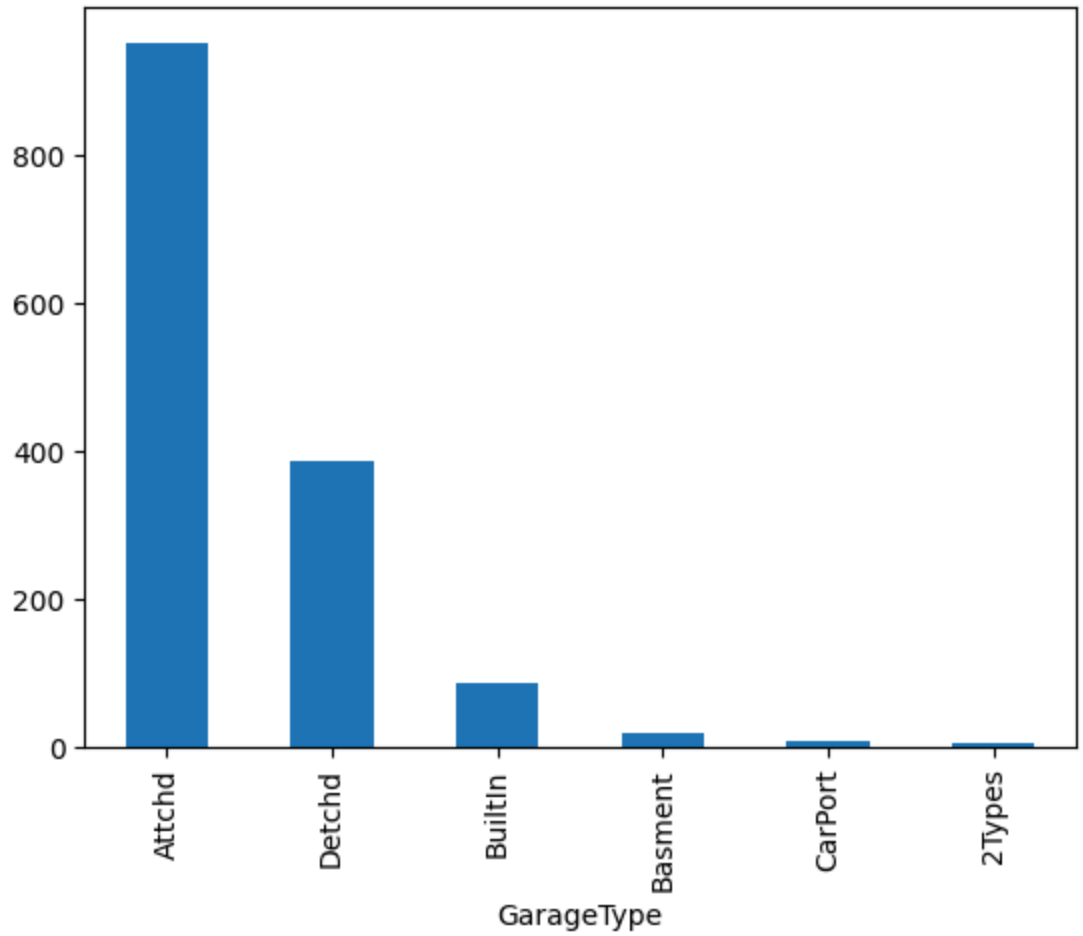
```
Functional
```


1400
1200
1000
800
600
400
200
0
Typ
Min2
Min1
Mod
Maj1
Maj2
Sev
Functional

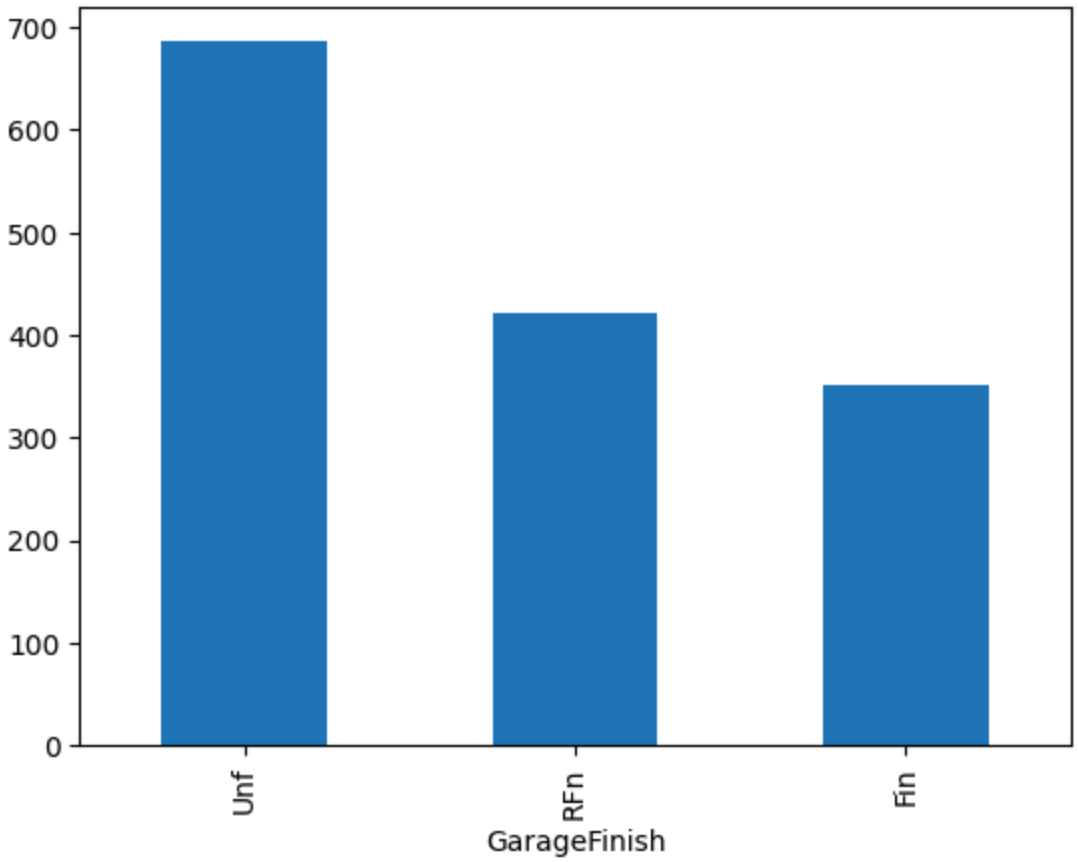
FireplaceQu



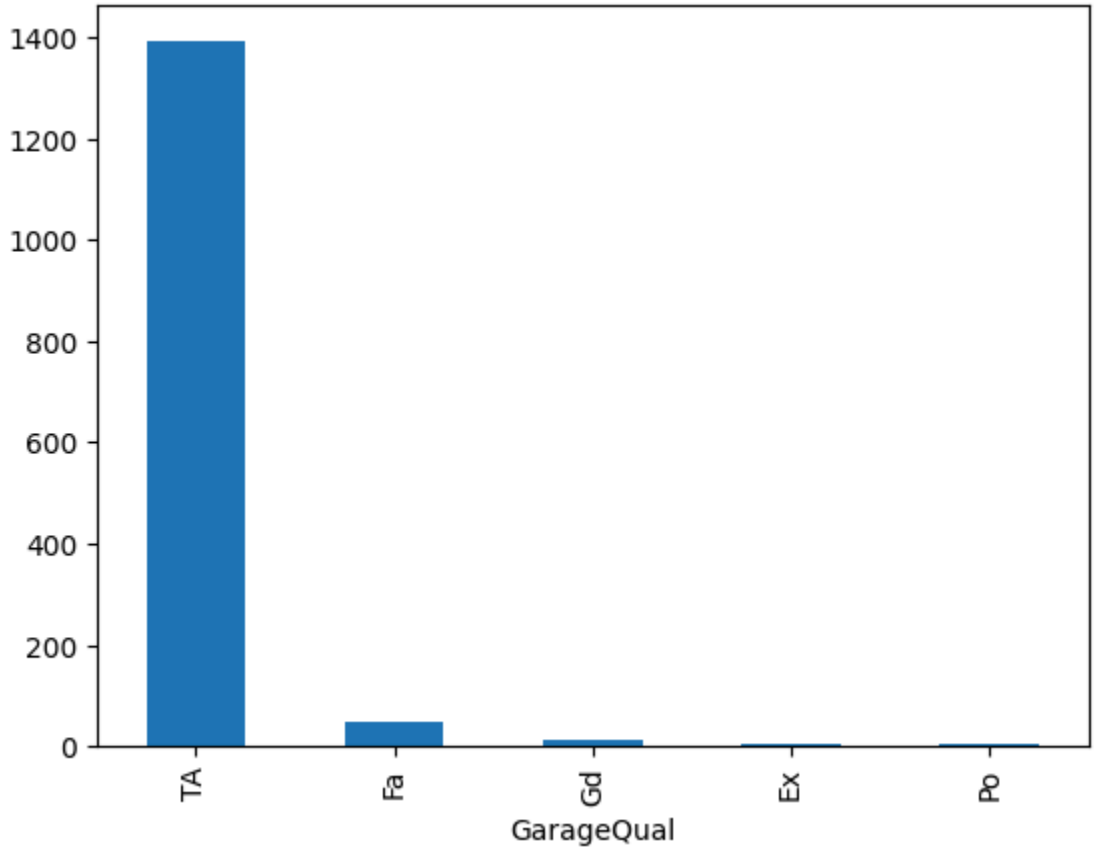
GarageType



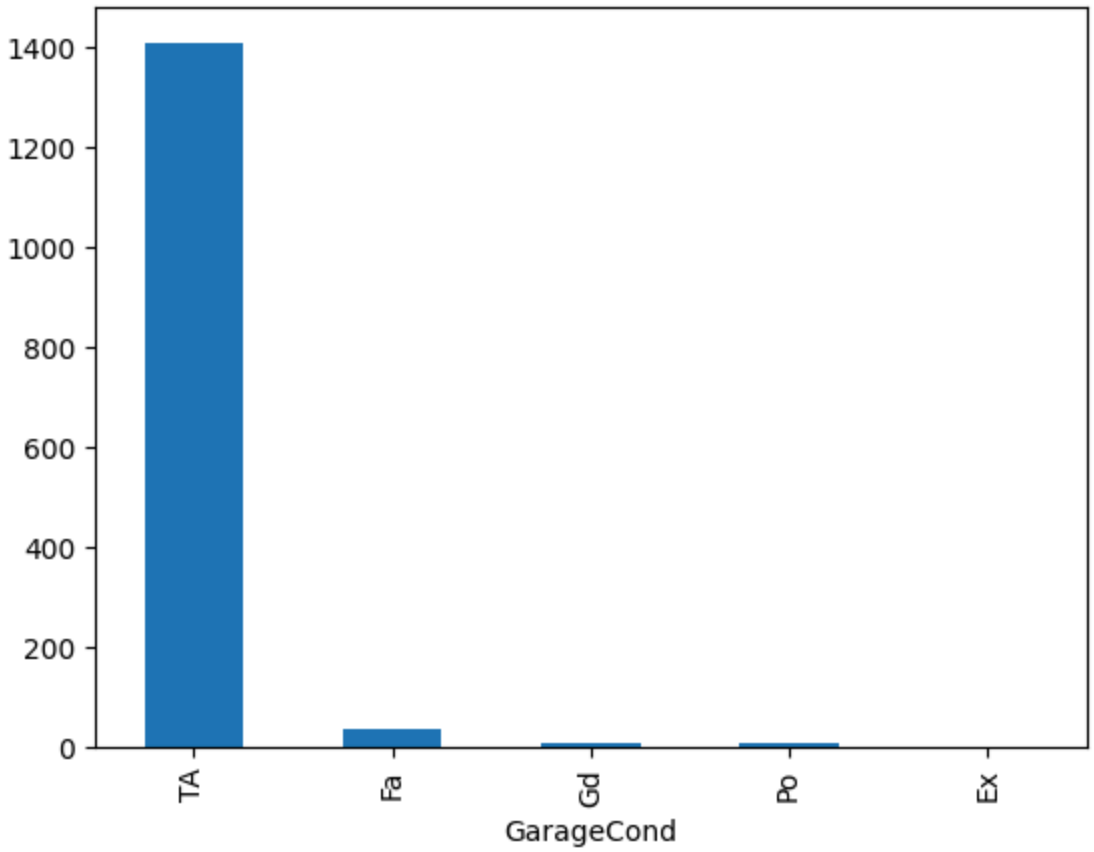
GarageFinish



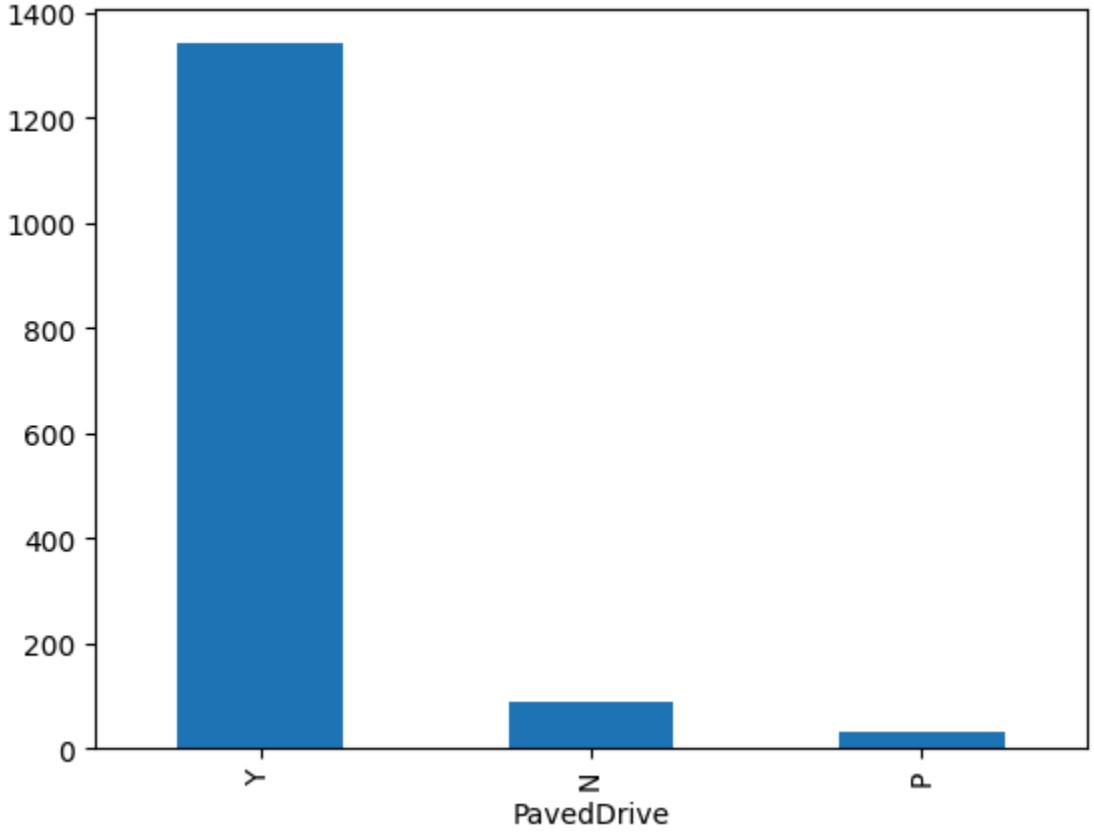
GarageQual



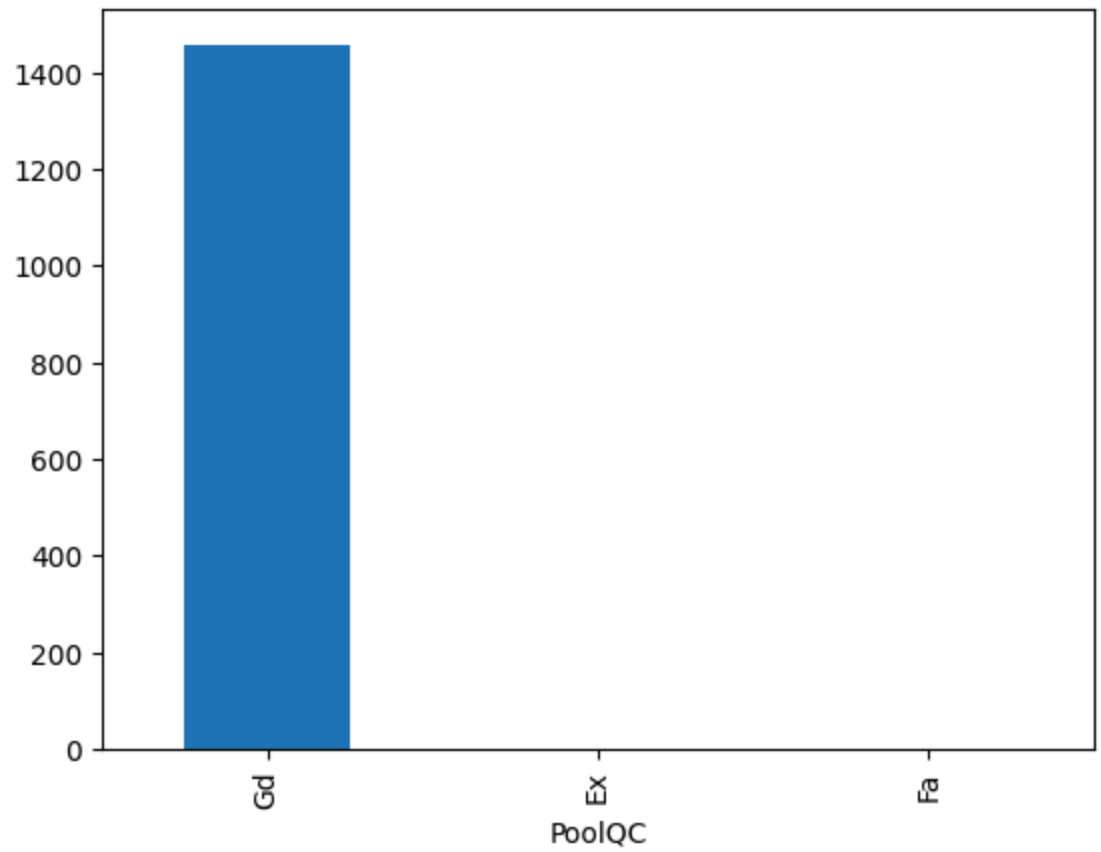
GarageCond



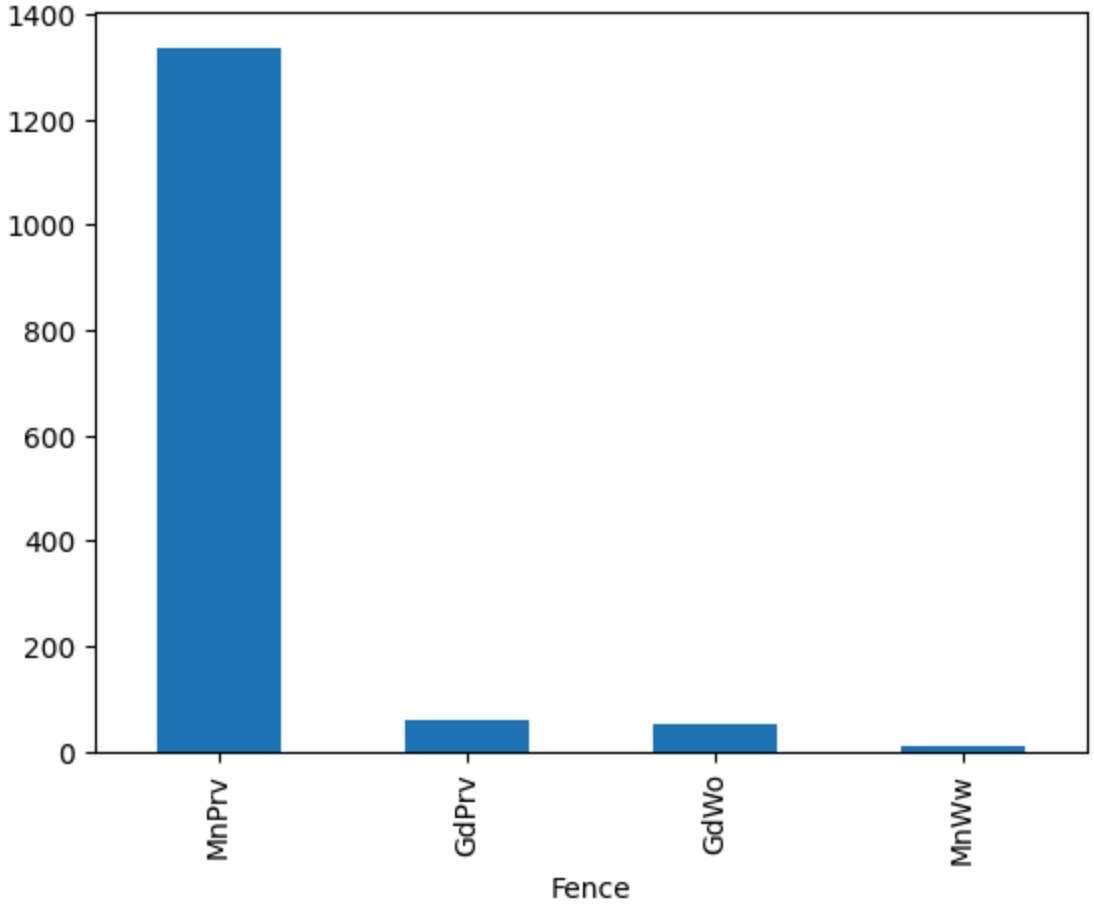
PavedDrive



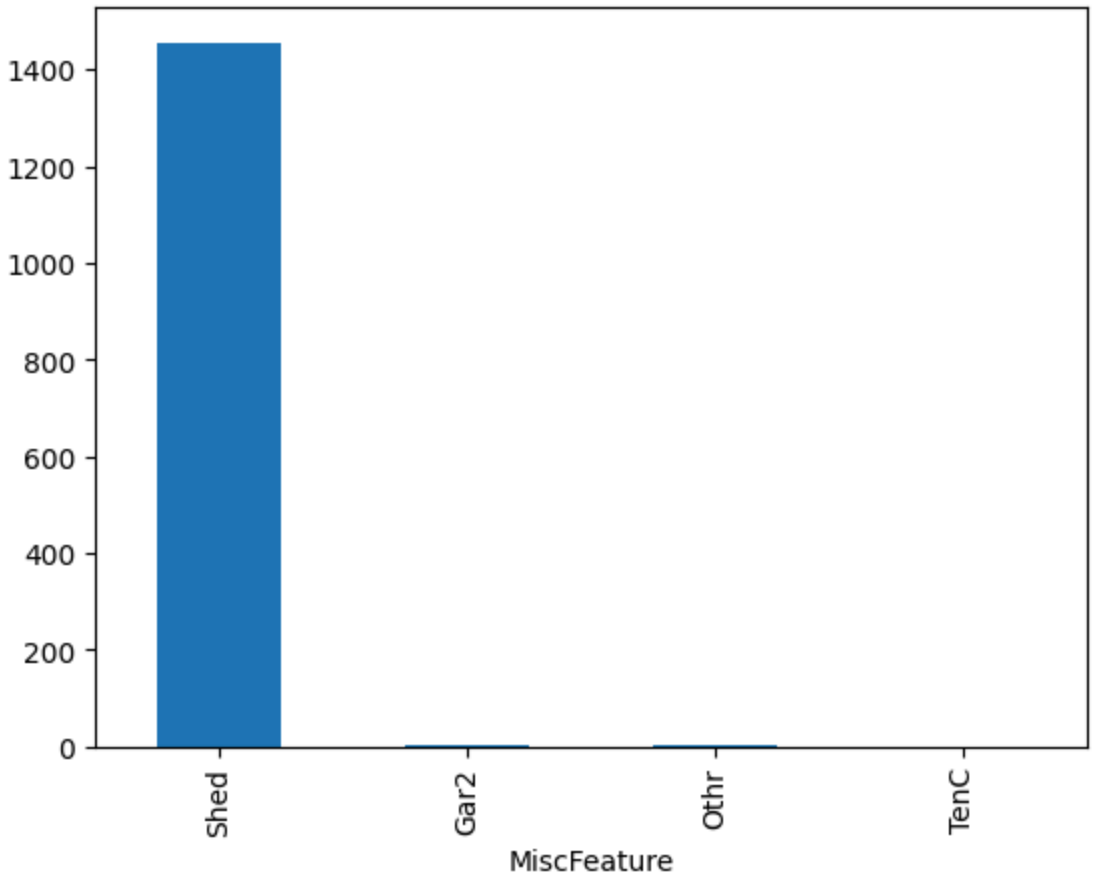
PoolQC



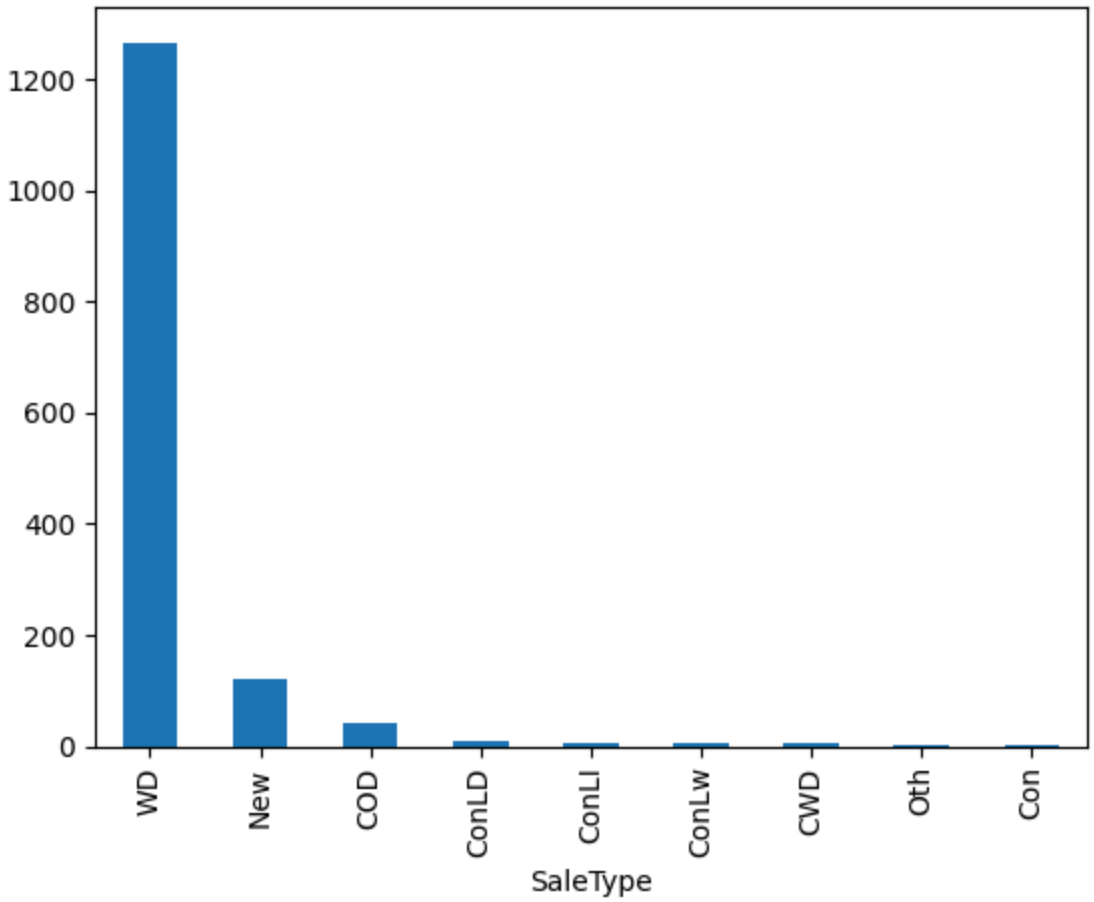
Fence



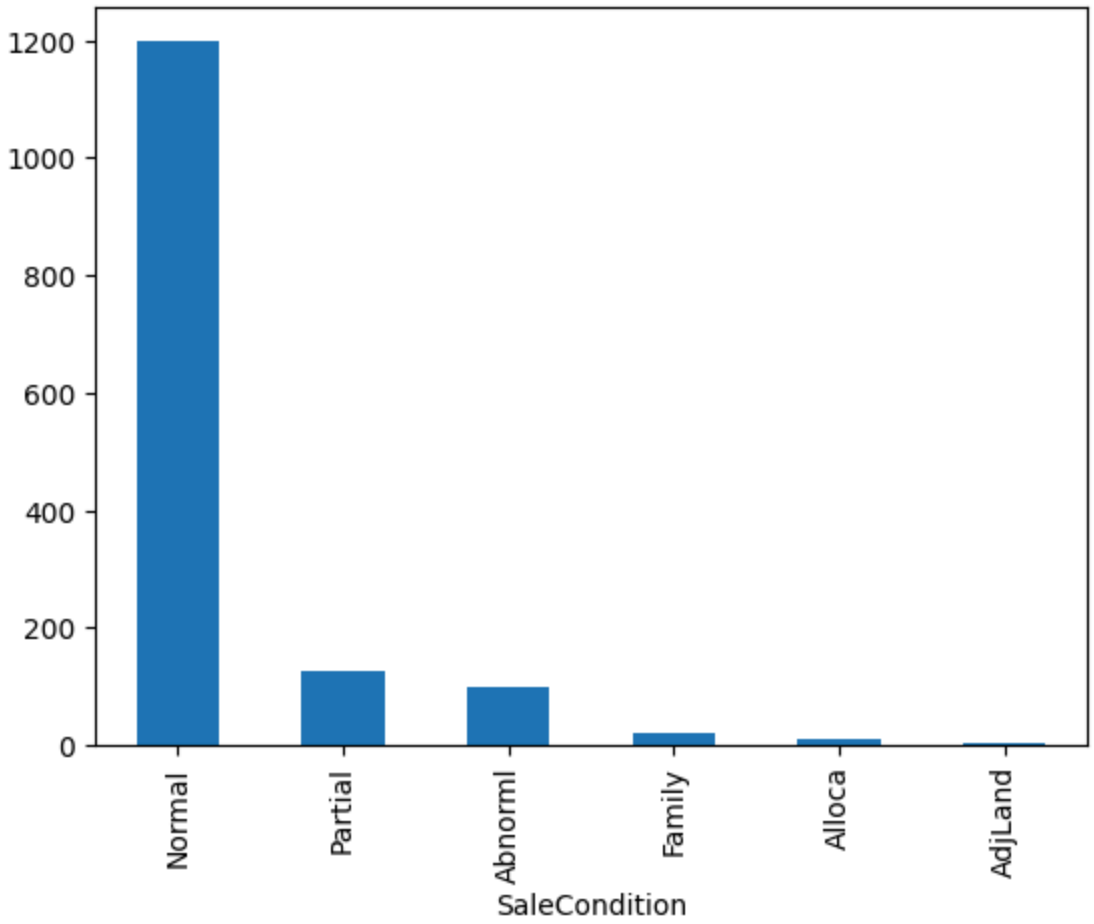
MiscFeature


1400
1200
1000
800
600
400
200
0
Shed
Gar2
Othr
TenC
MiscFeature

SaleType



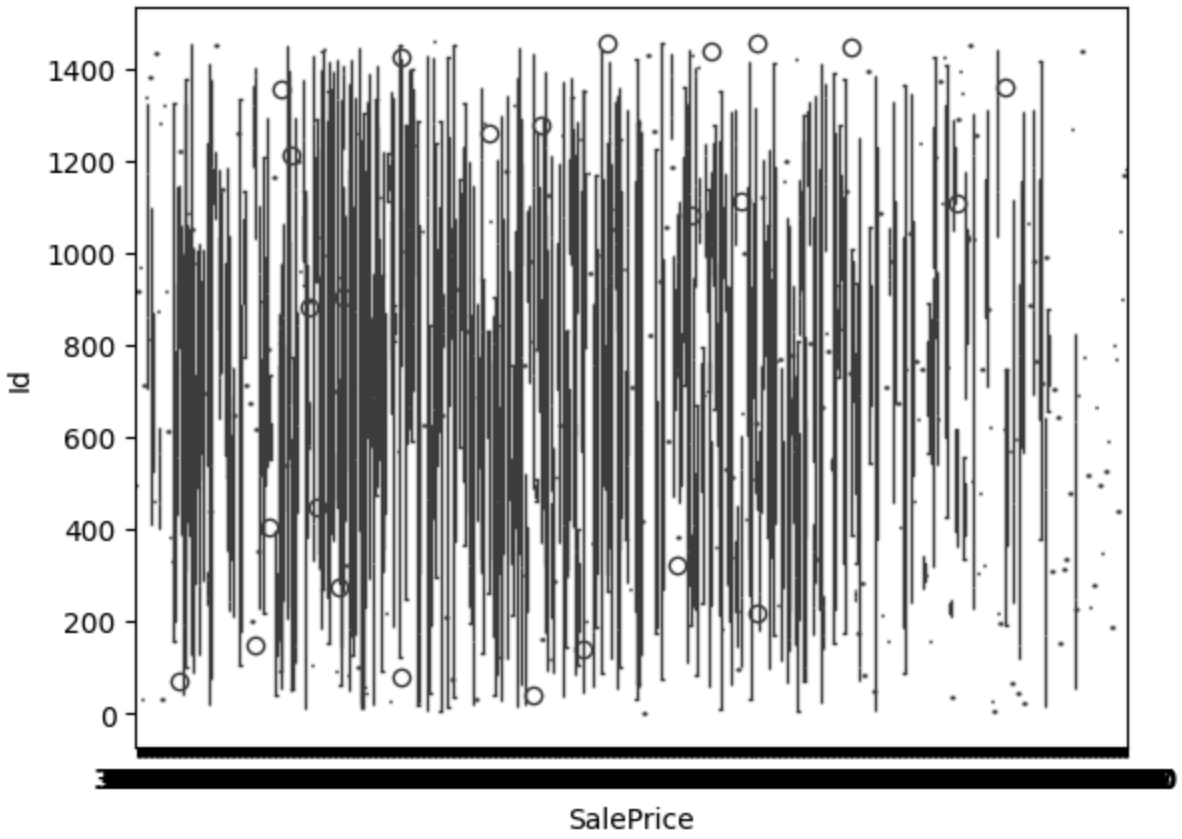
SaleCondition



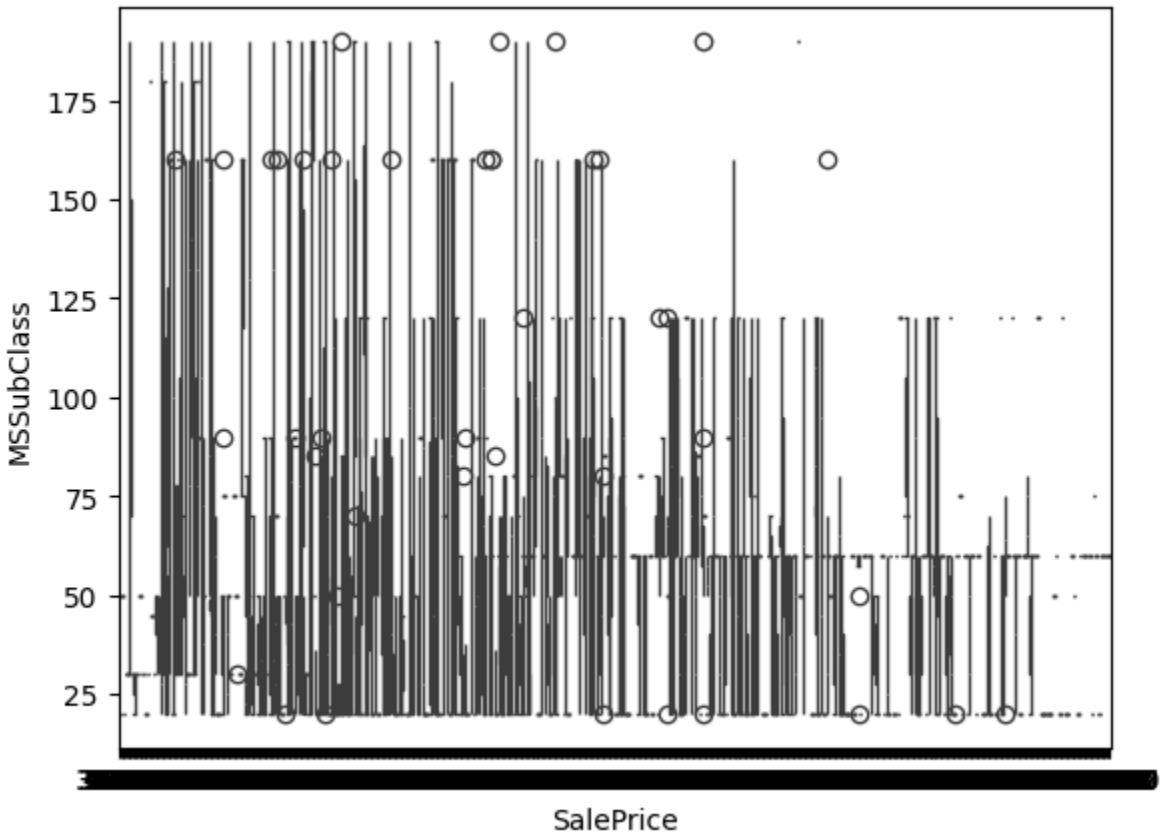
In [319…

```
for i in df.columns:
  sns.boxplot(data=df,x='SalePrice',y=i)
  print(i)
  show()
```

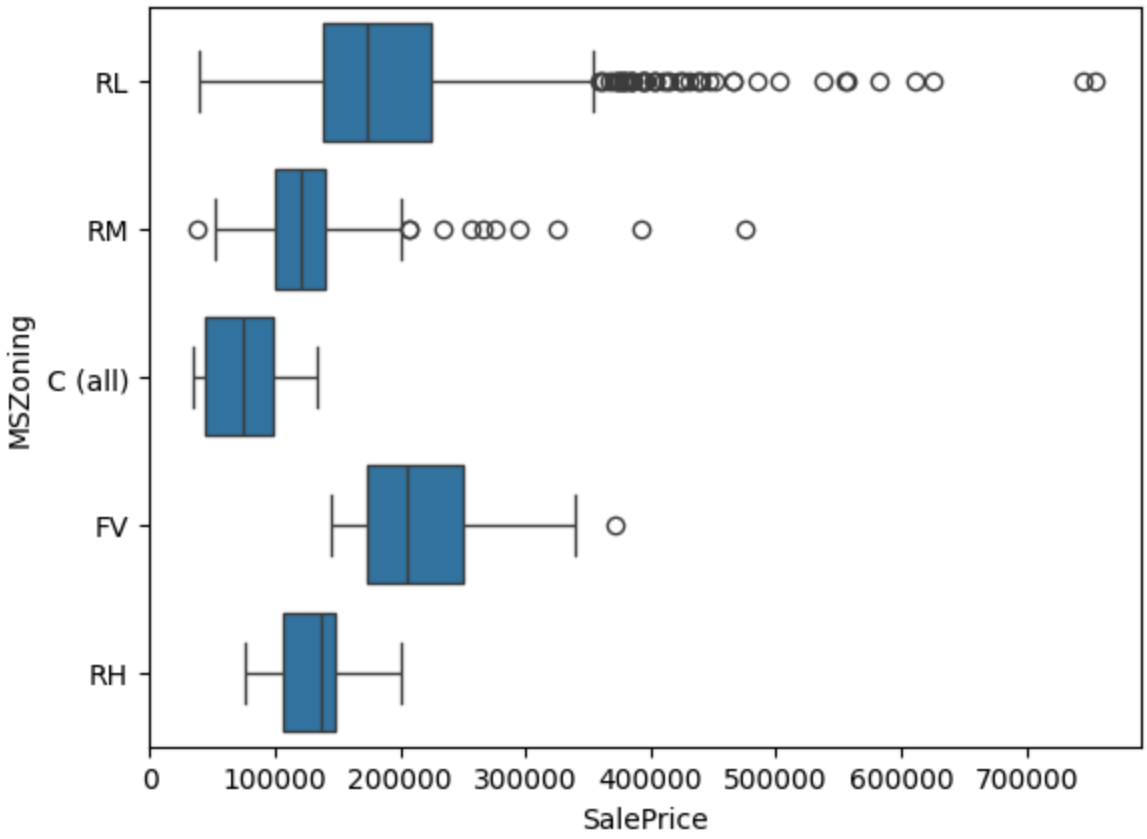
```
Id
```



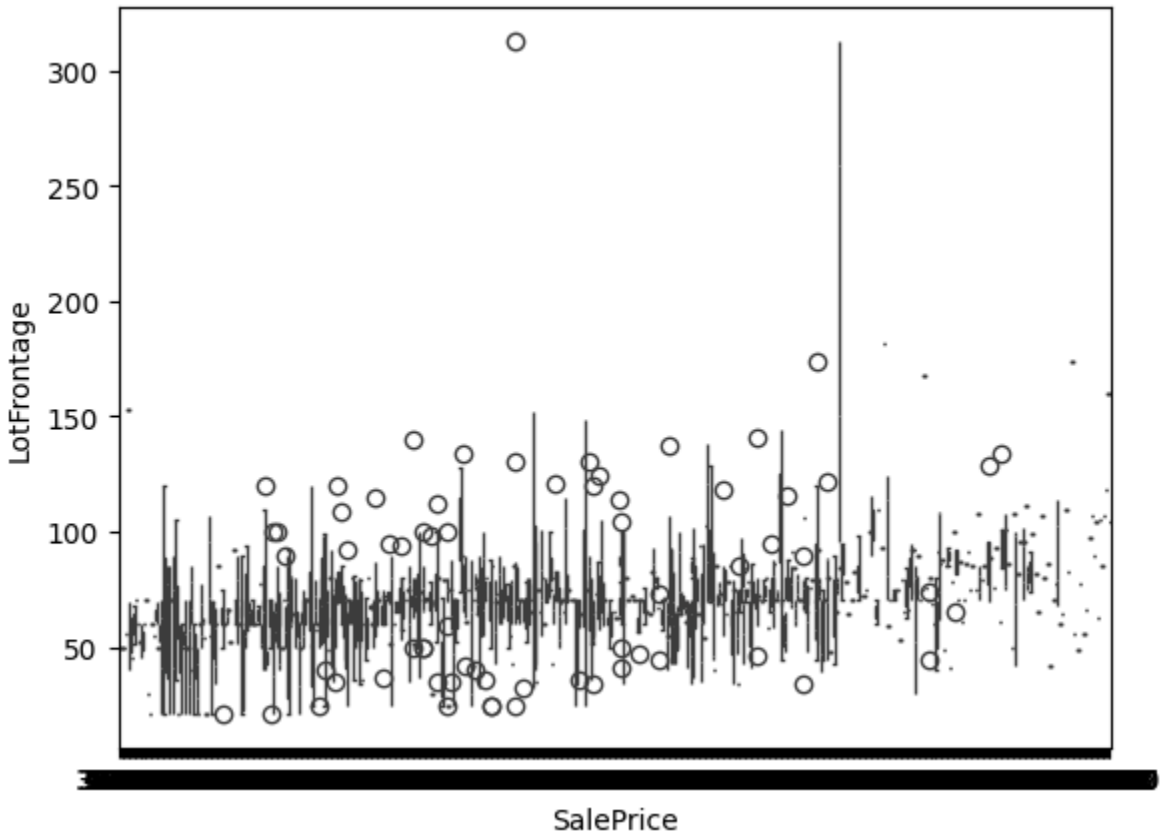
MSSubClass



MSZoning



LotFrontage



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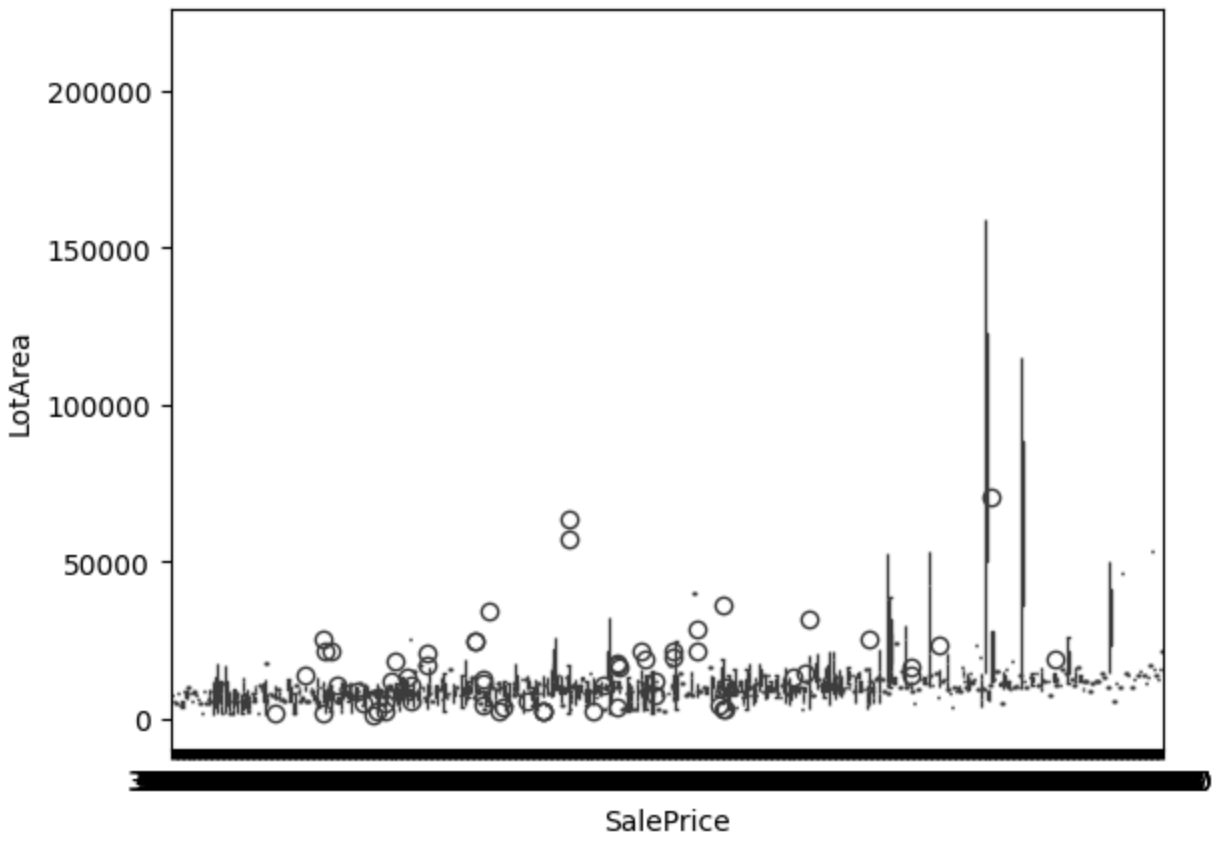

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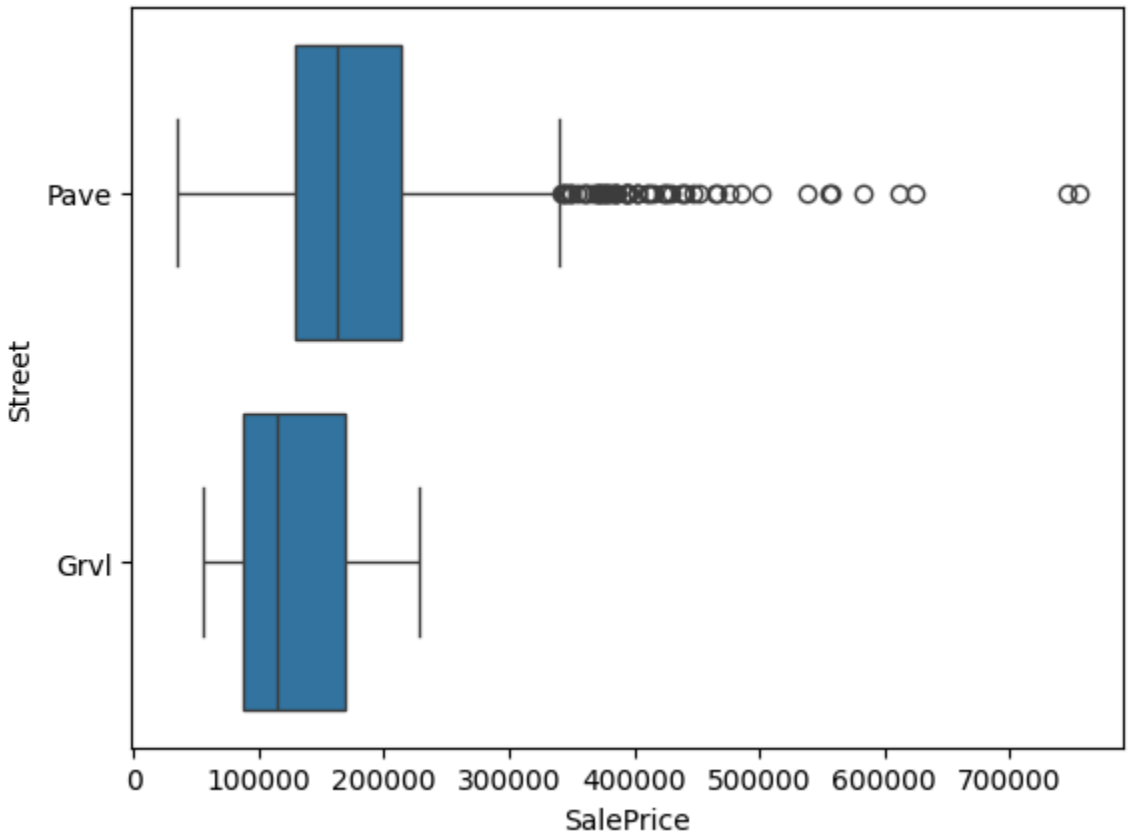

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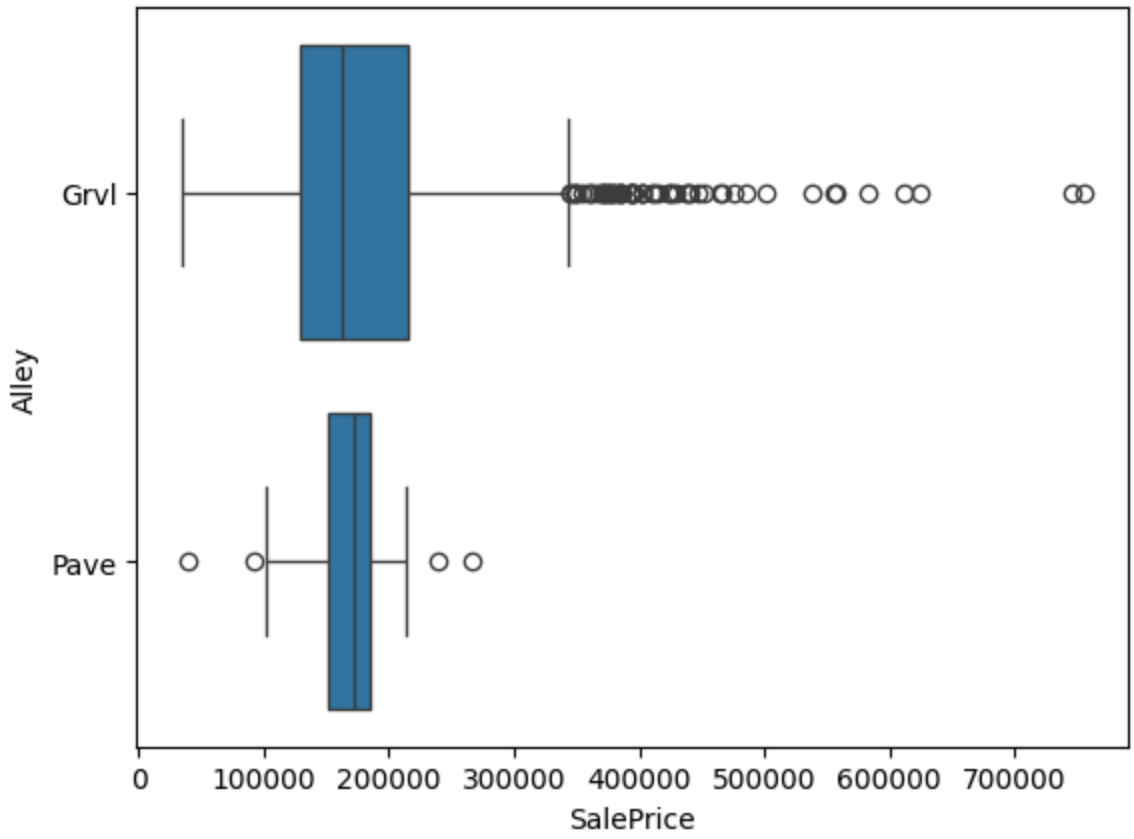

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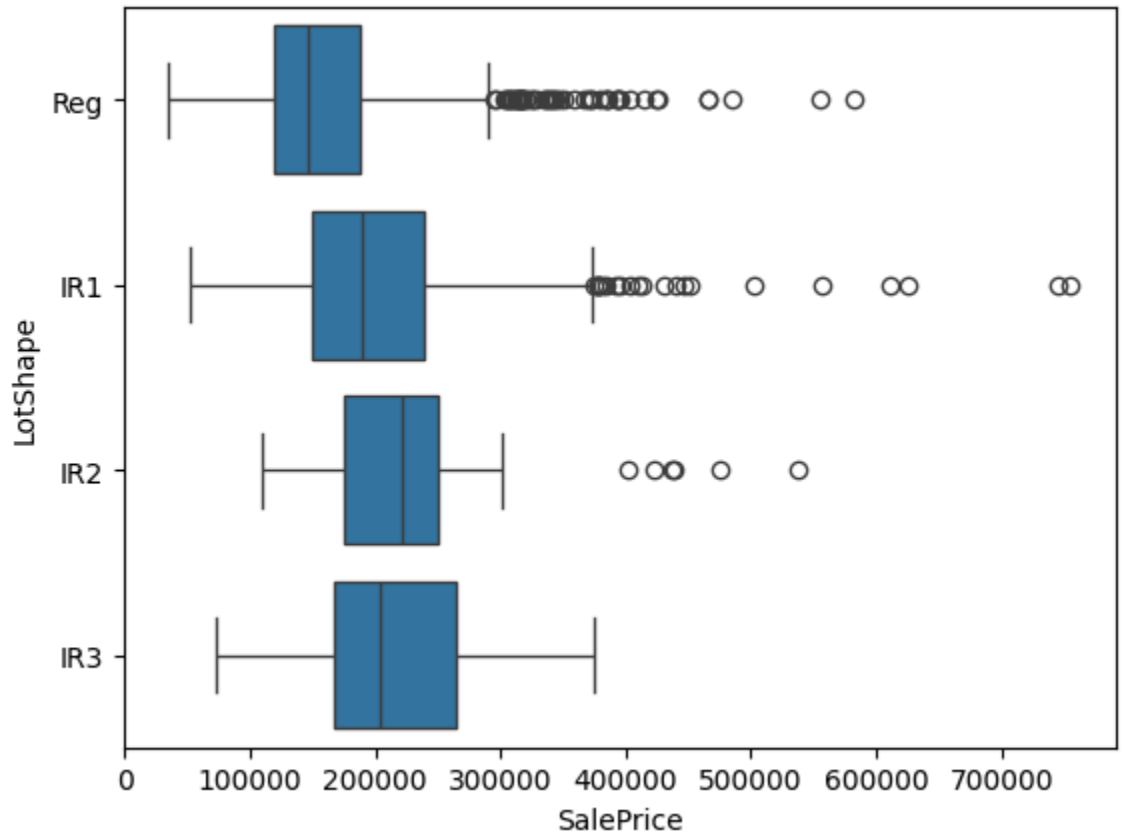

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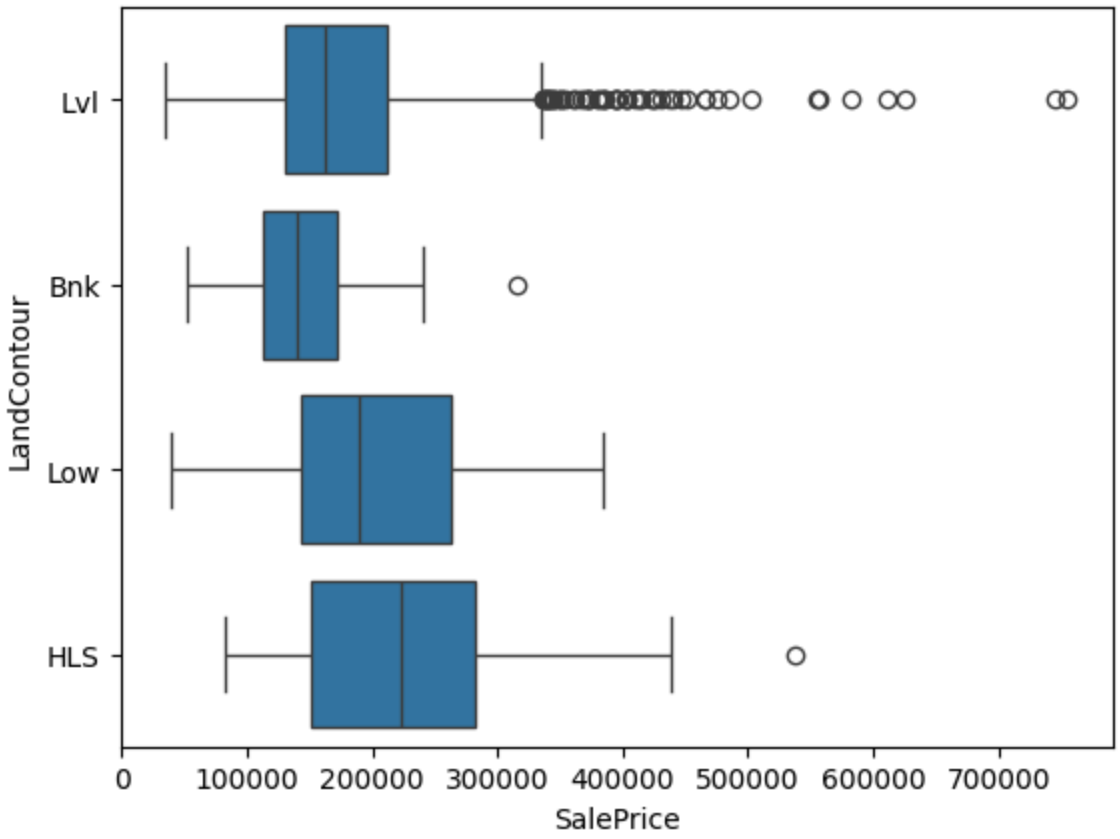

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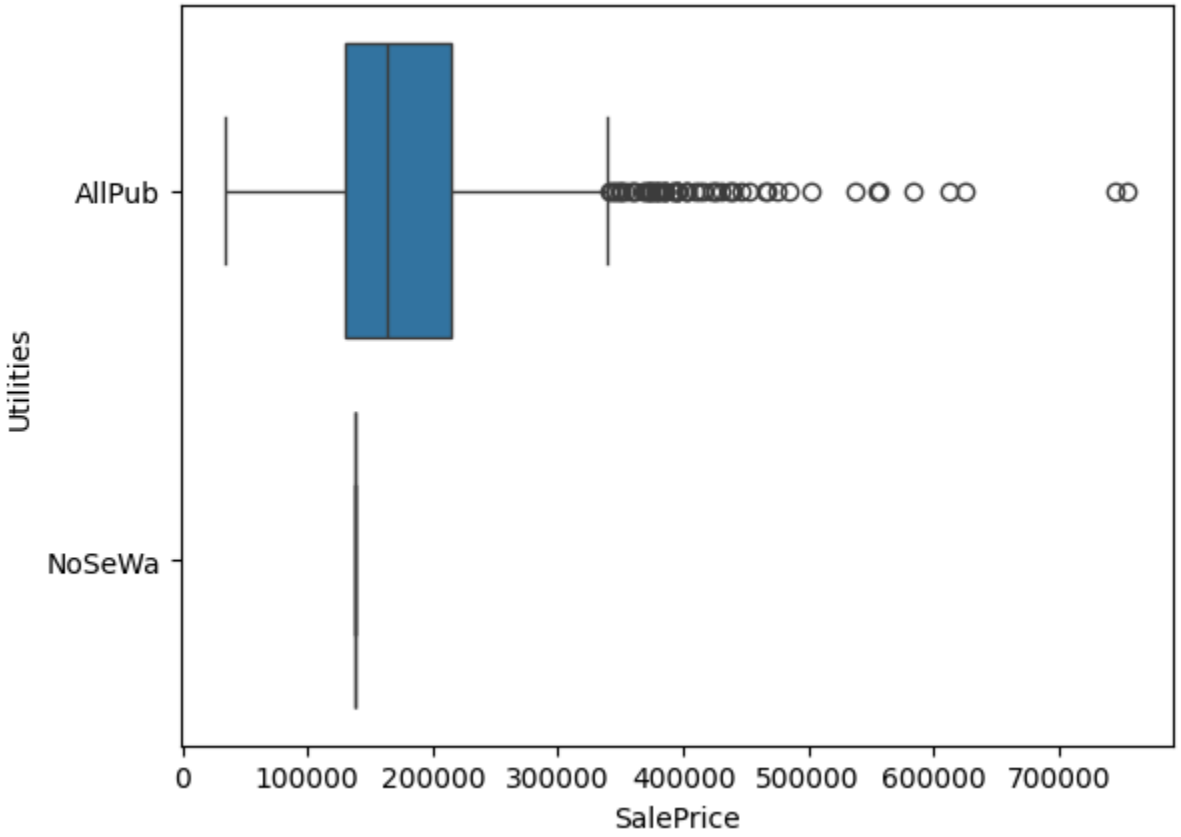

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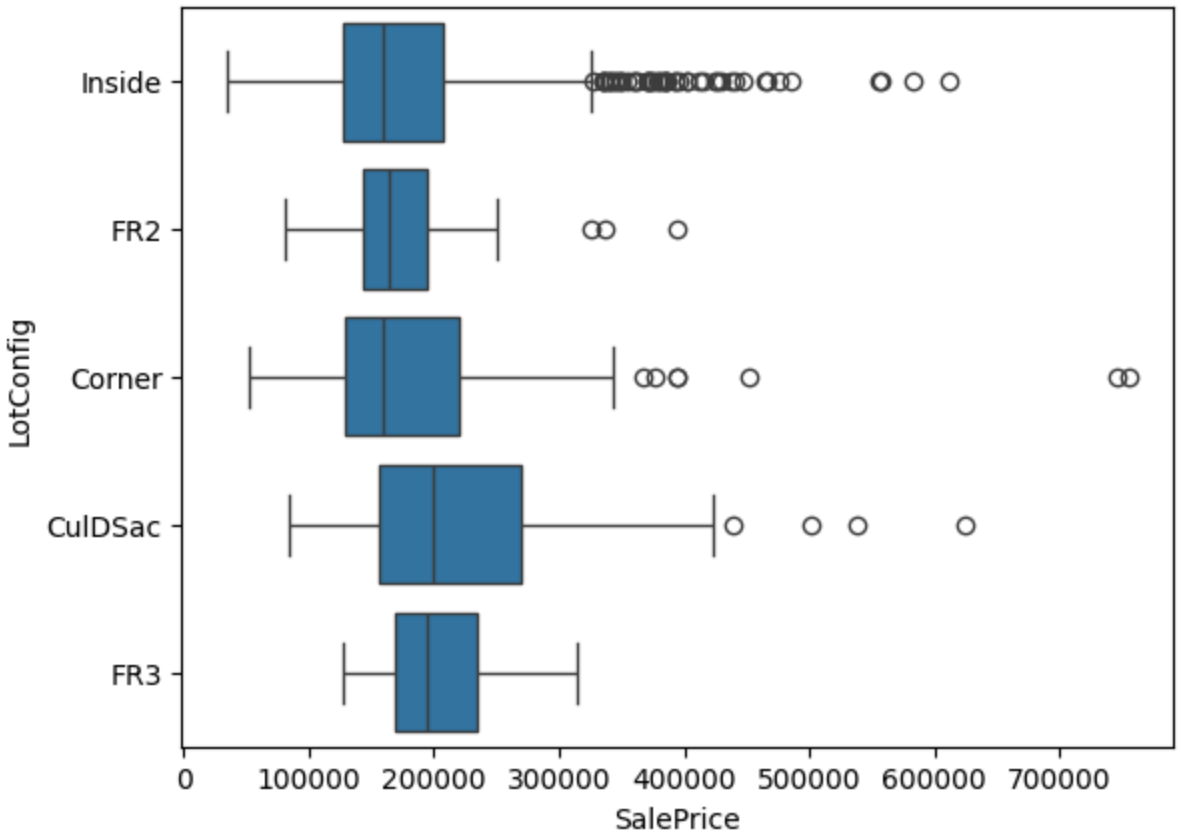

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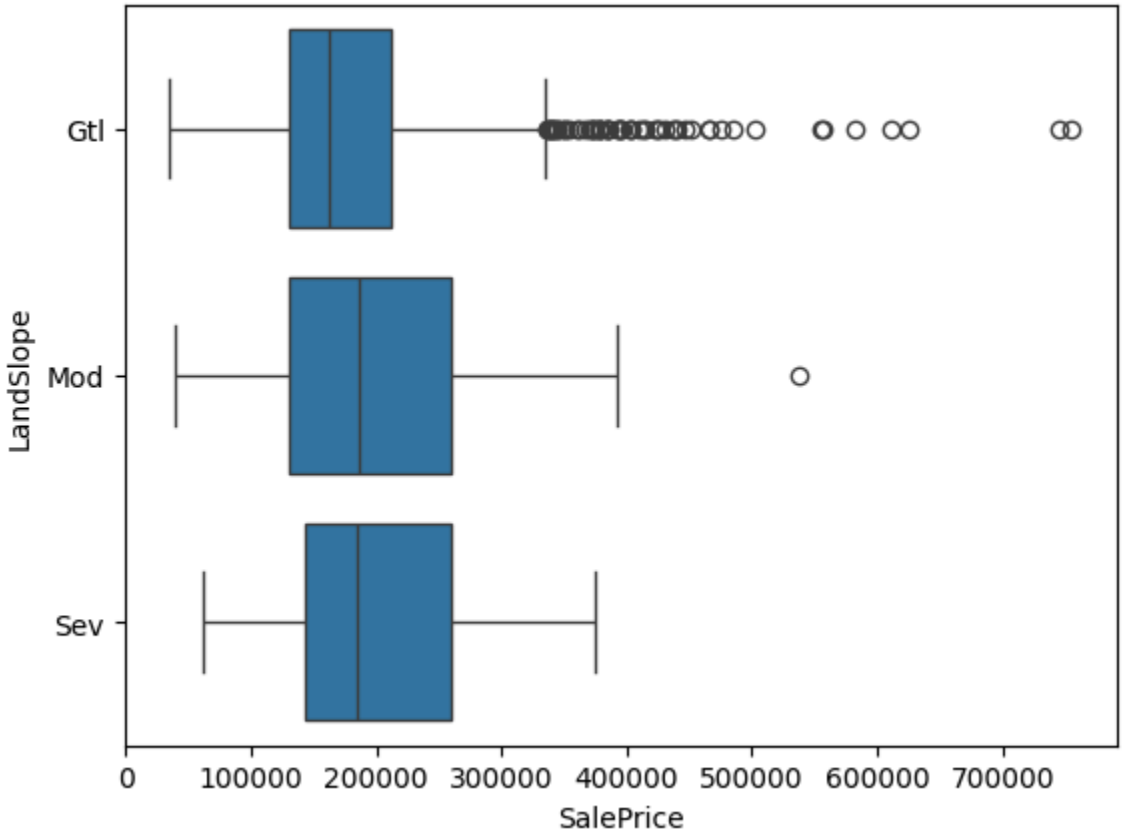

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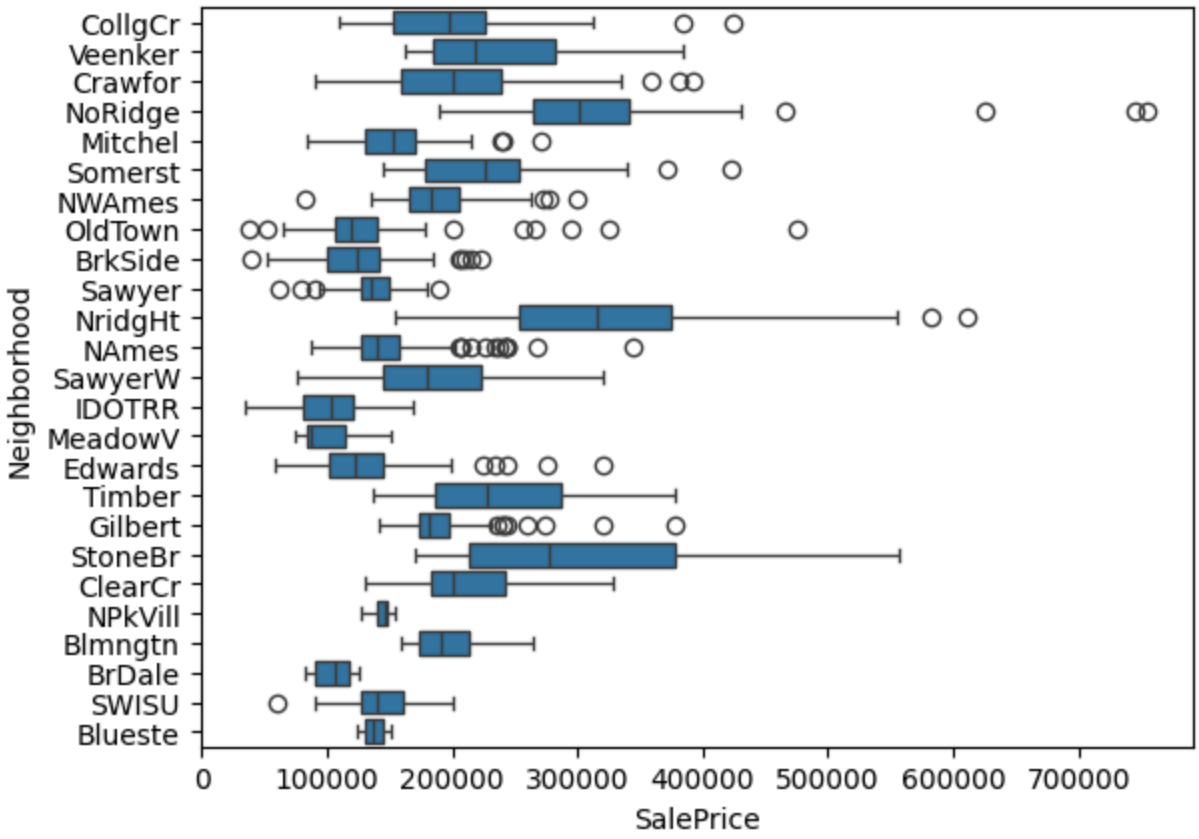

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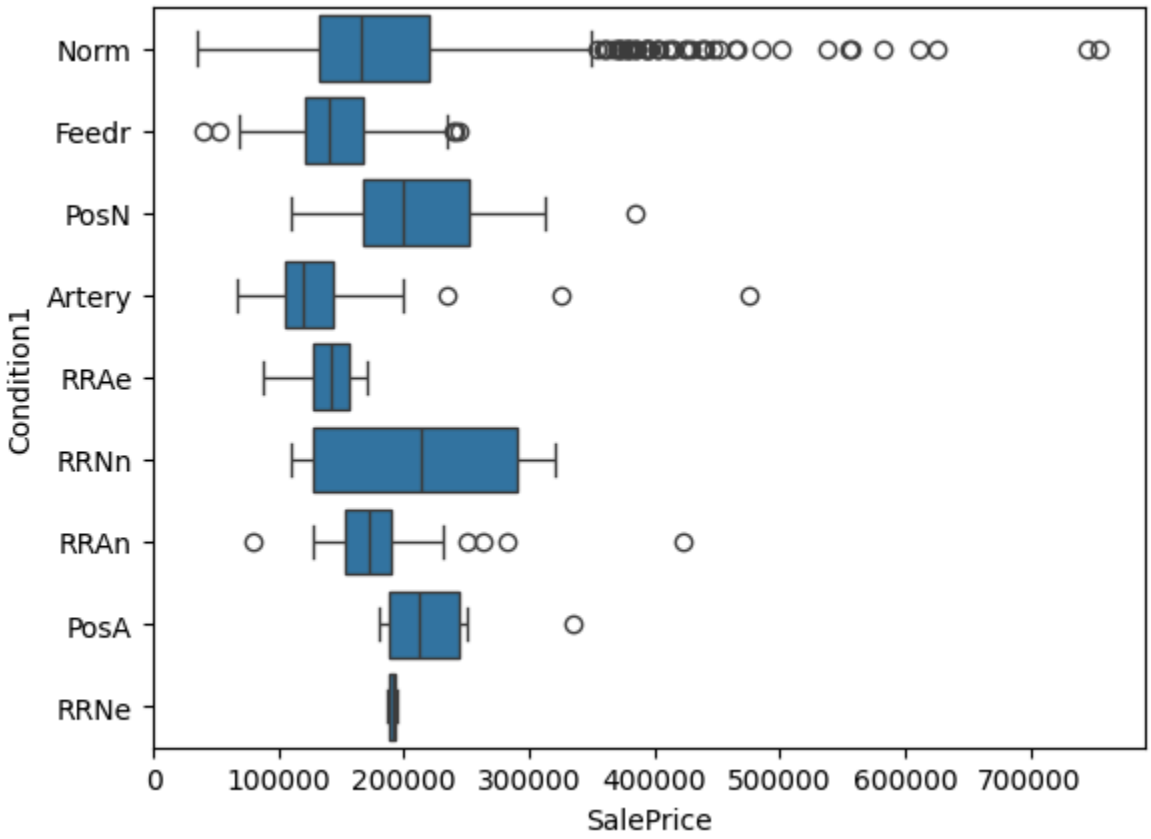

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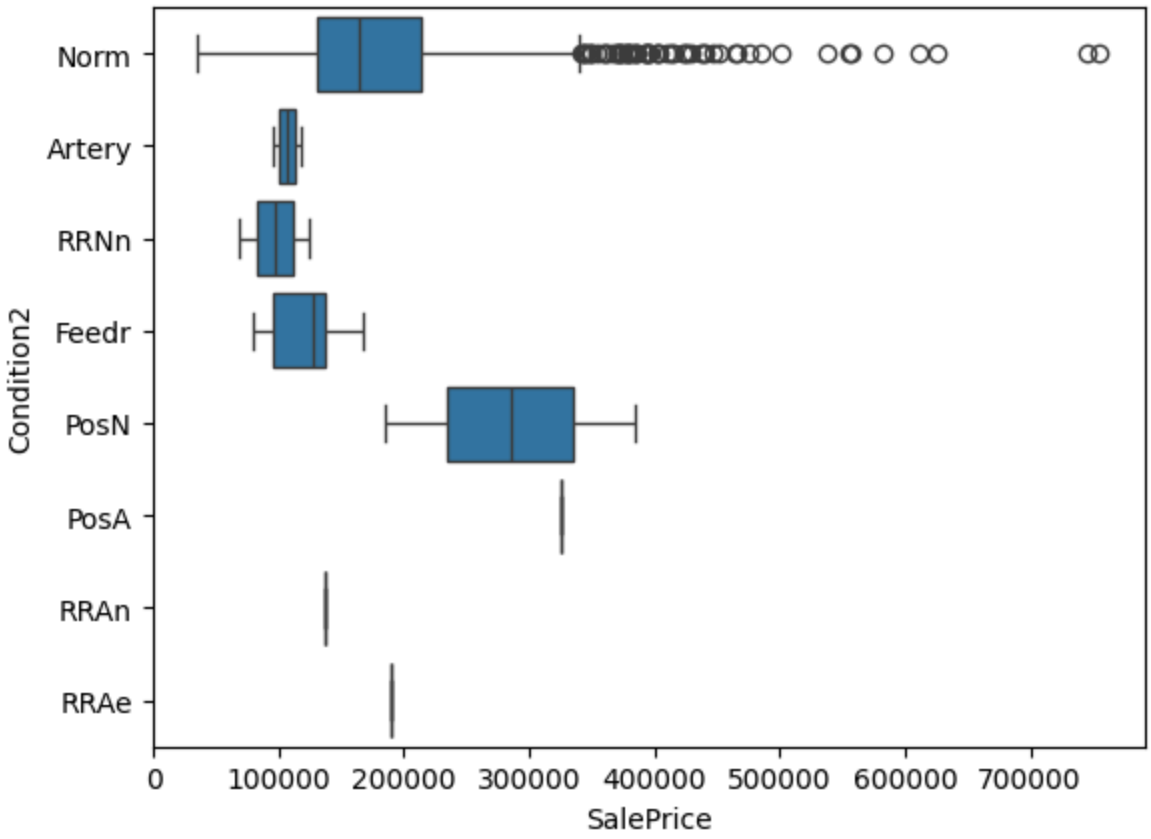

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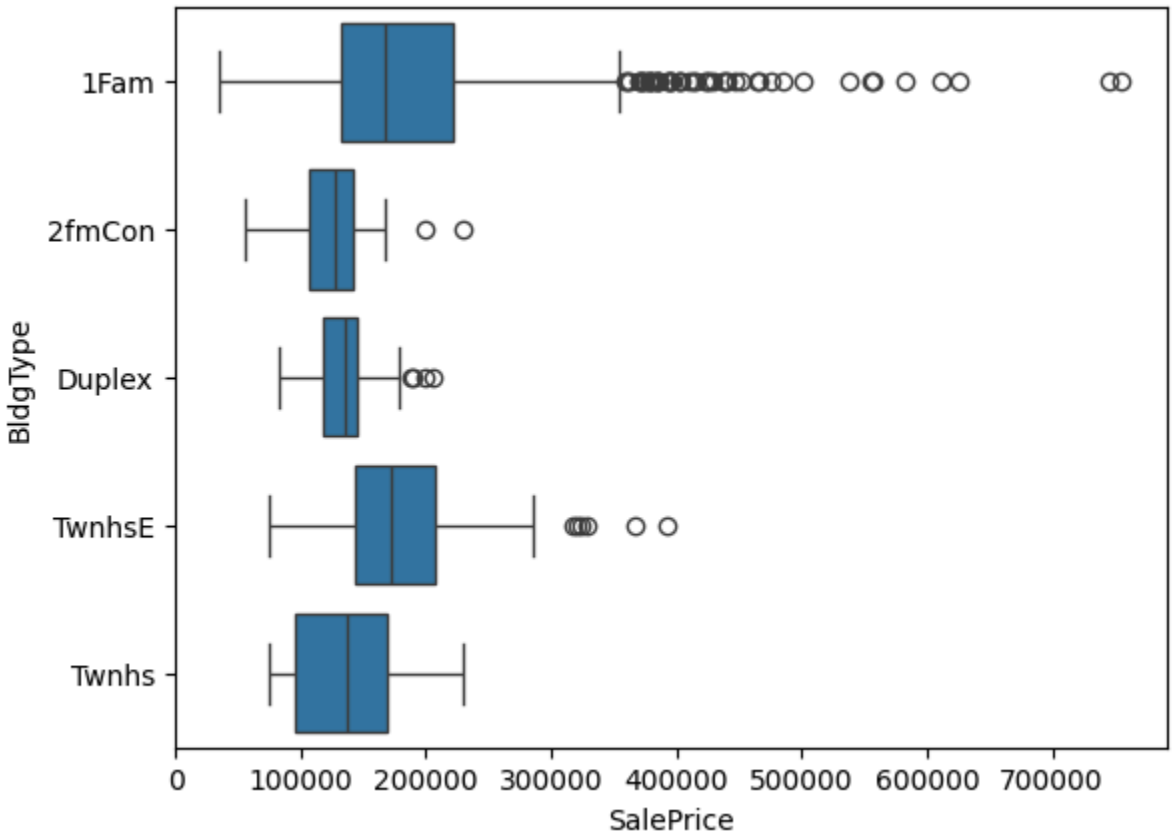

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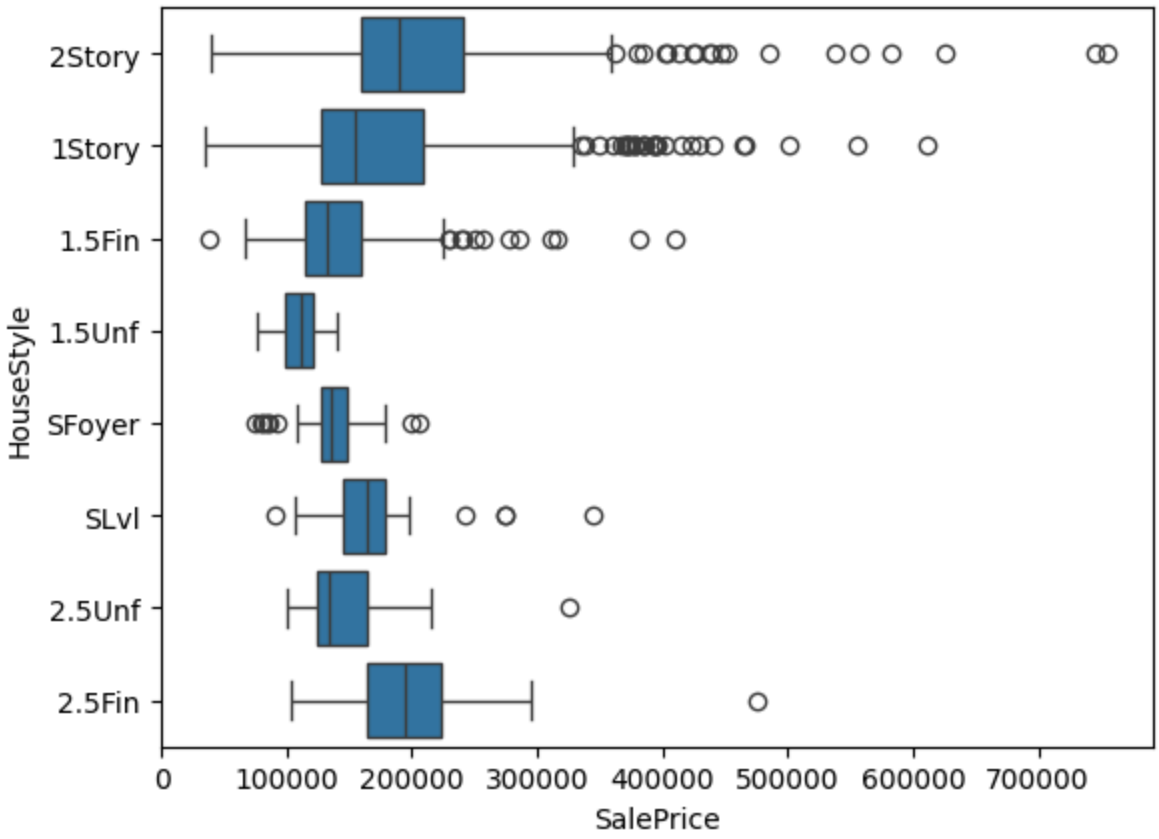

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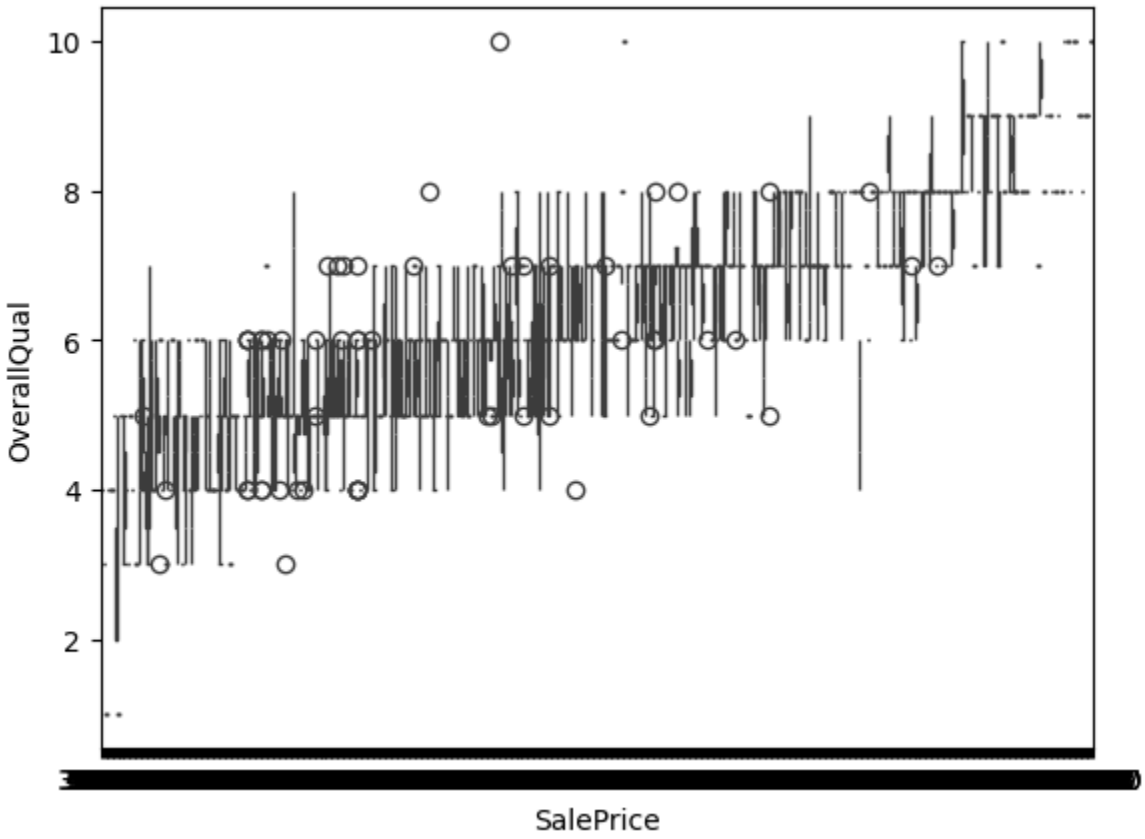

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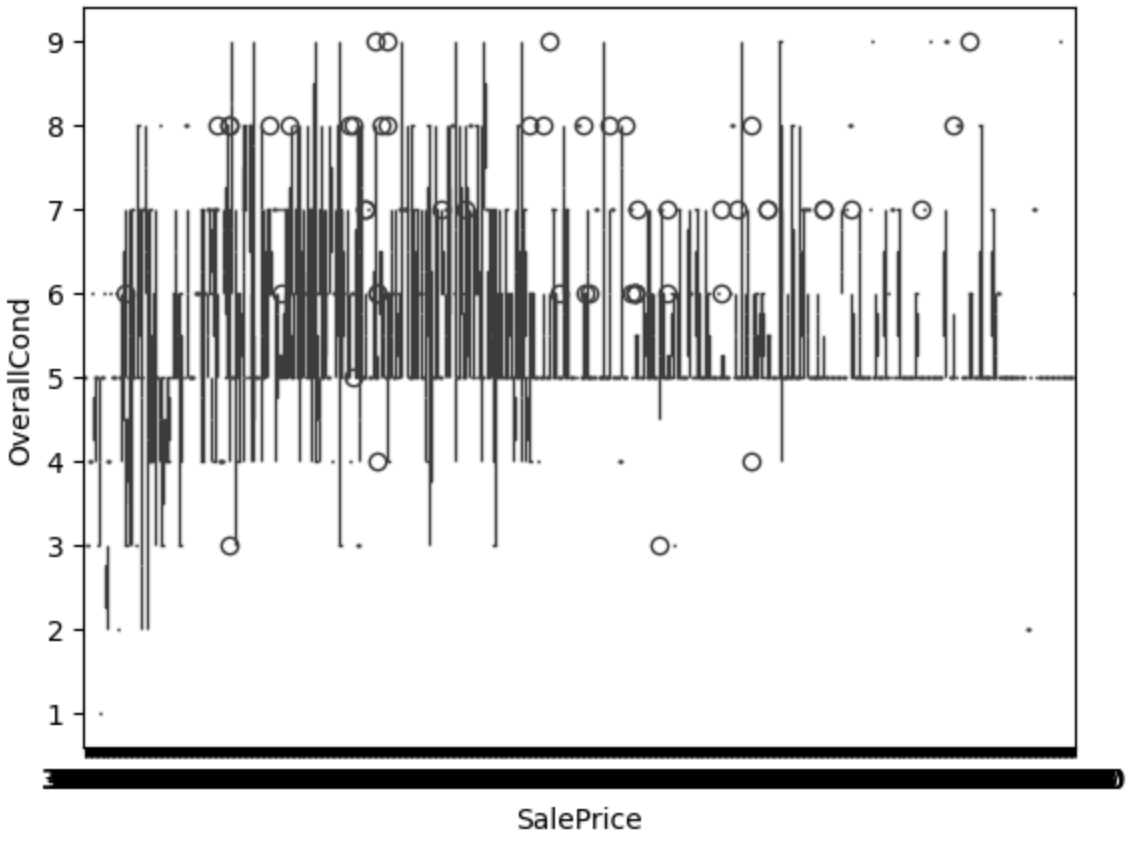

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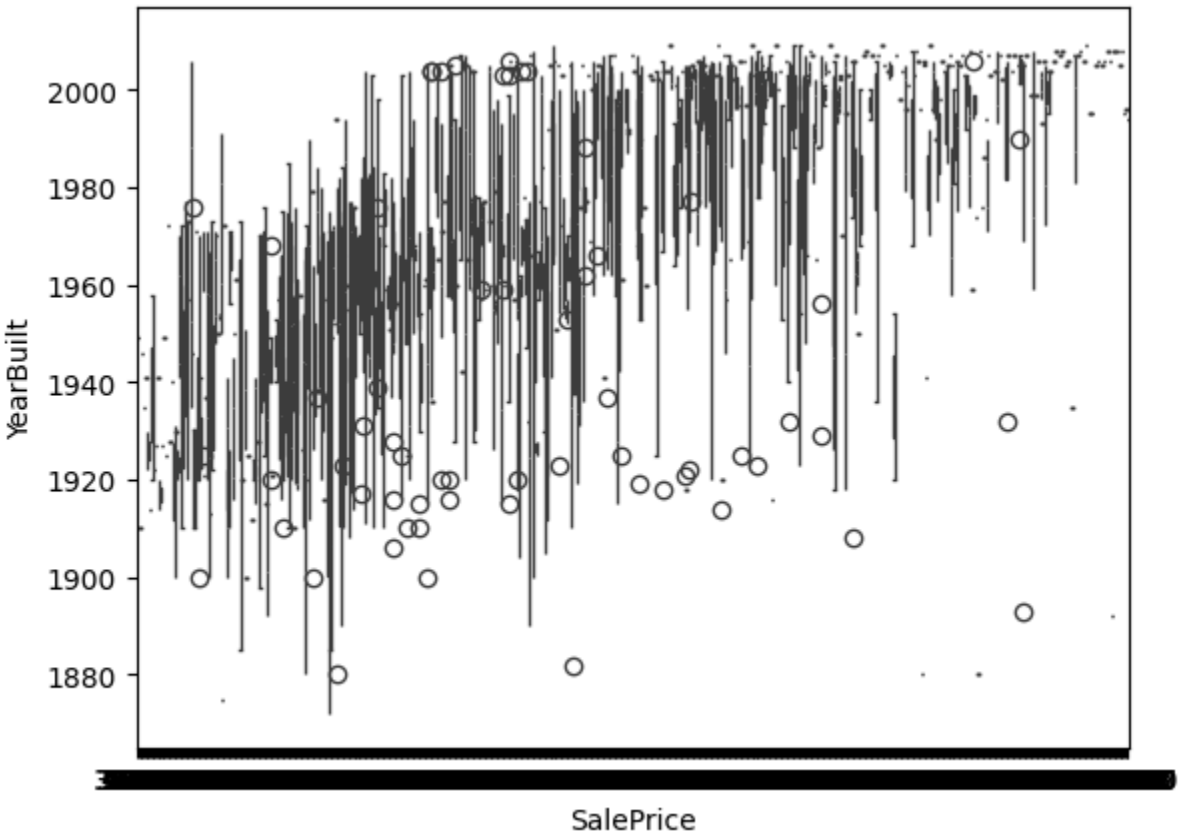

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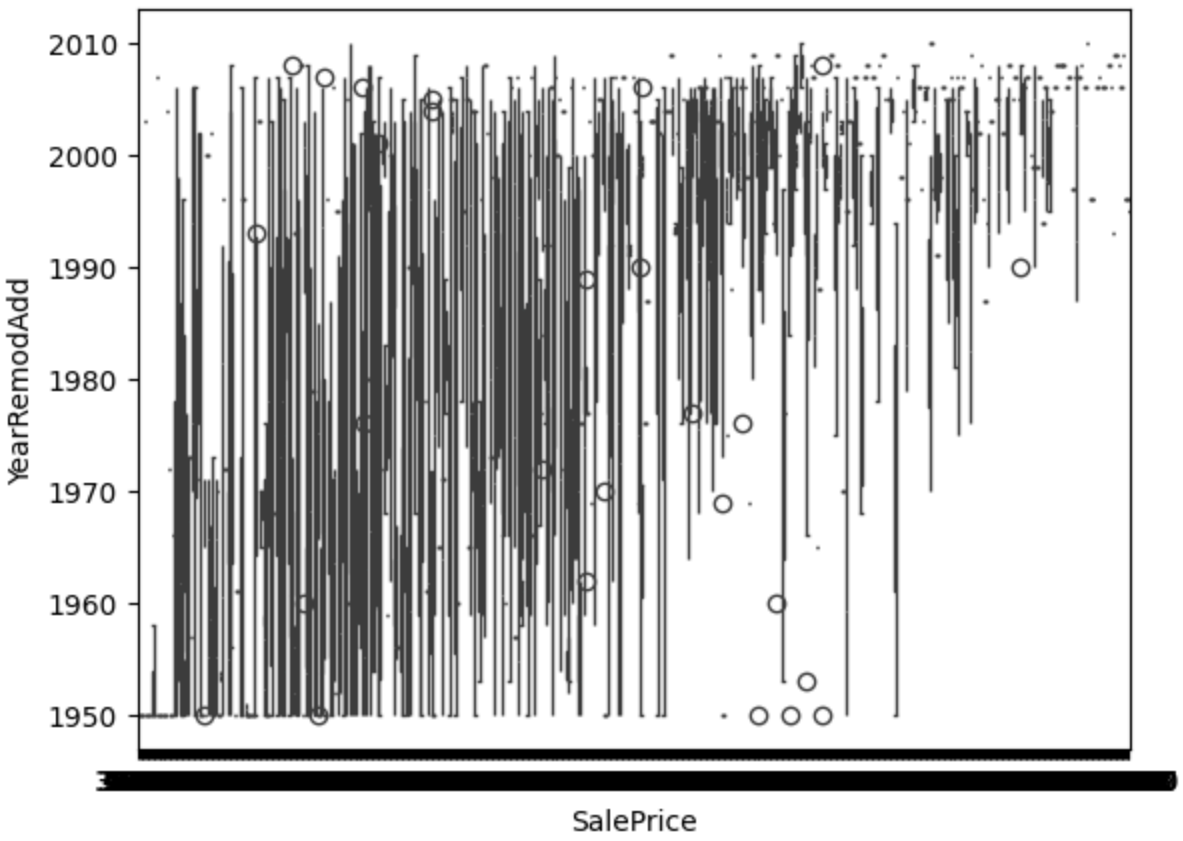

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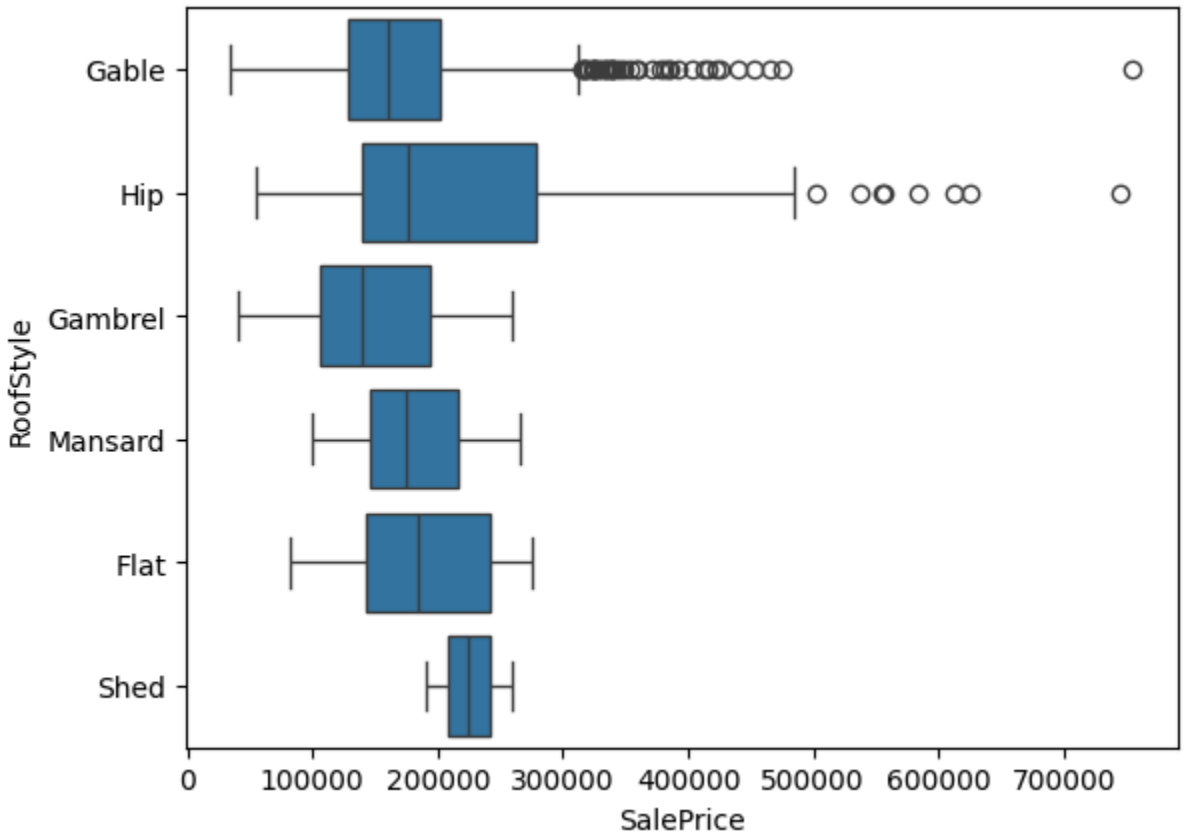

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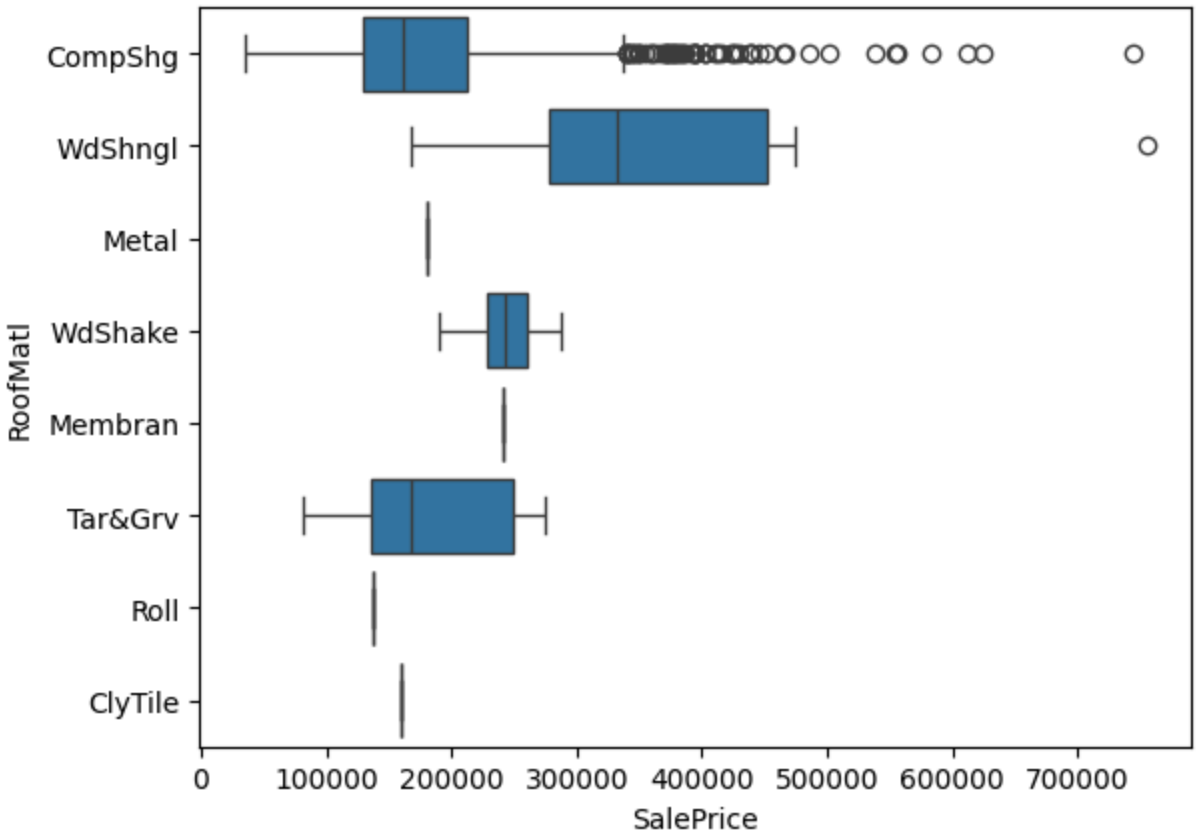

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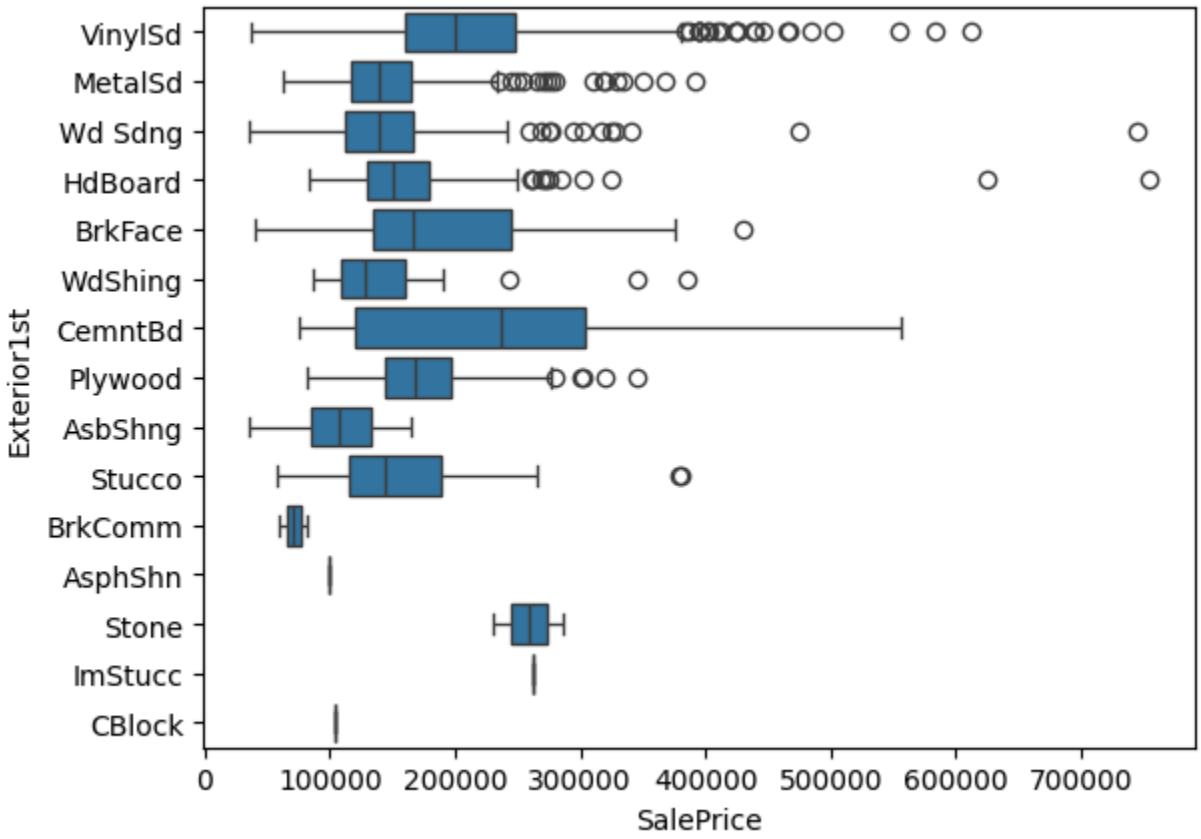

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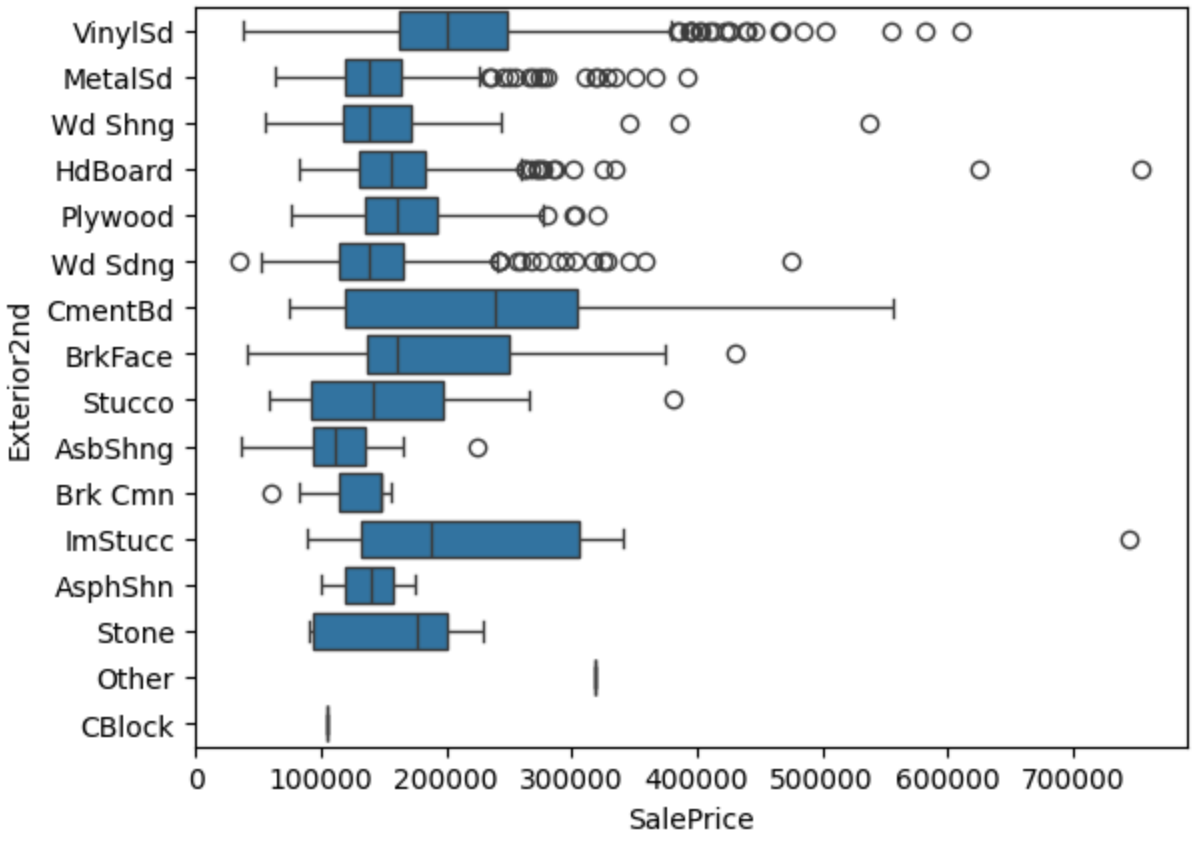

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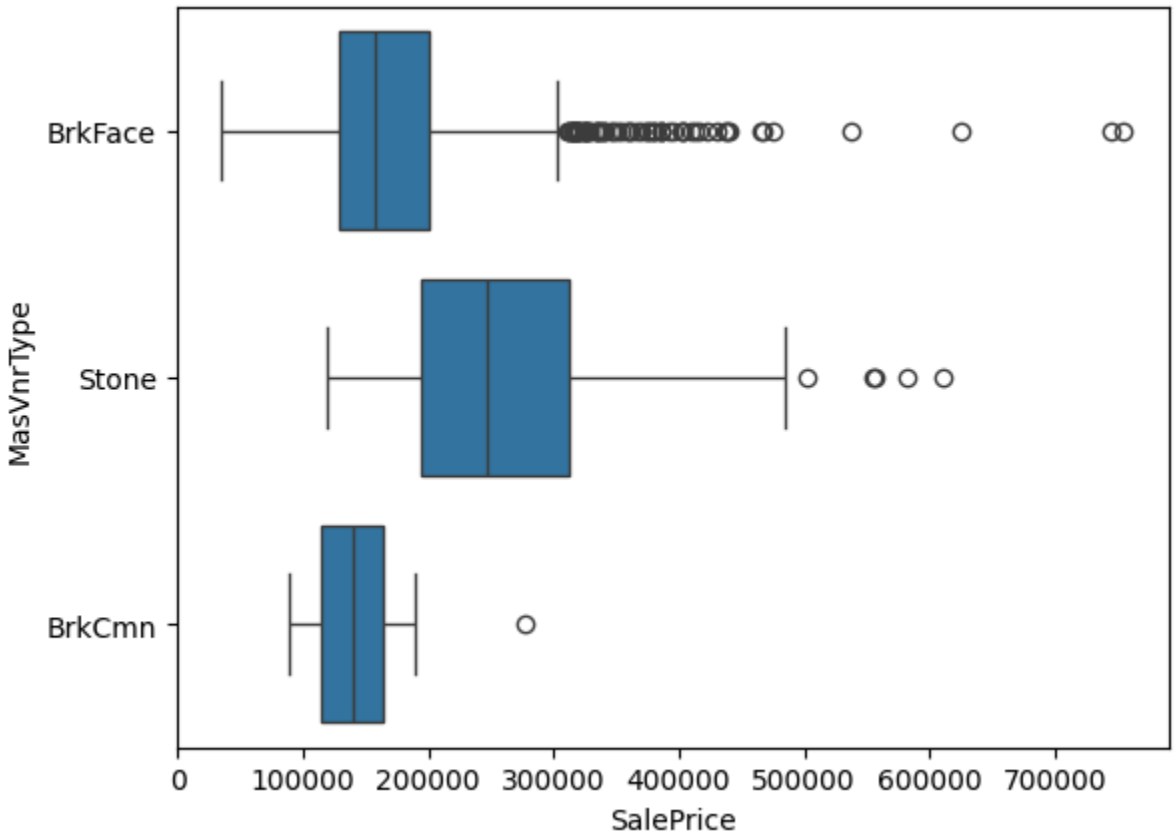

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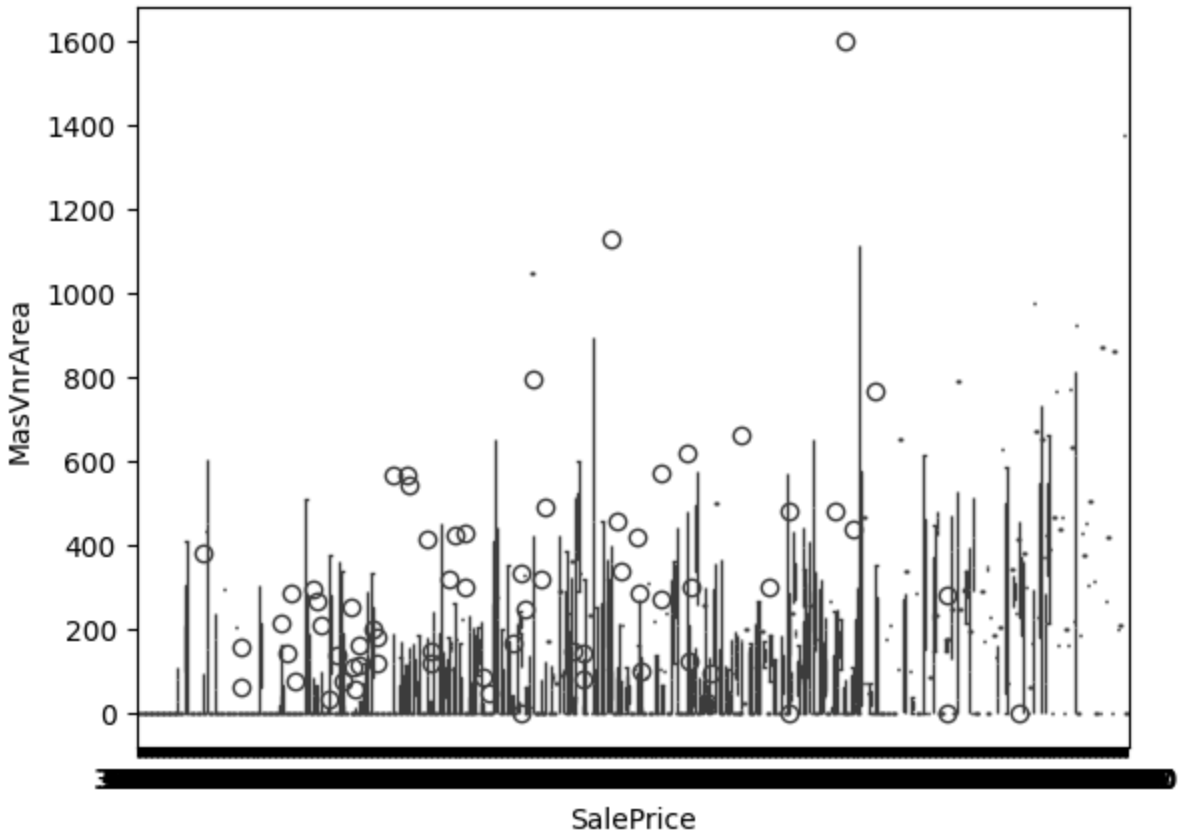

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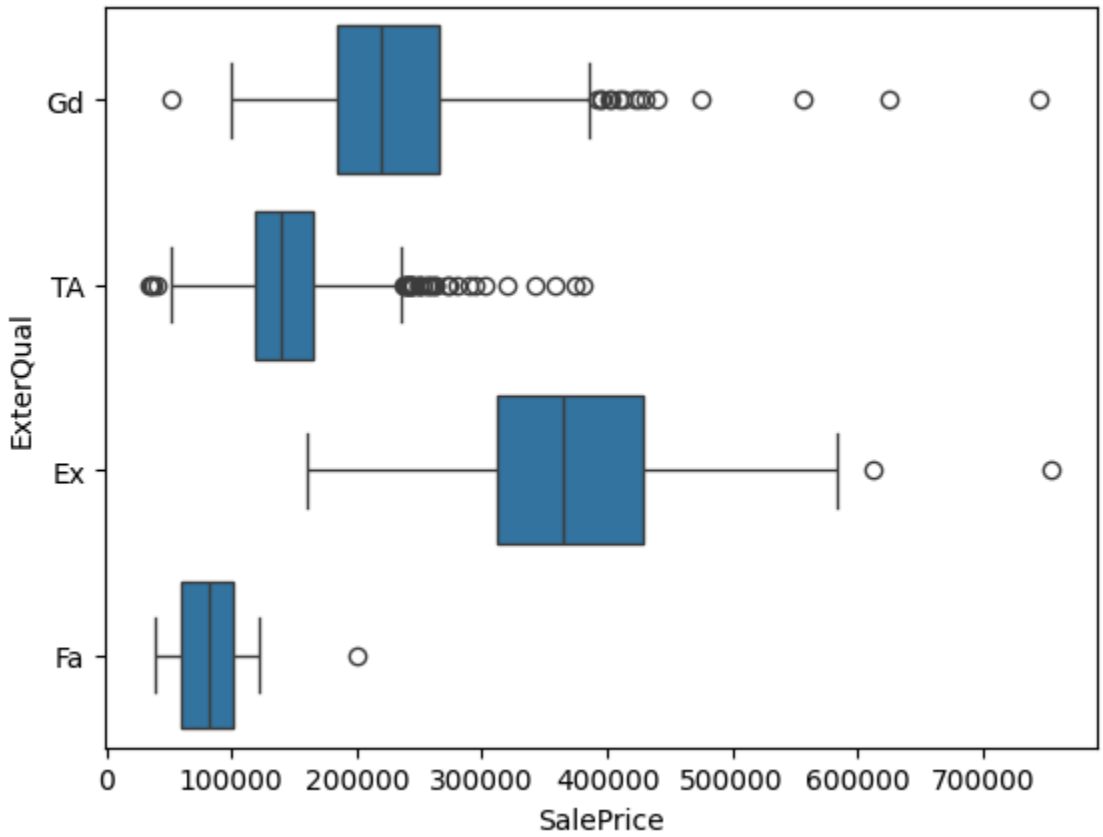

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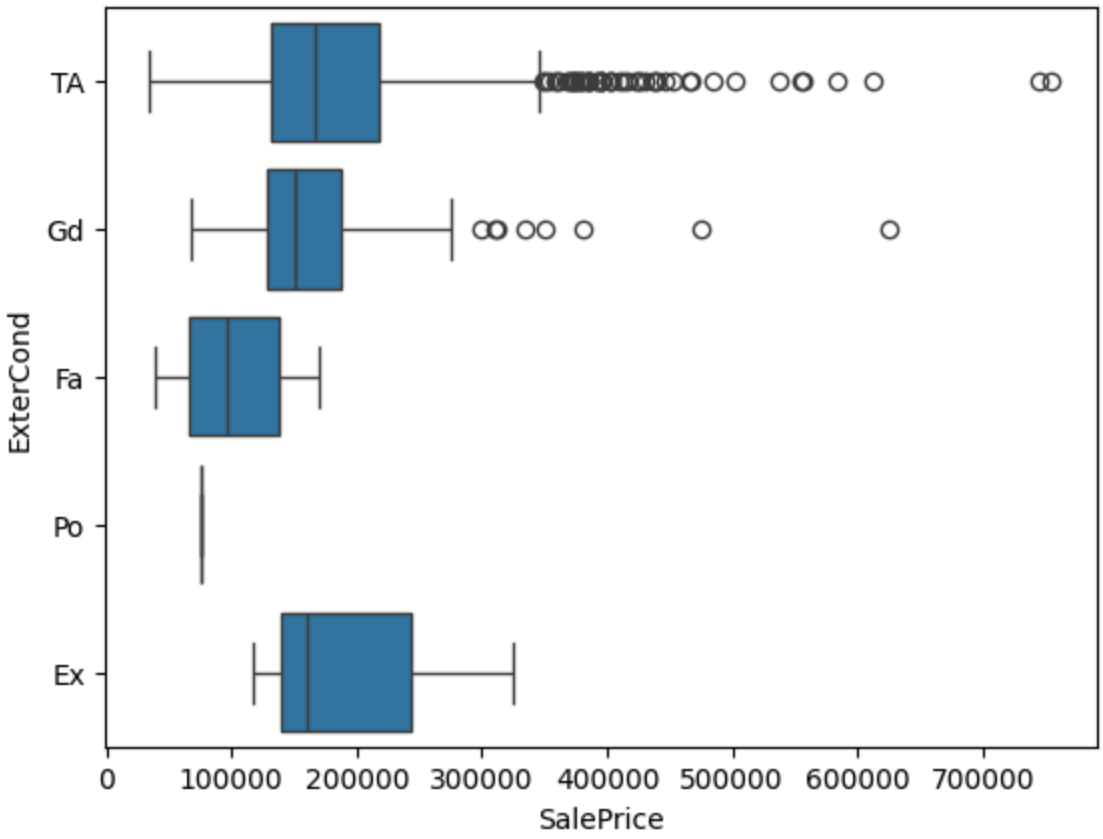

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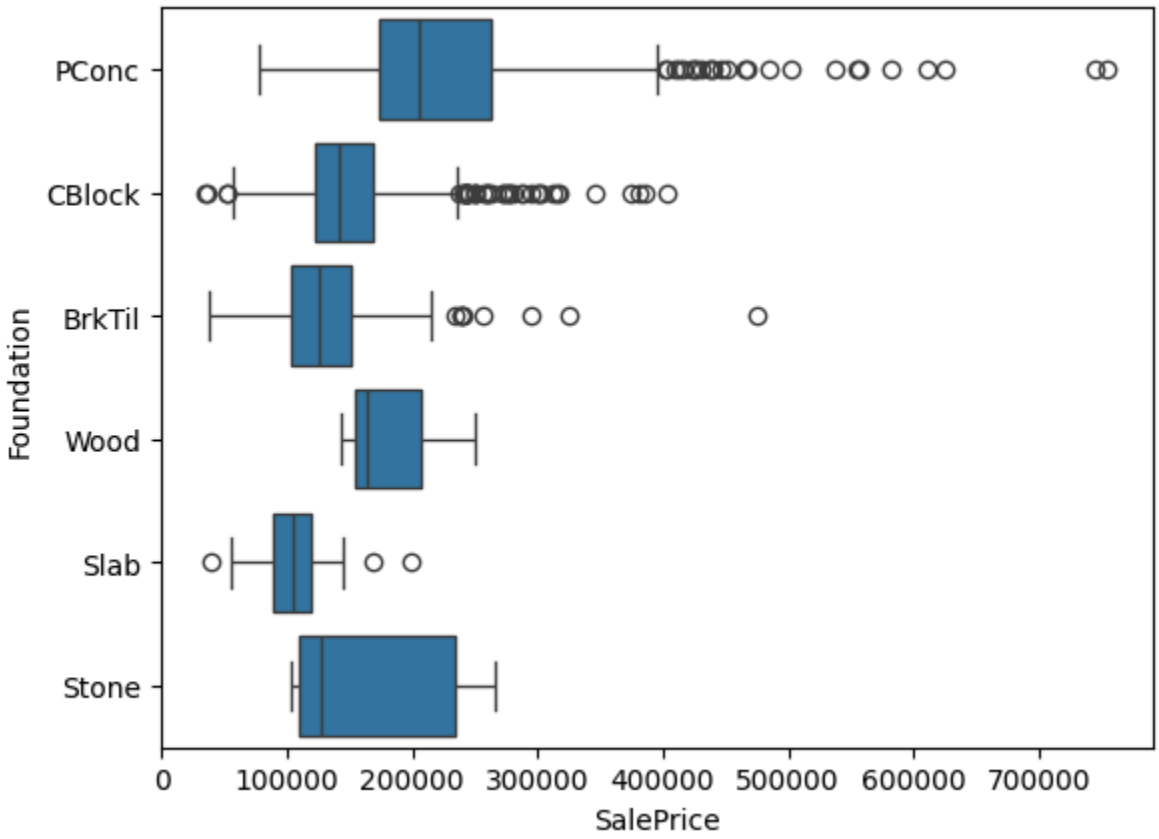

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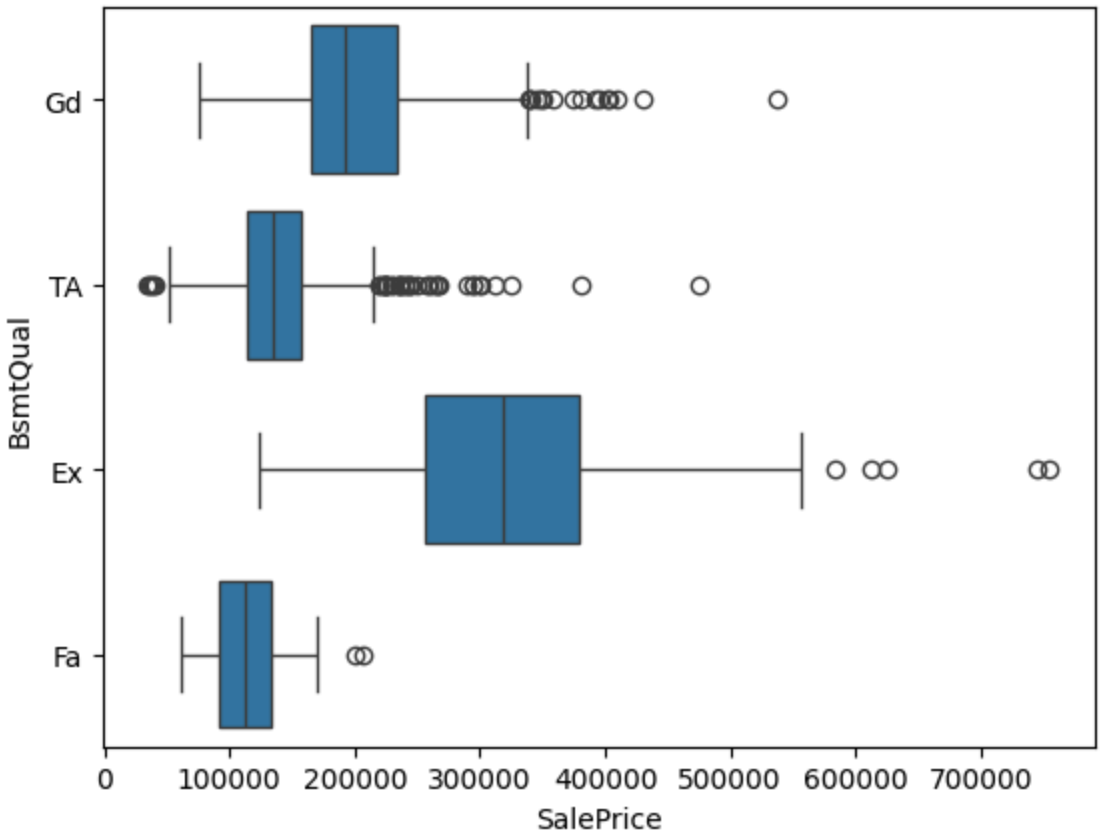

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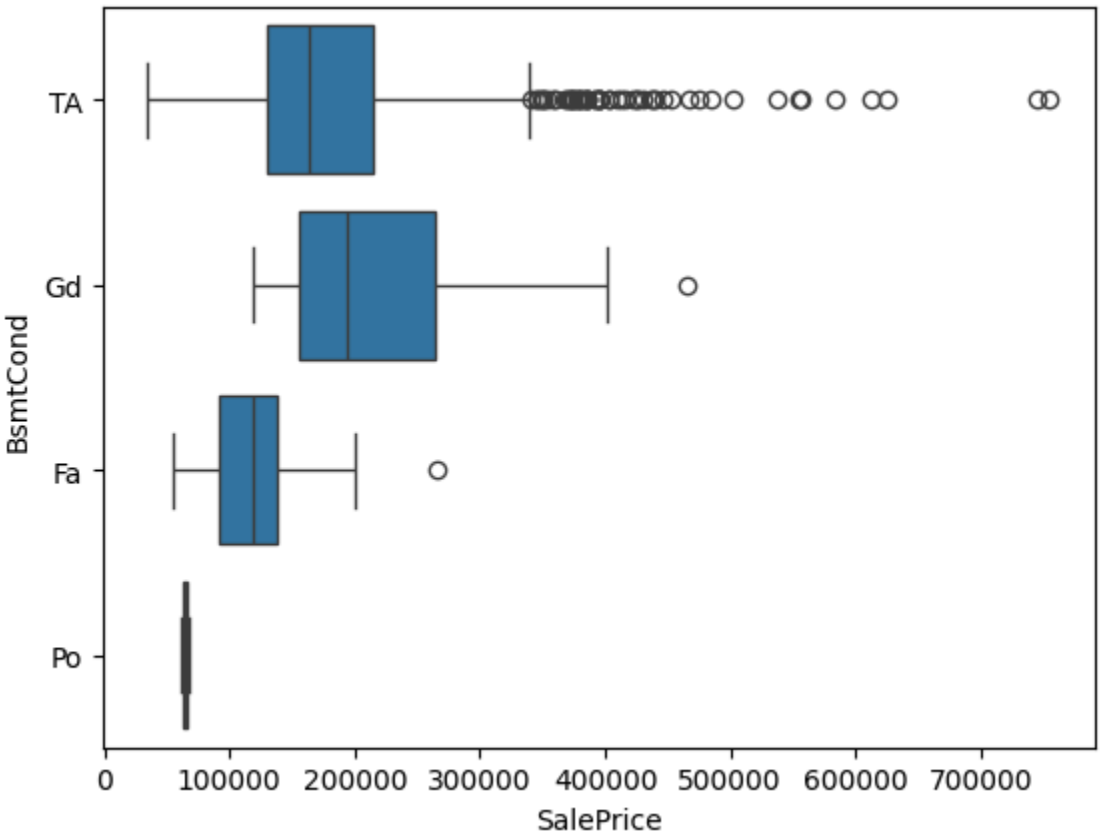

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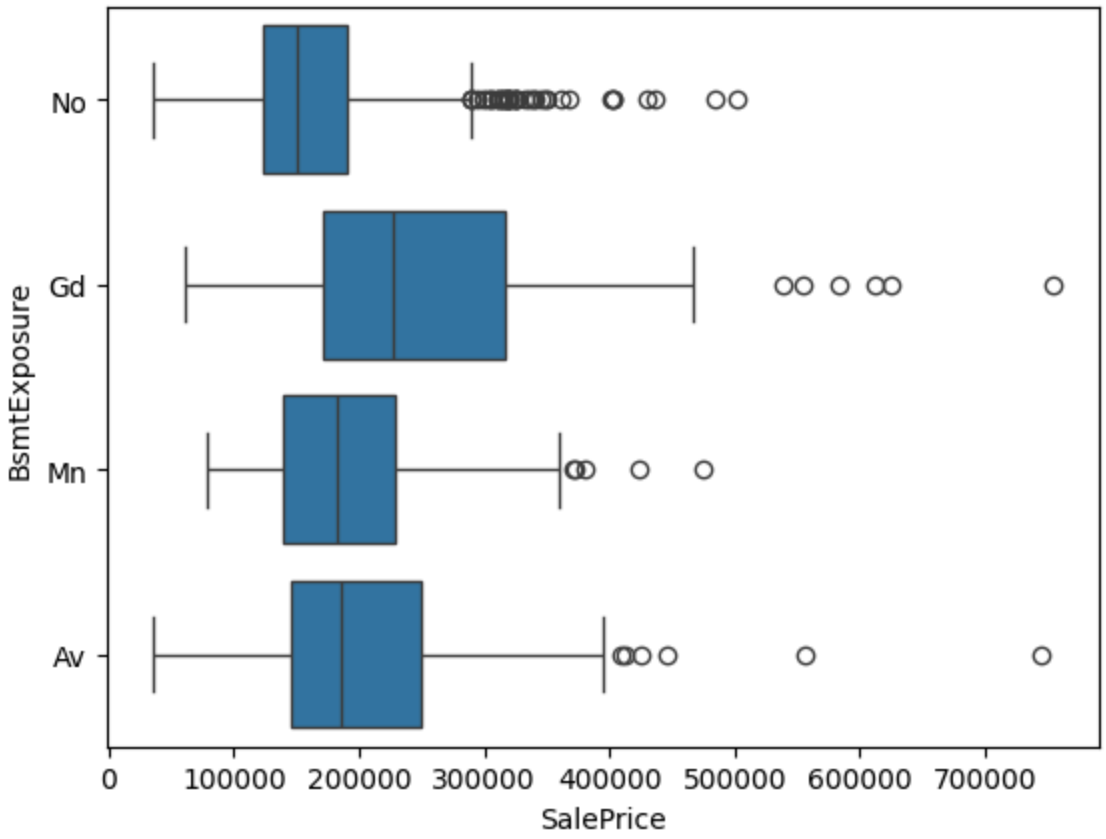

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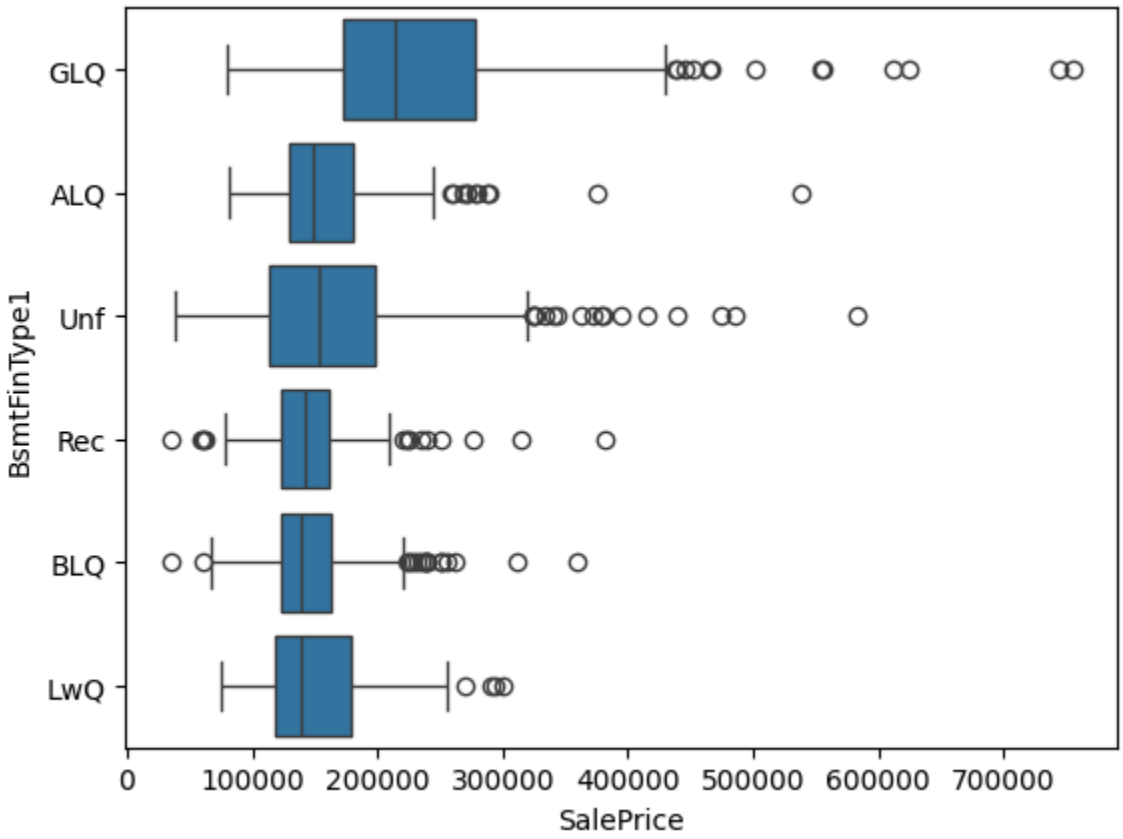

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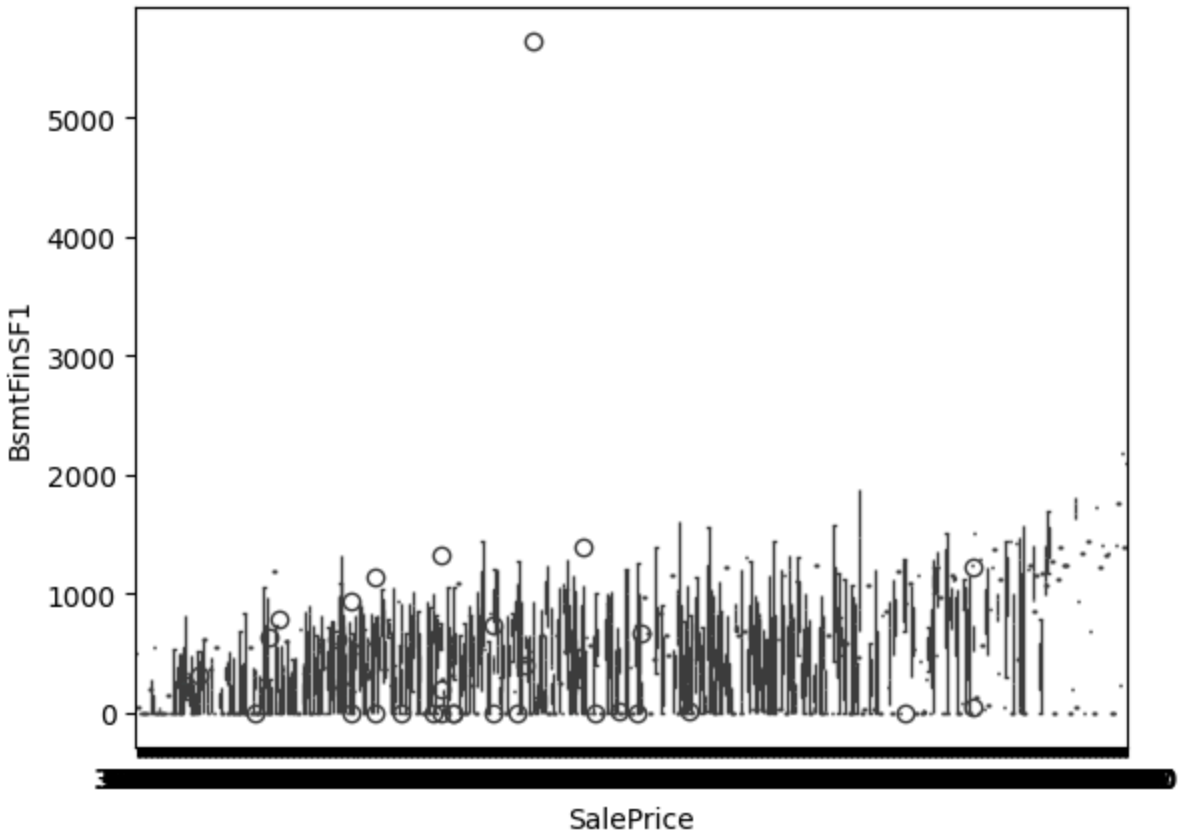

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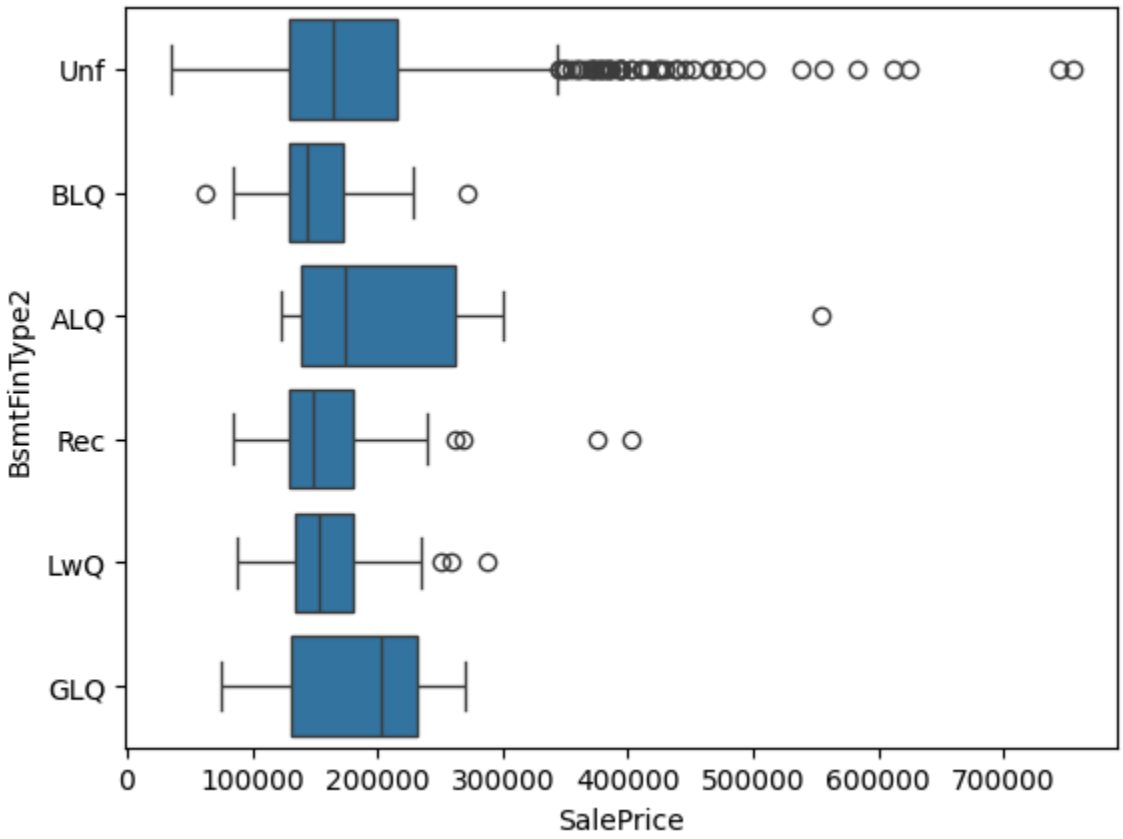

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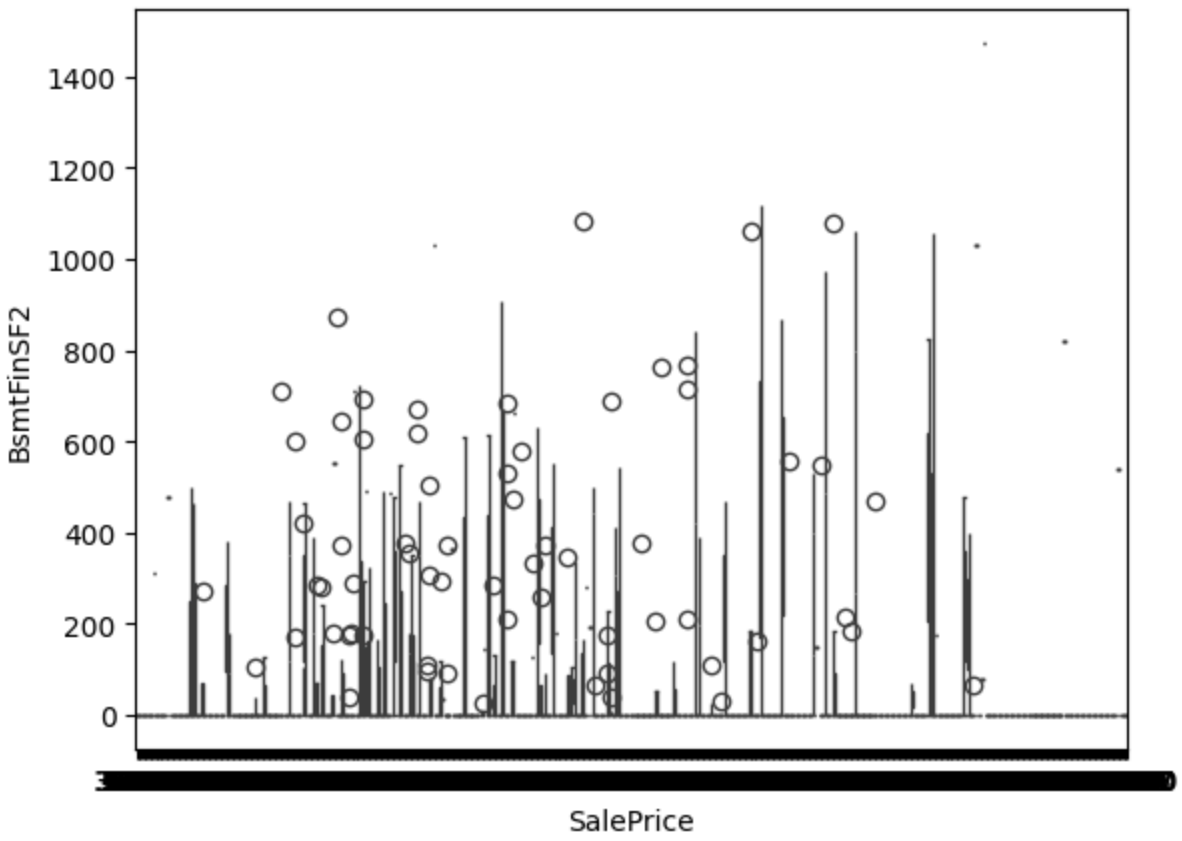

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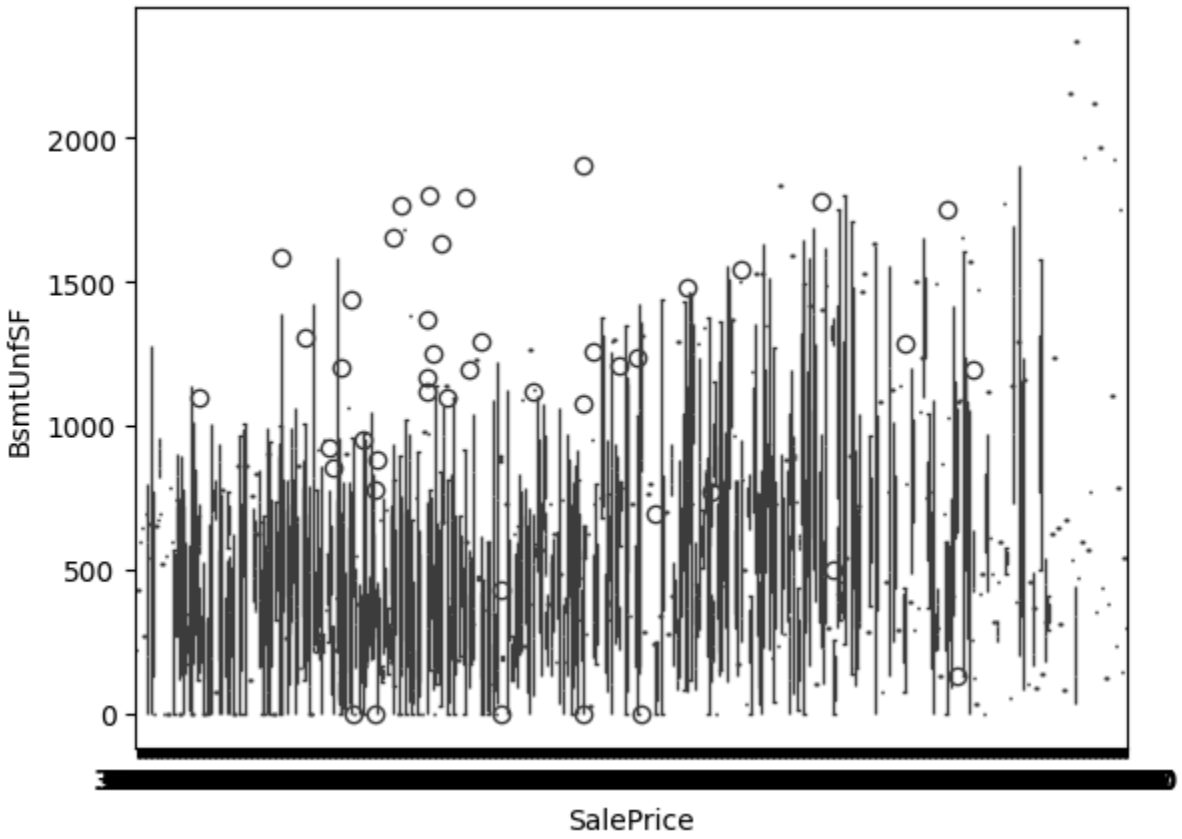

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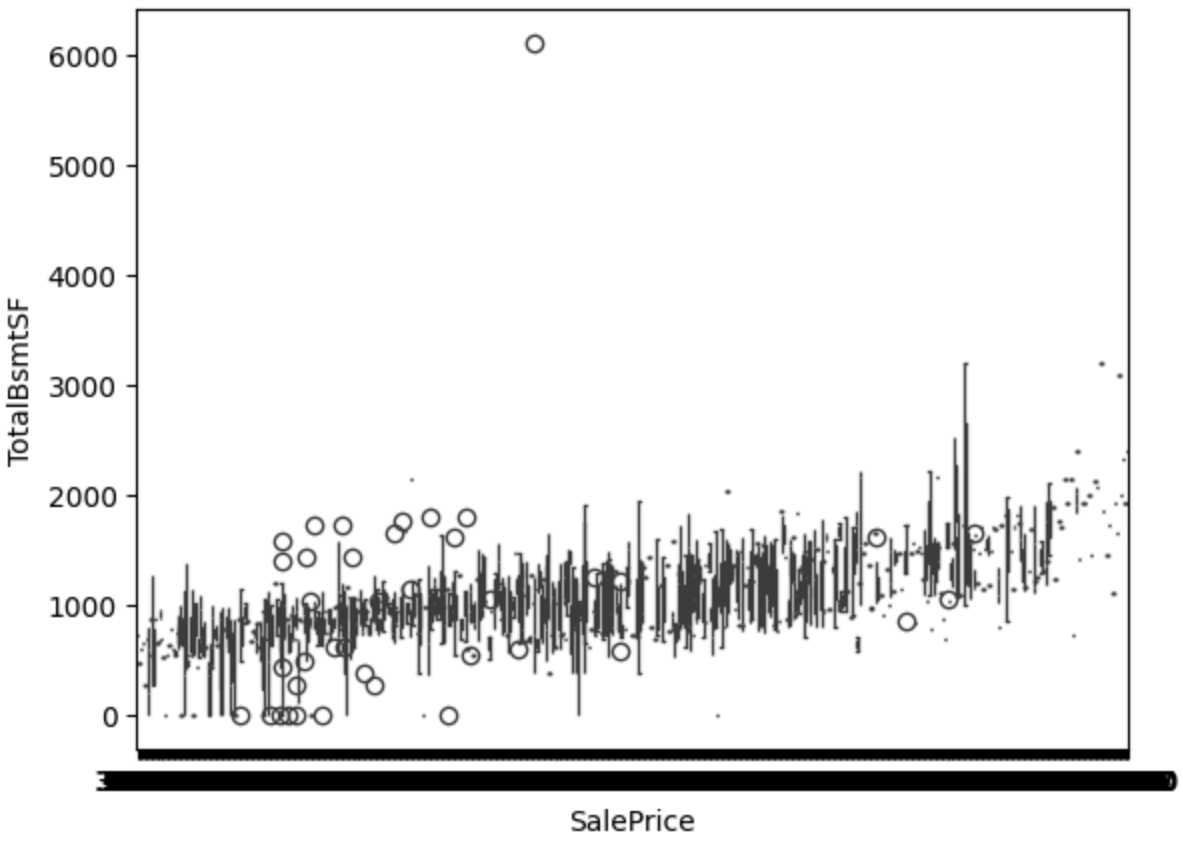

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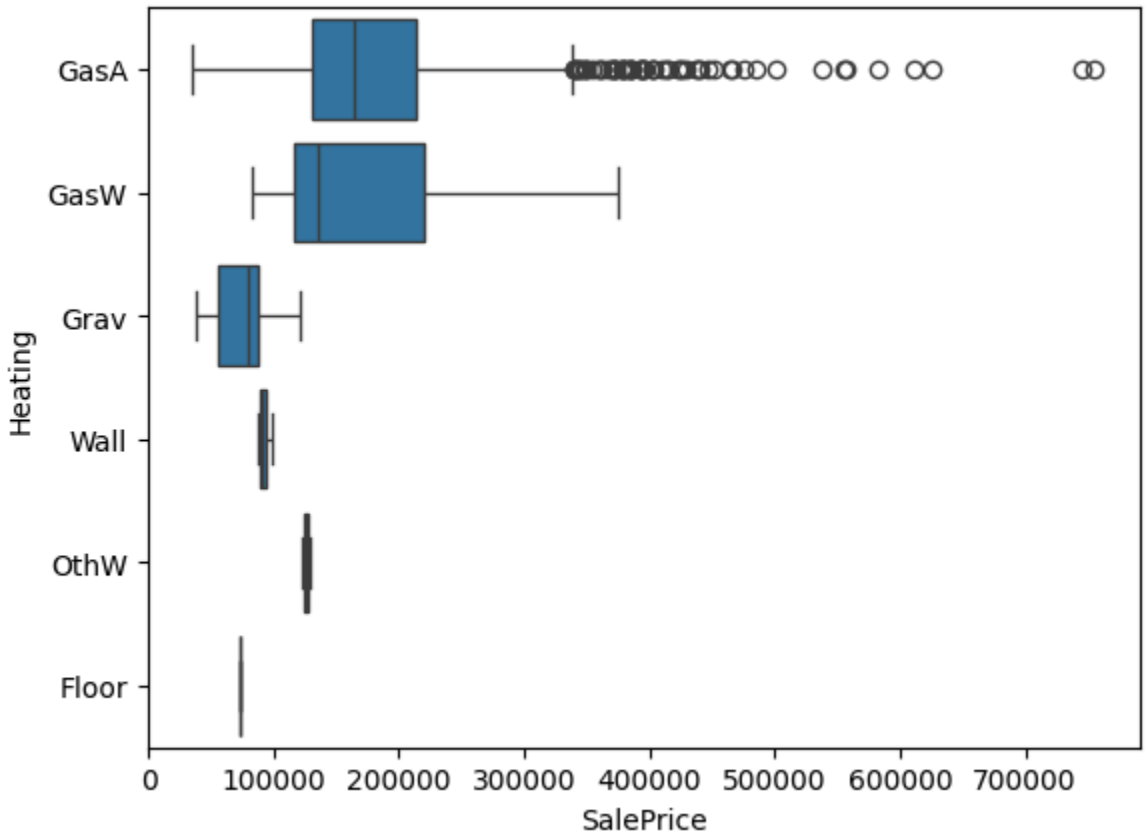

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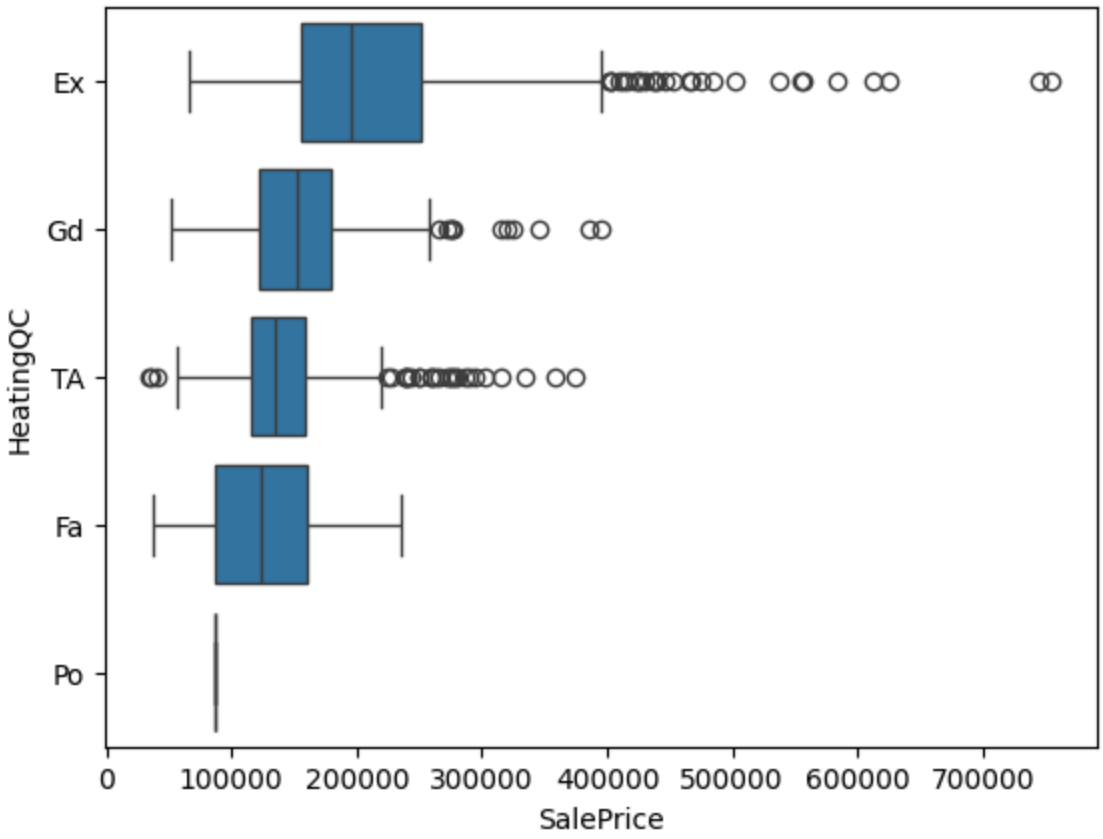

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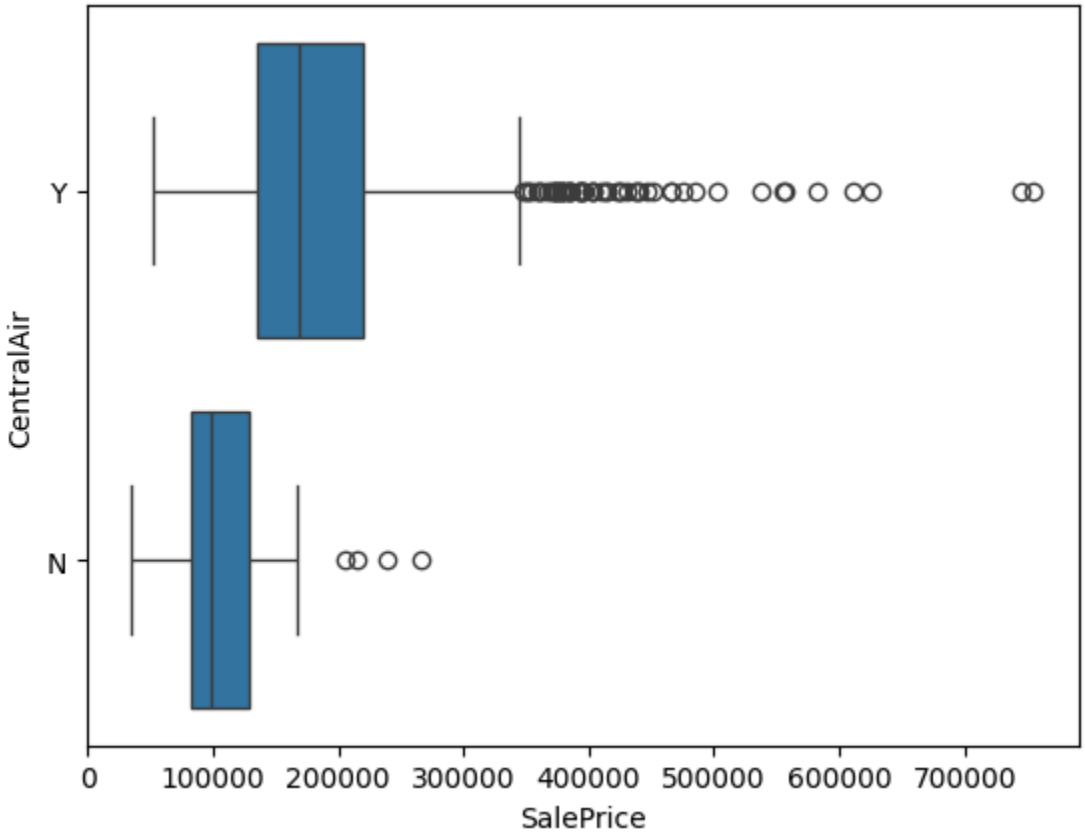

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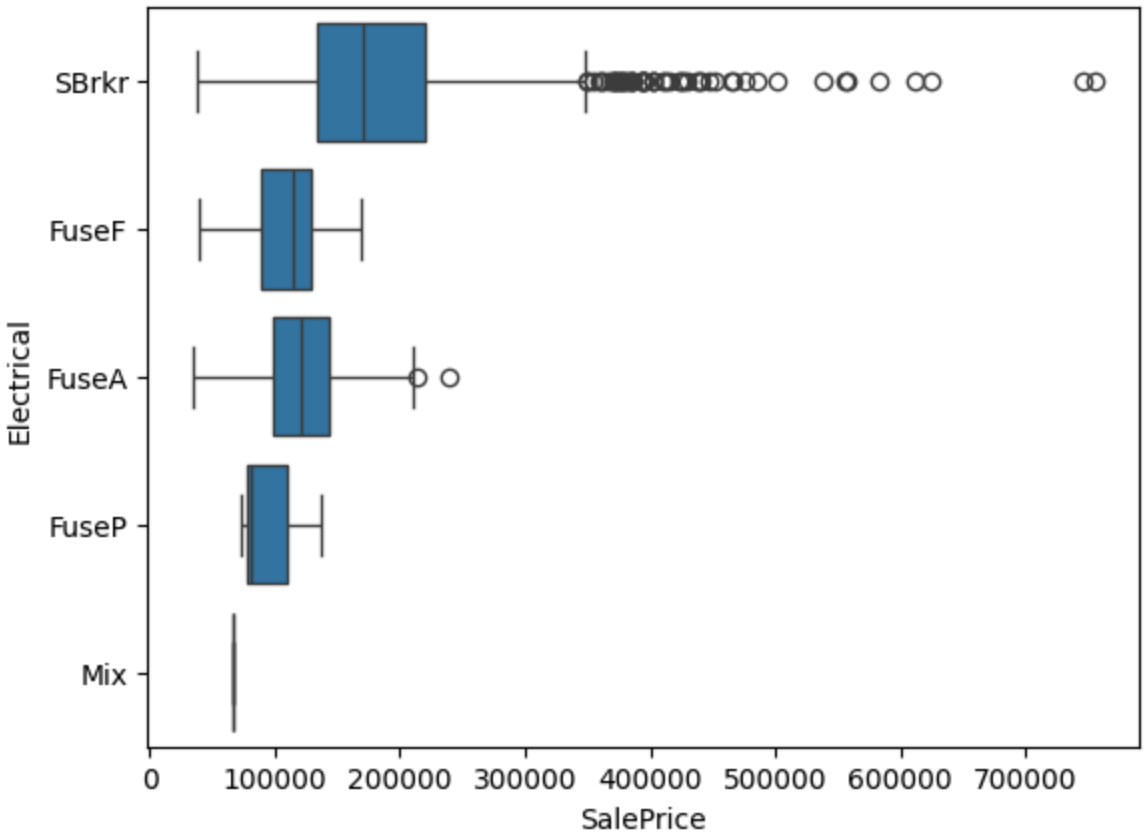

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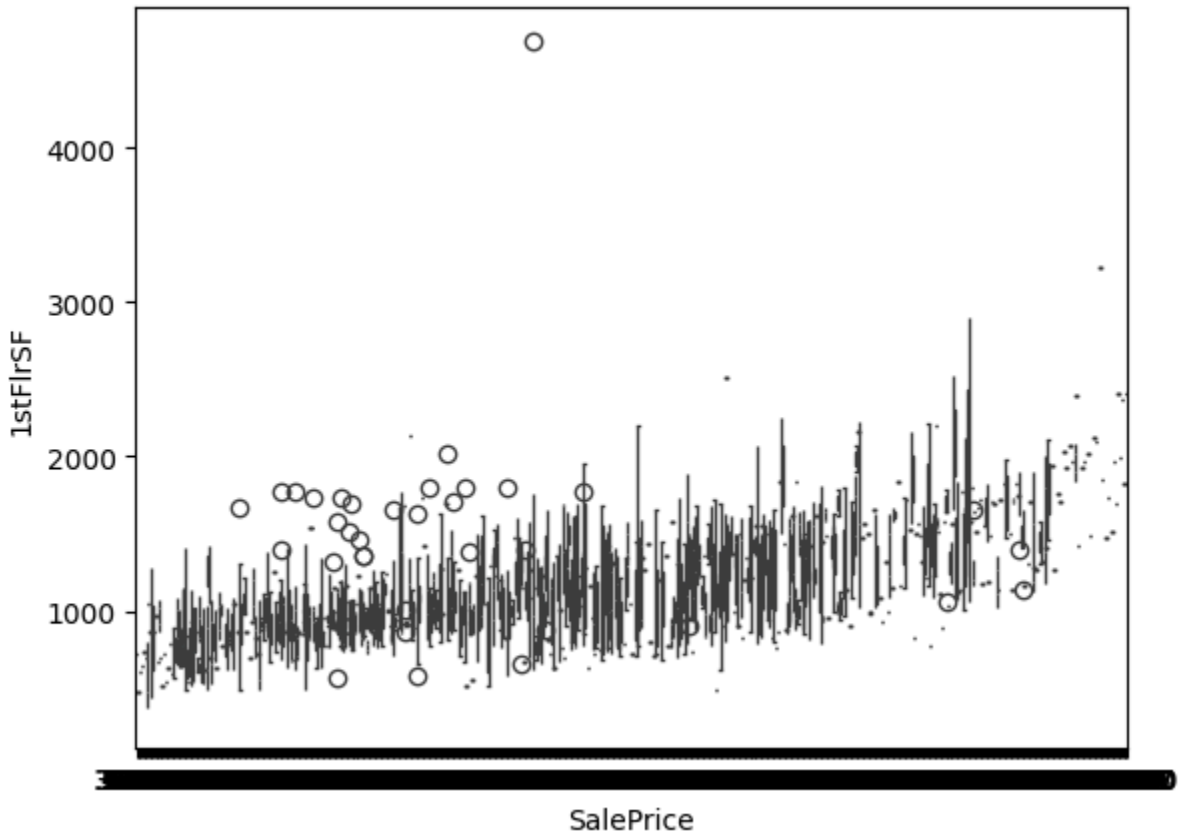

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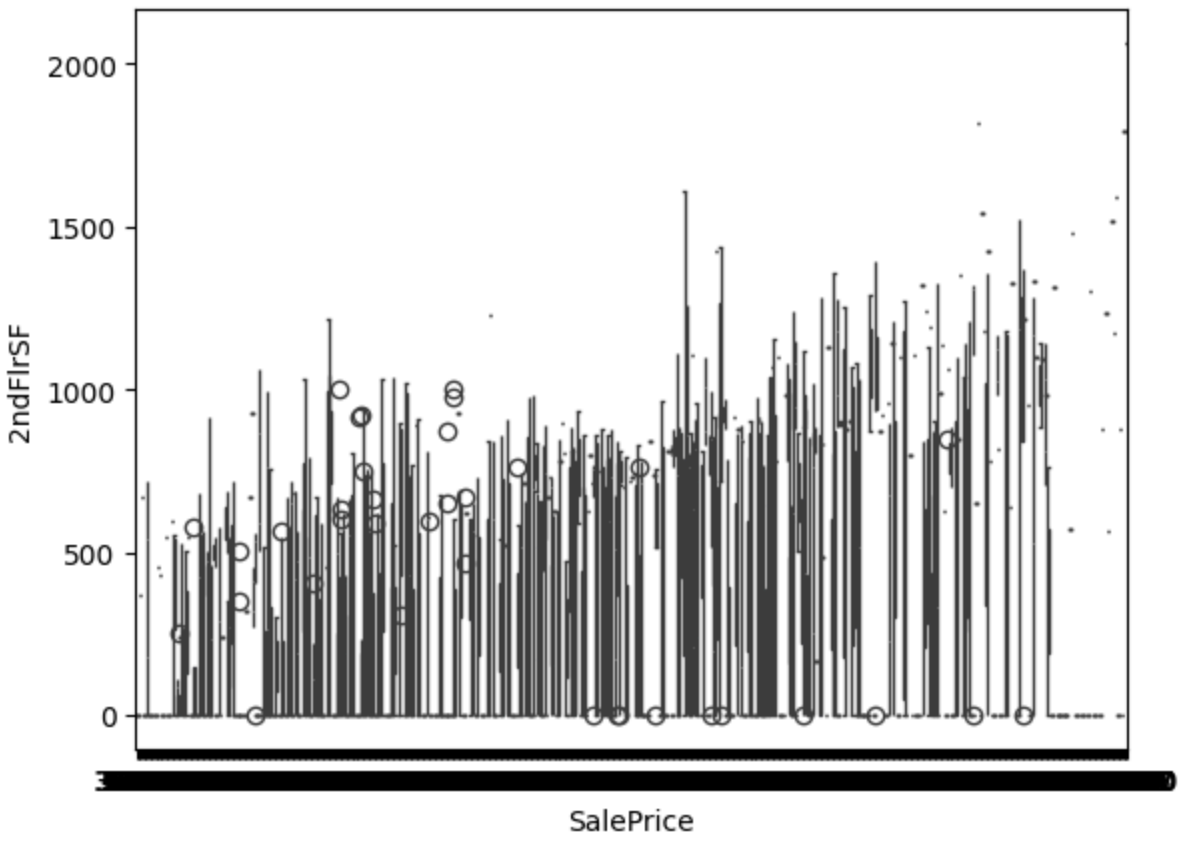

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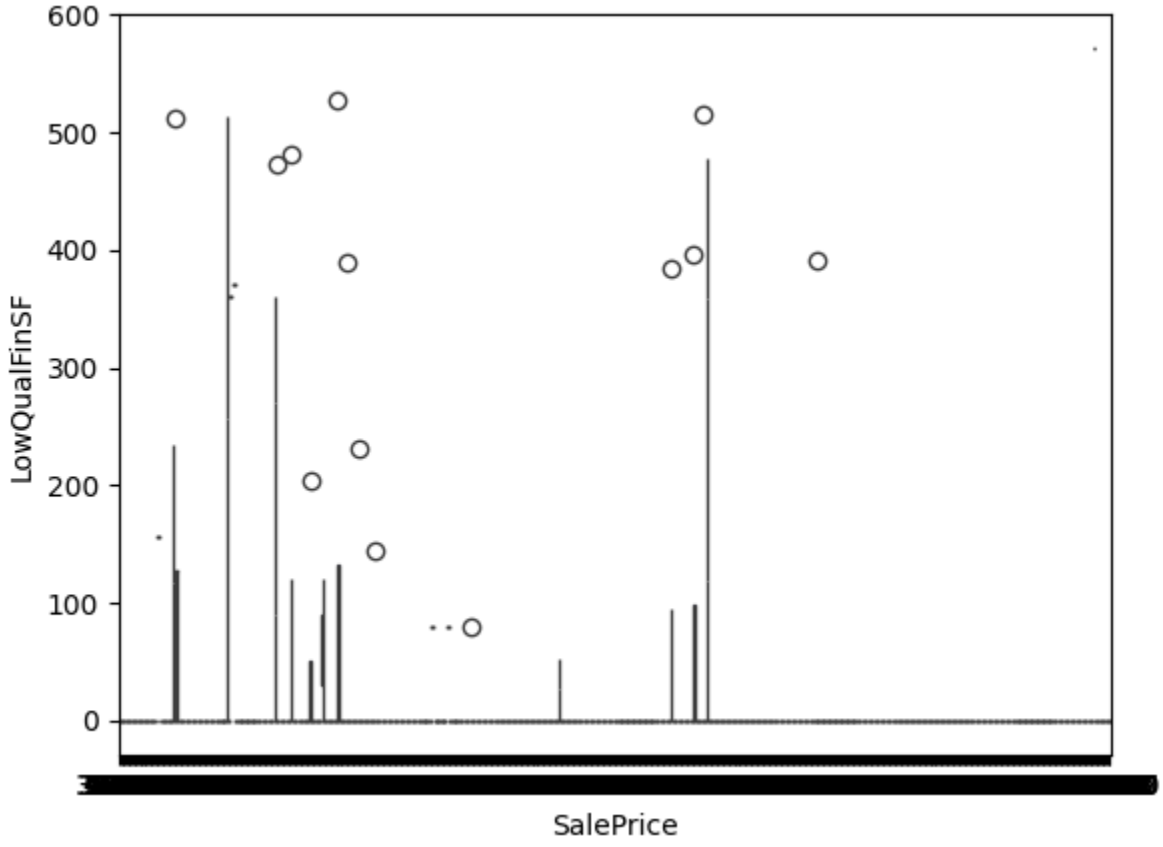

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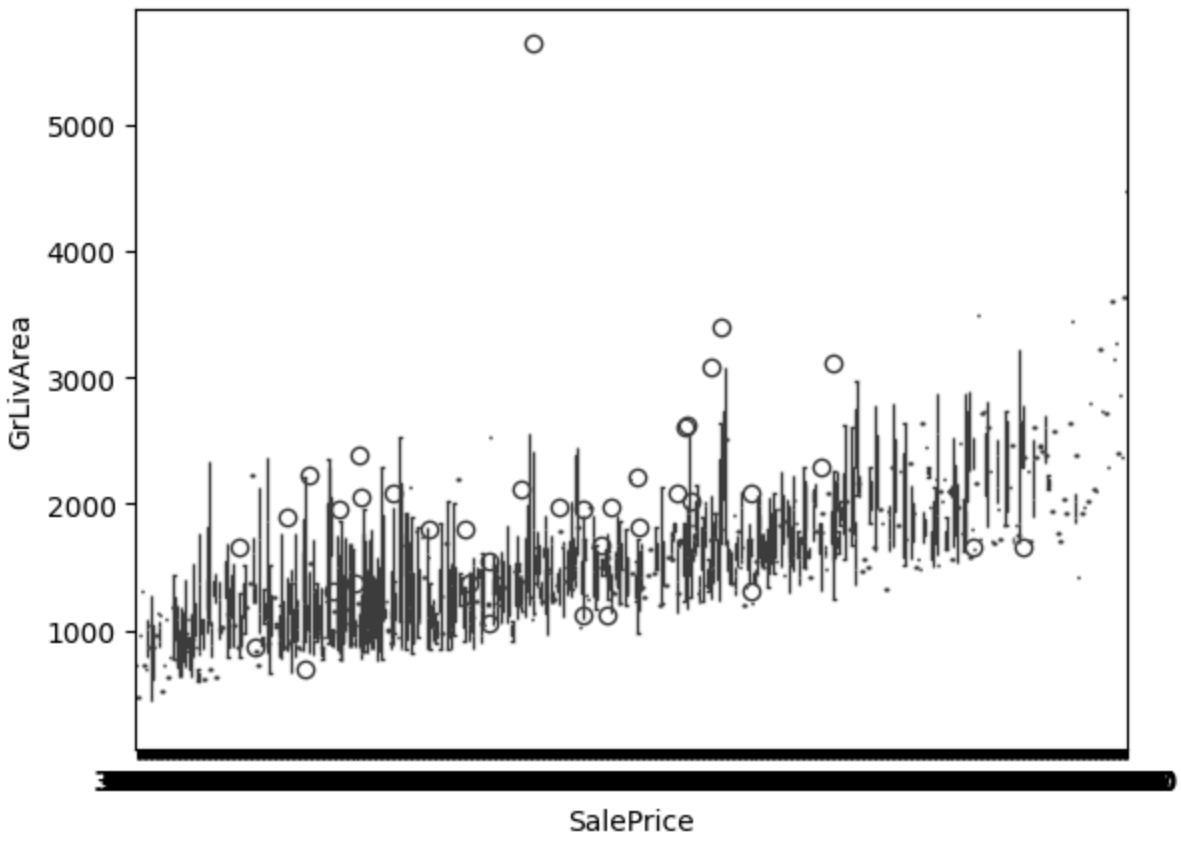
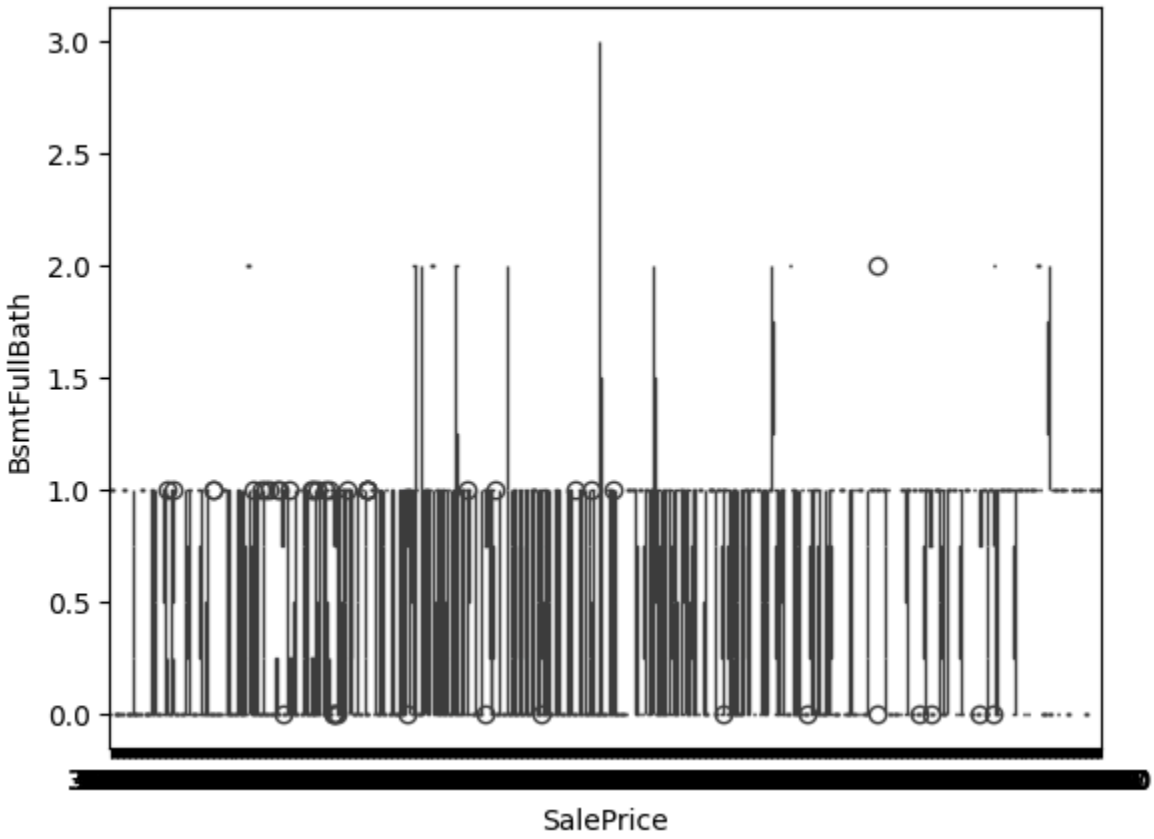
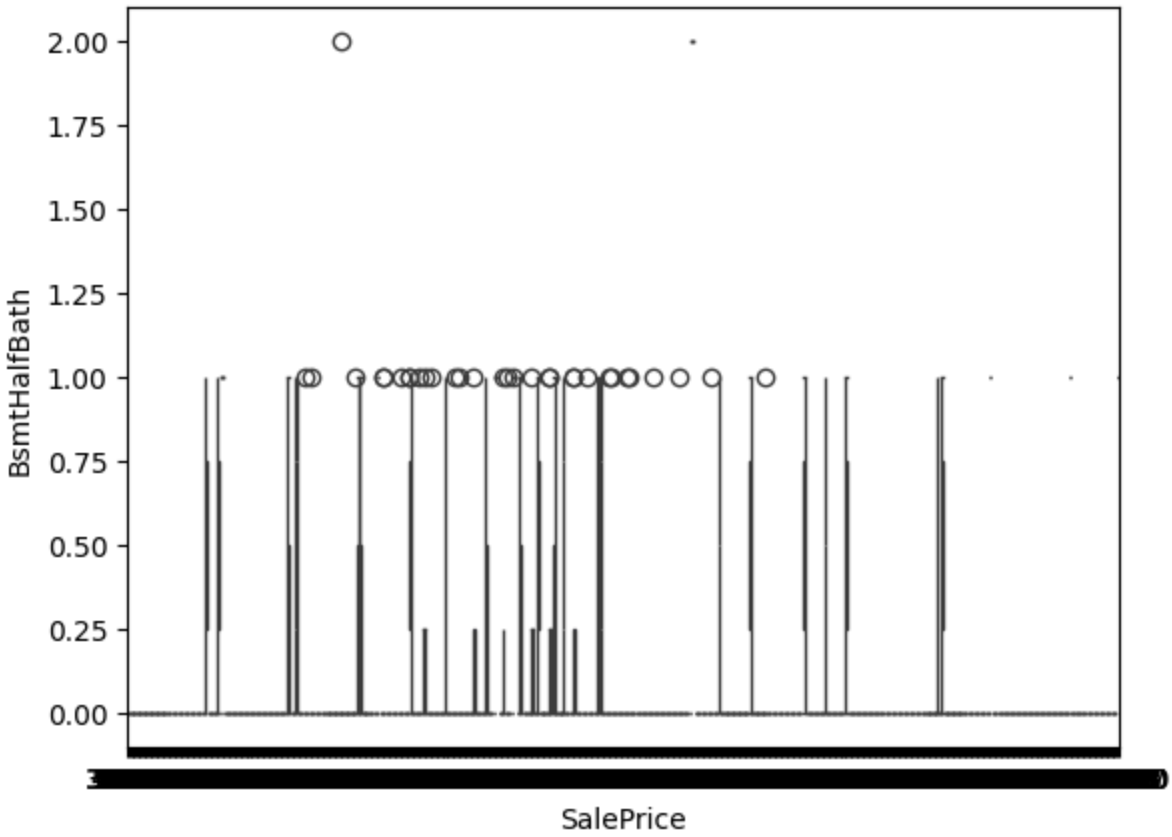


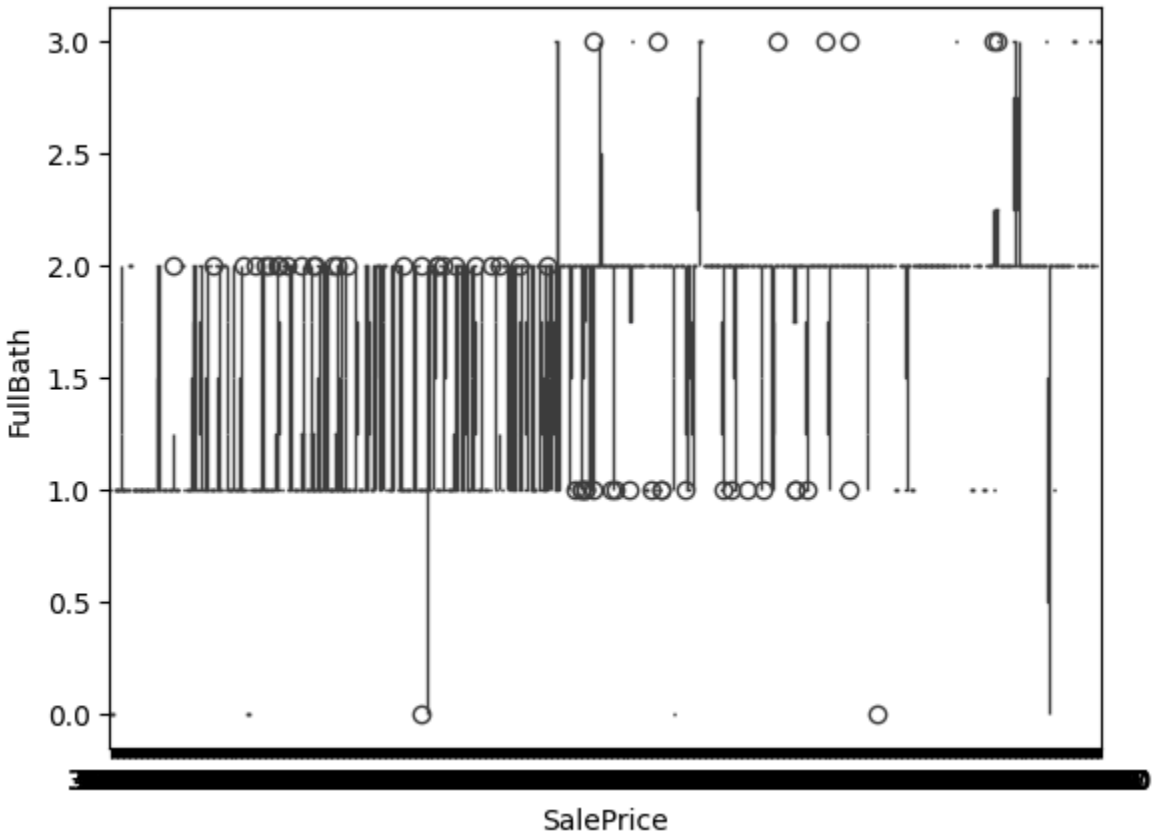
BsmtFullBath



BsmtHalfBath



FullBath



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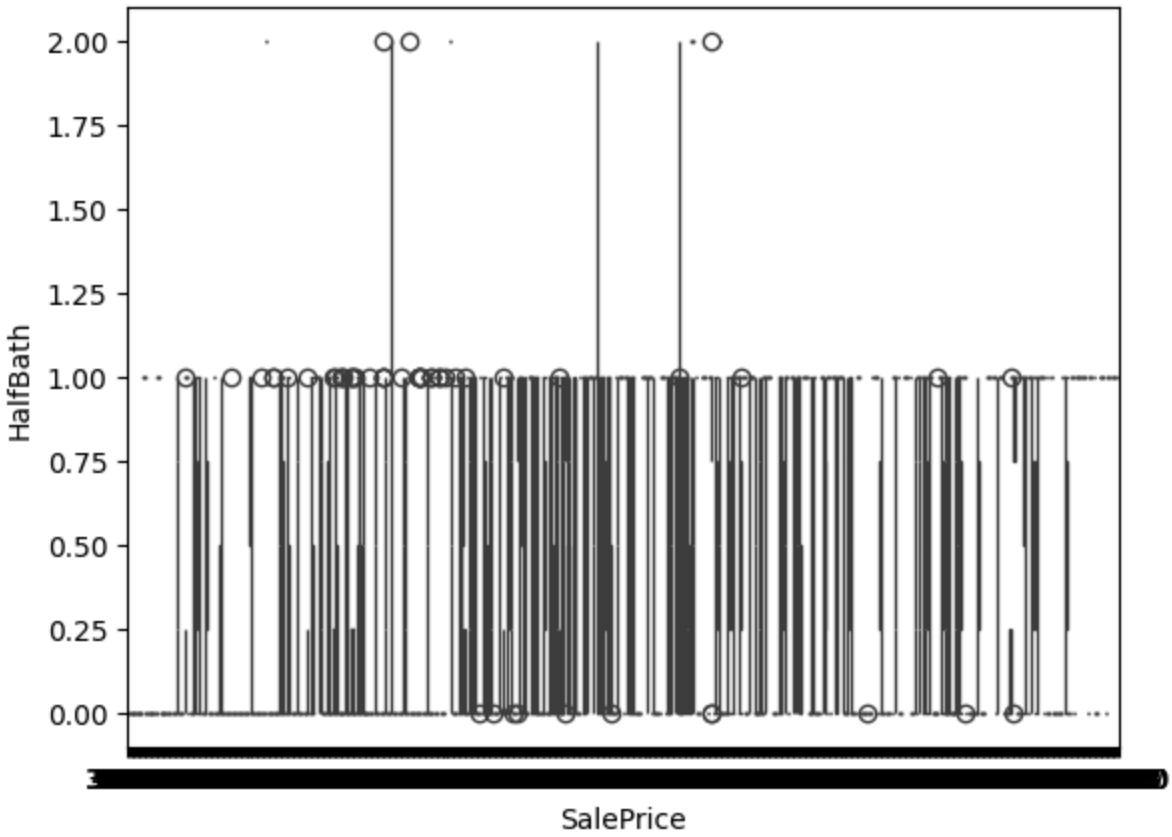

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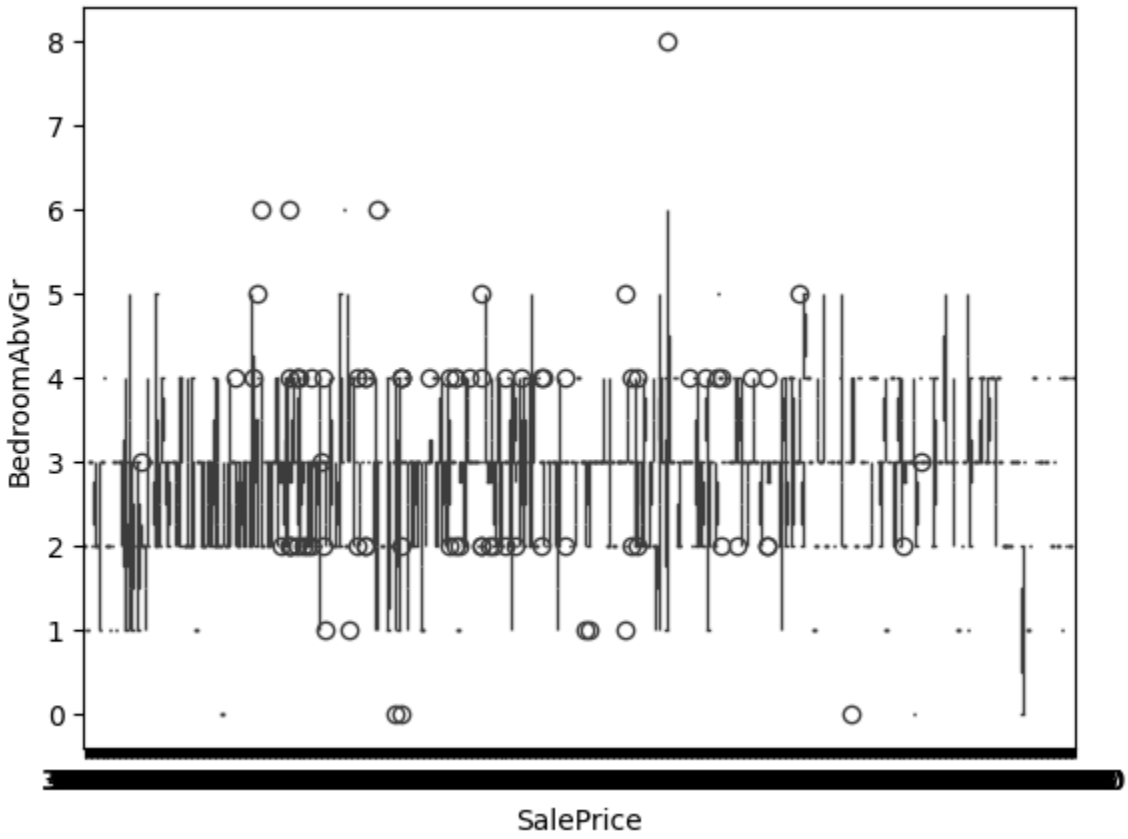
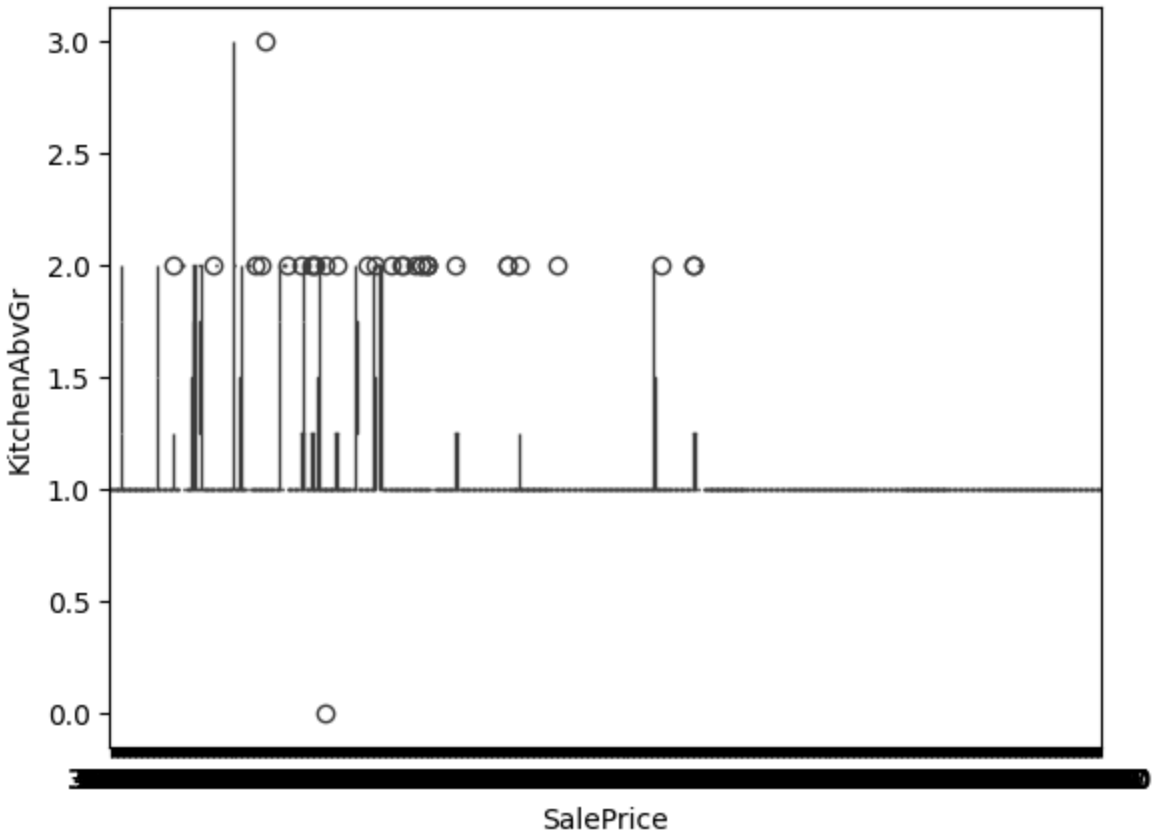
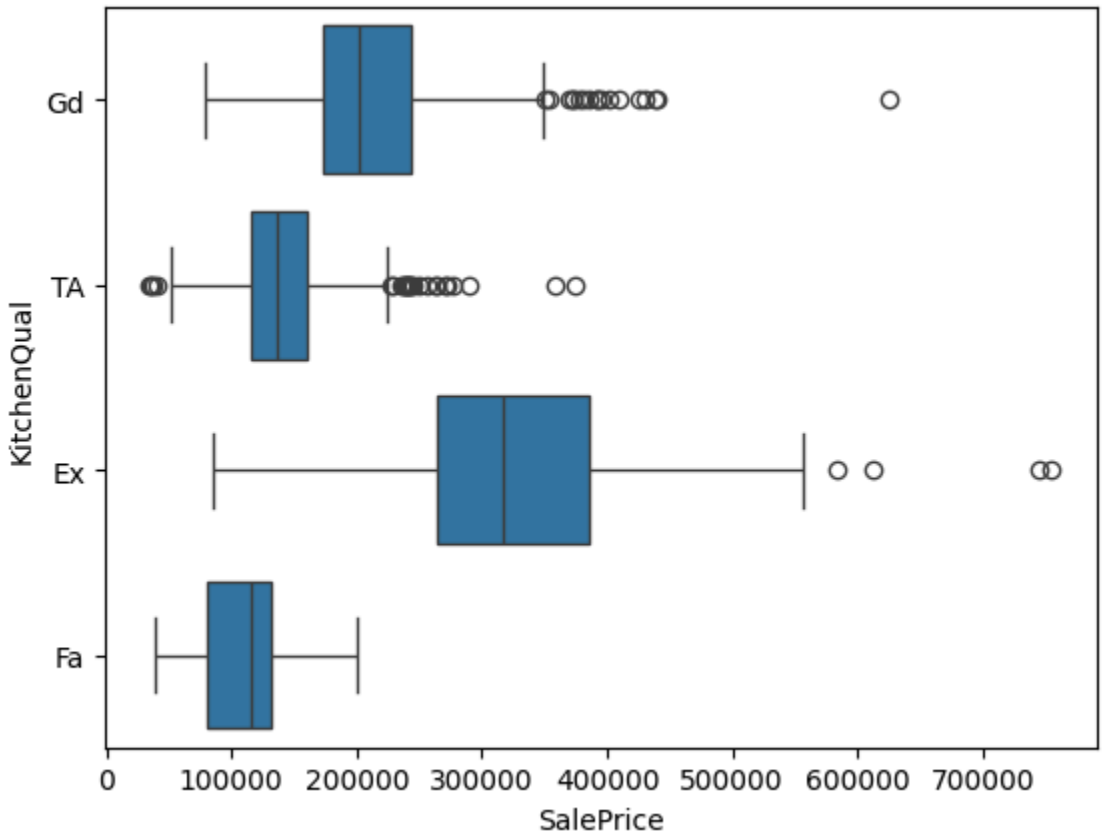


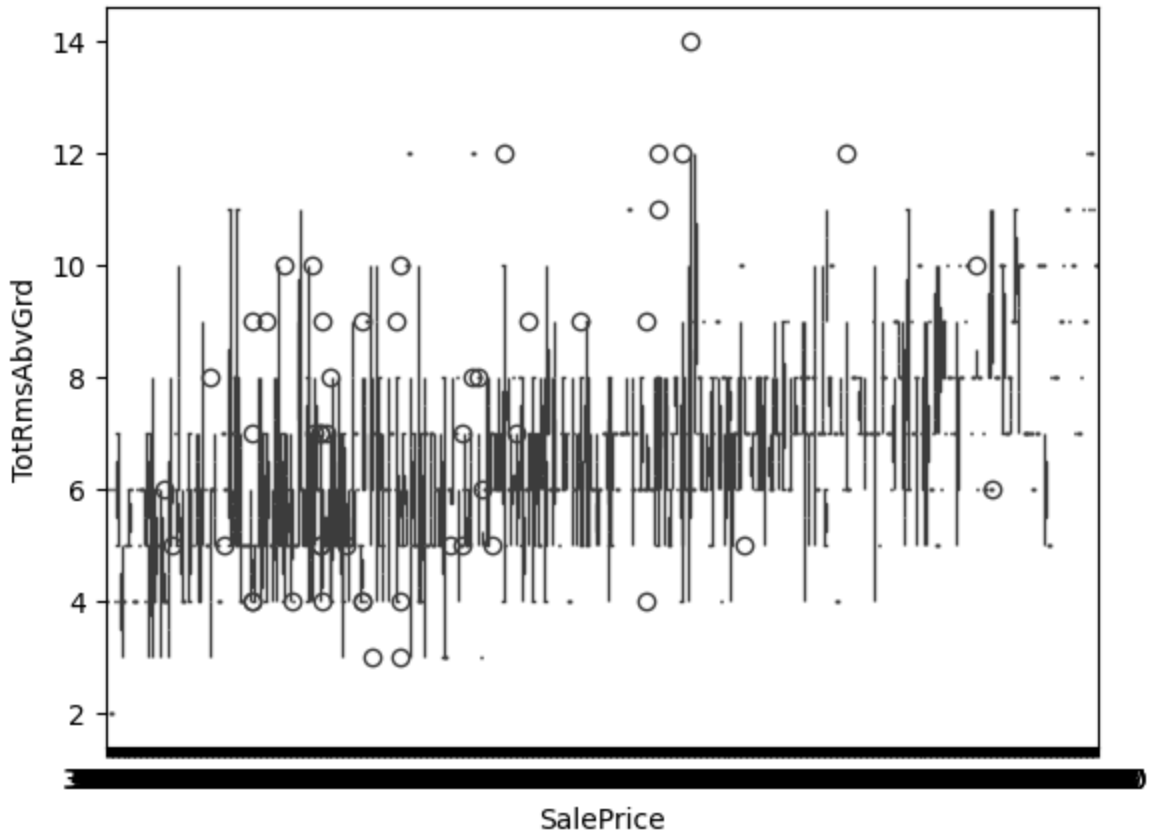
KitchenAbvGr



KitchenQual



TotRmsAbvGrd



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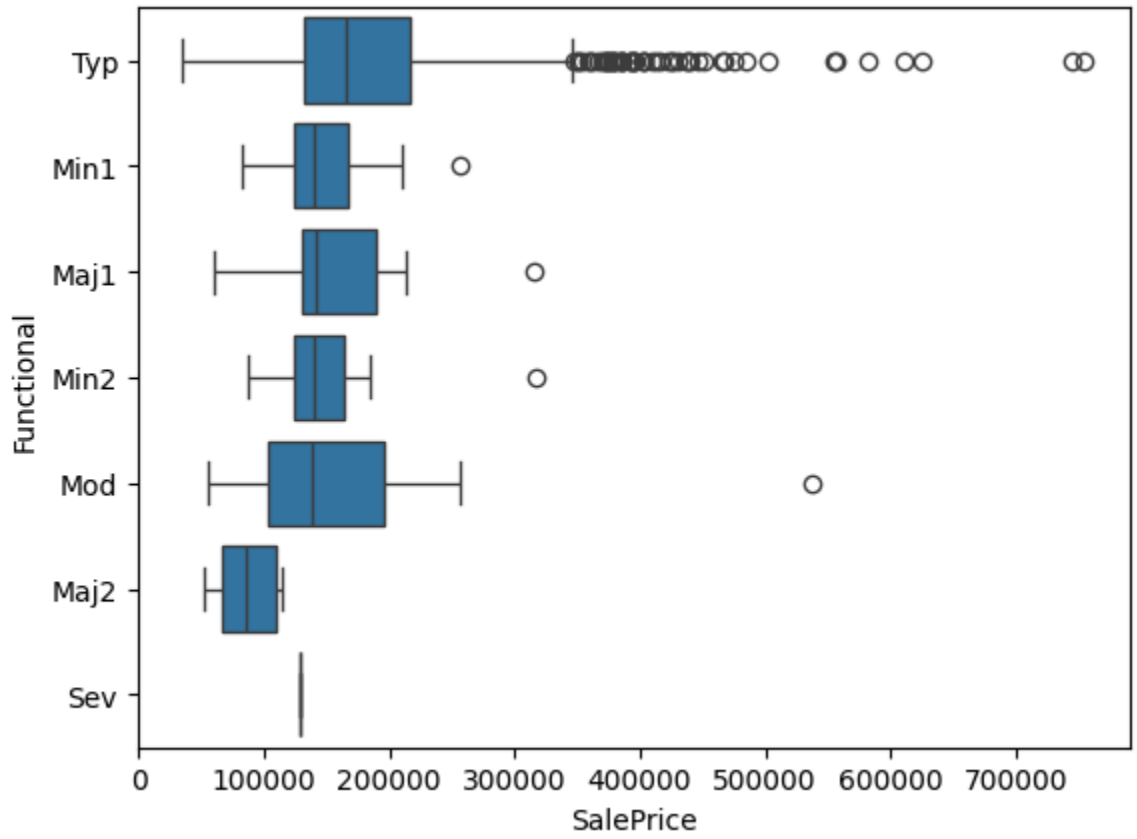

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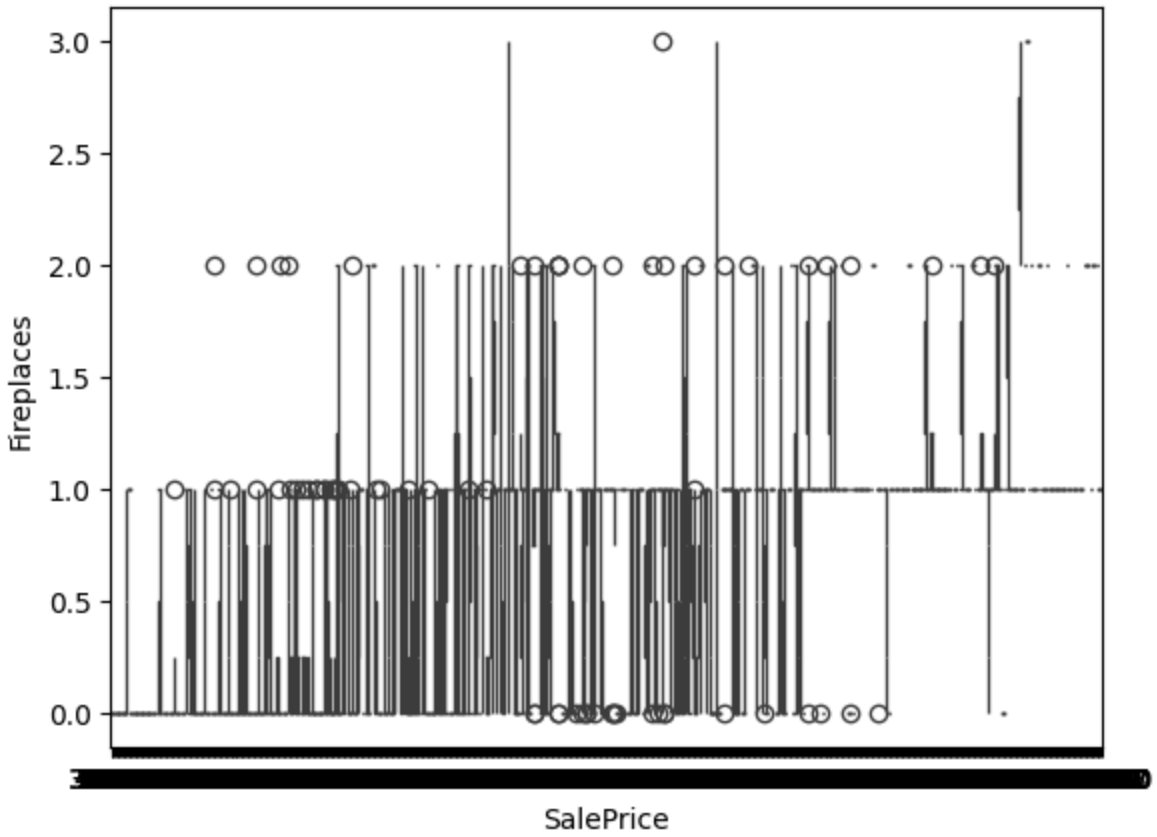

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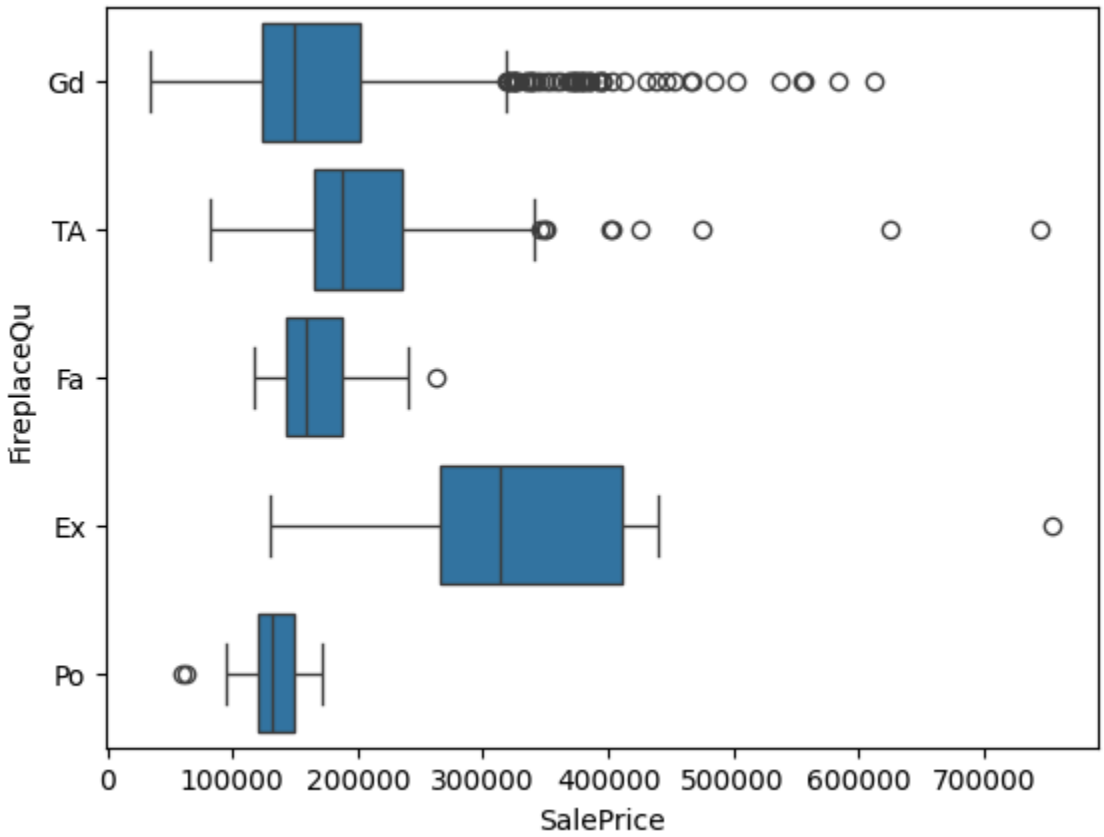

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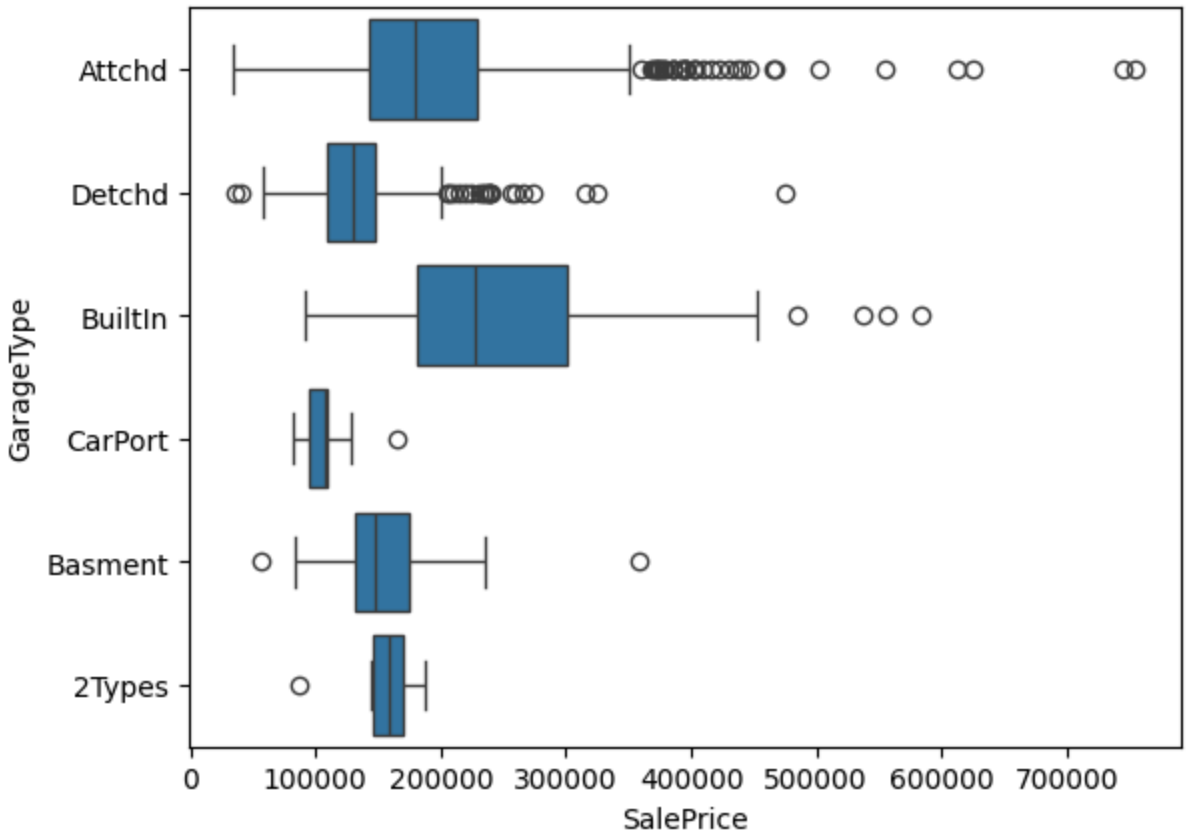

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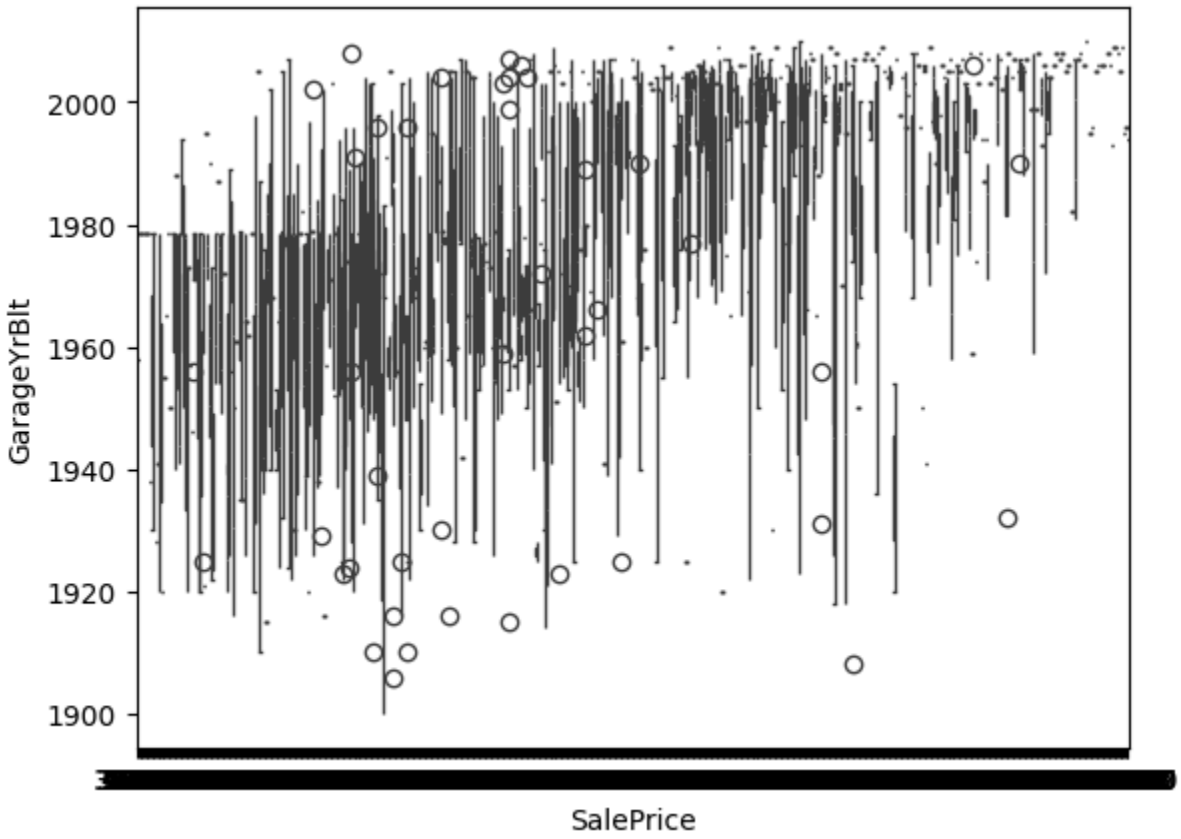

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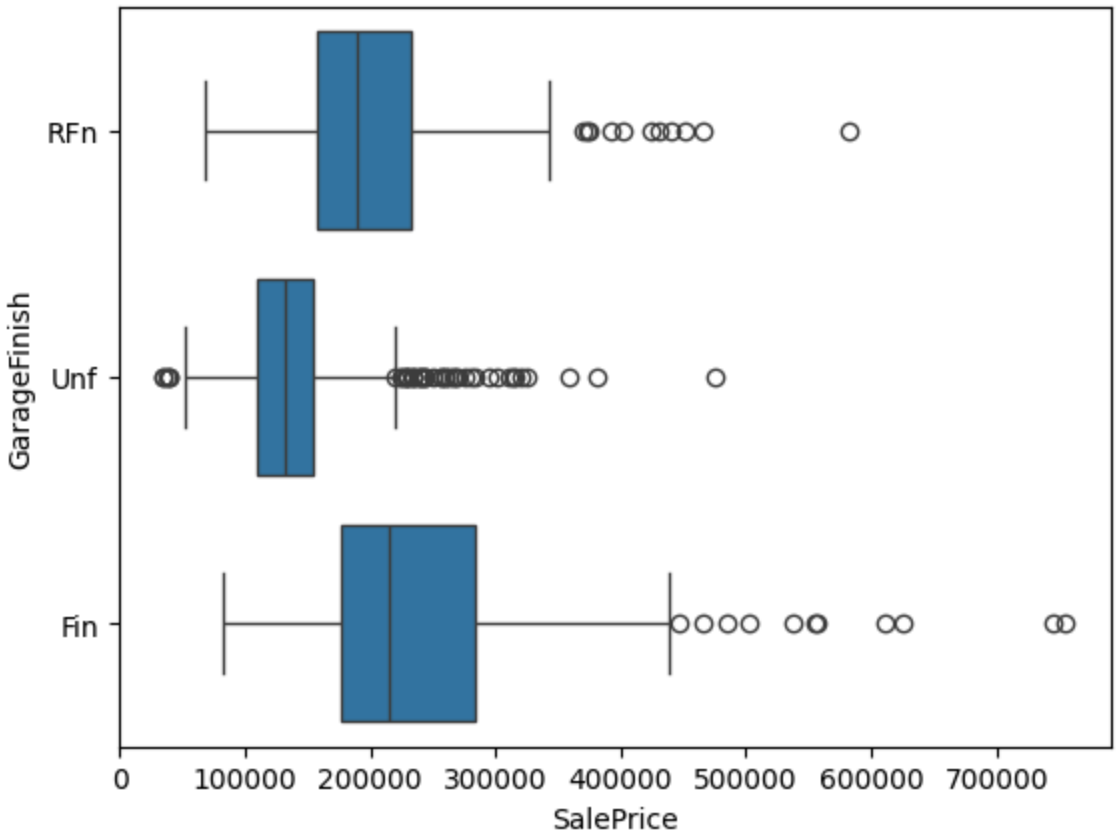

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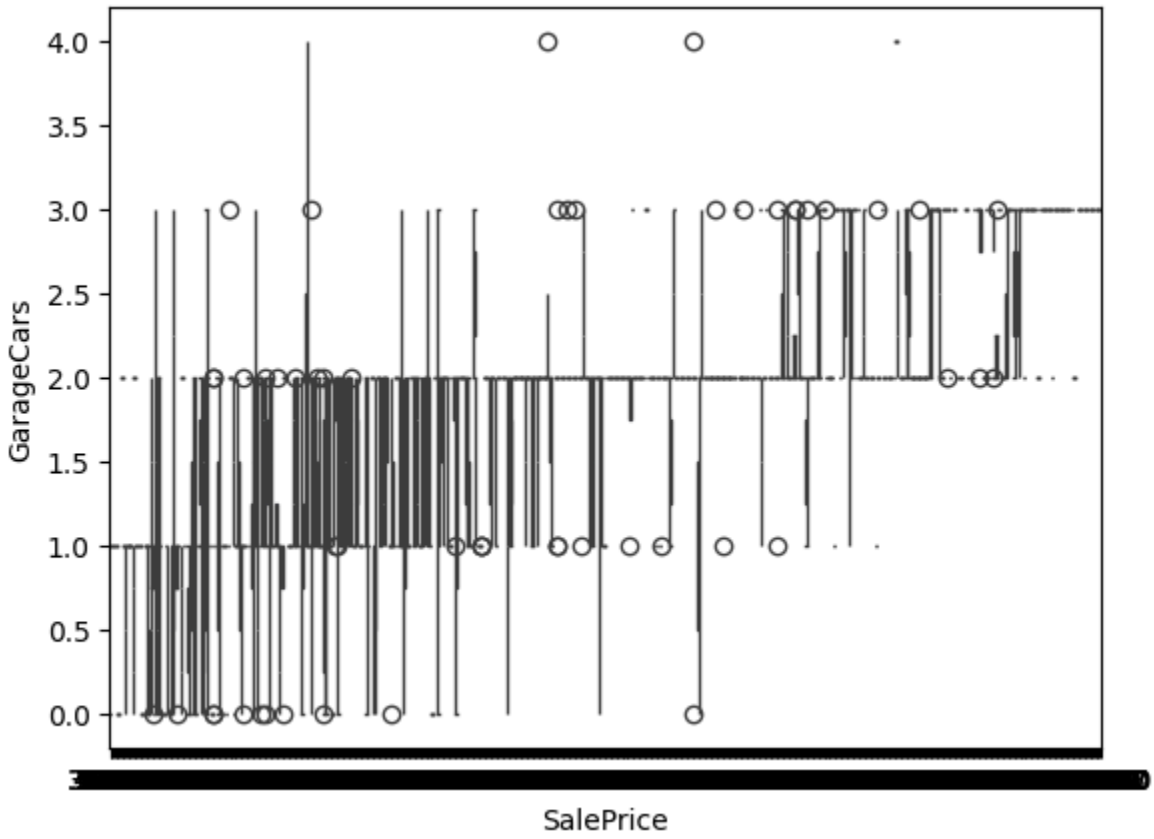

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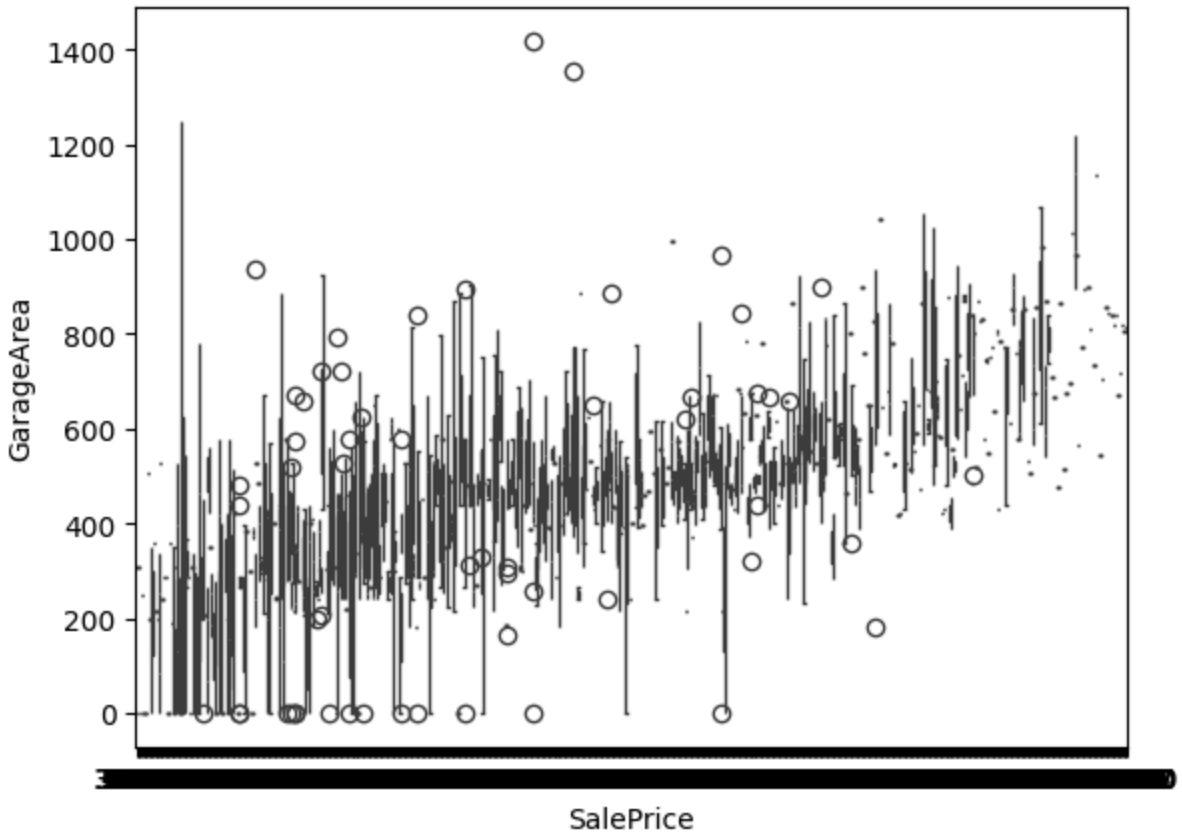

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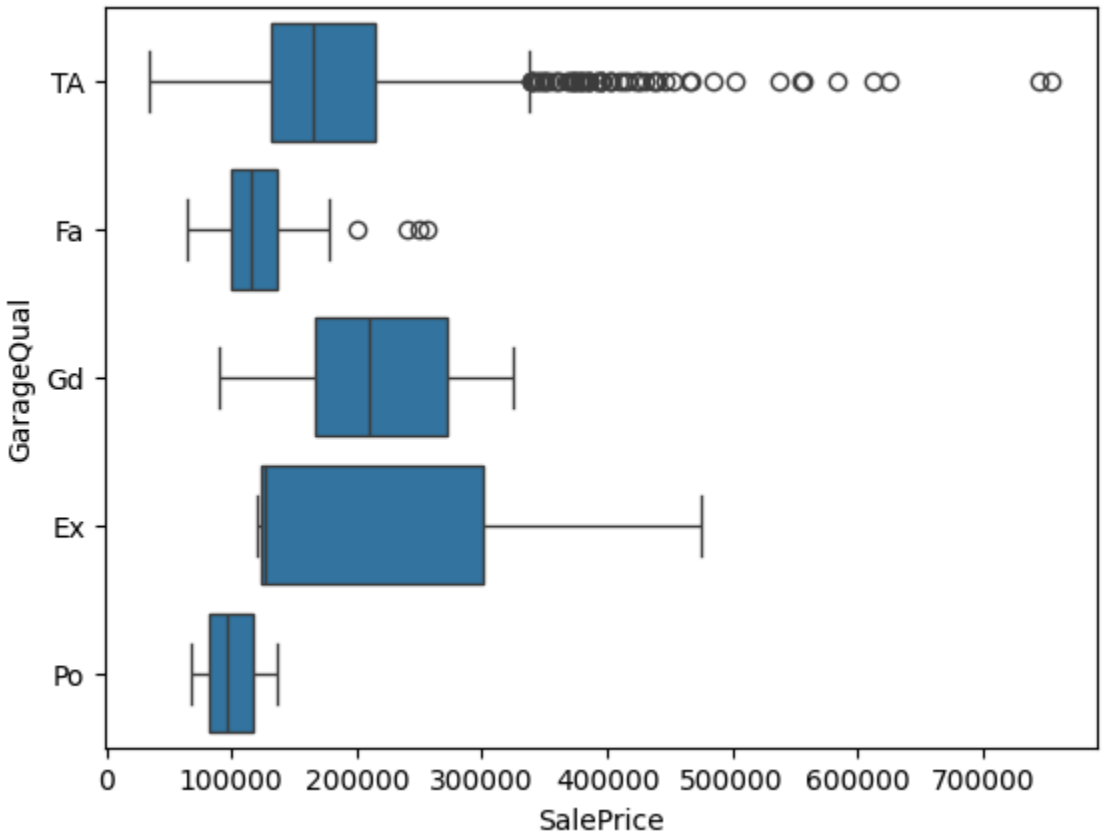

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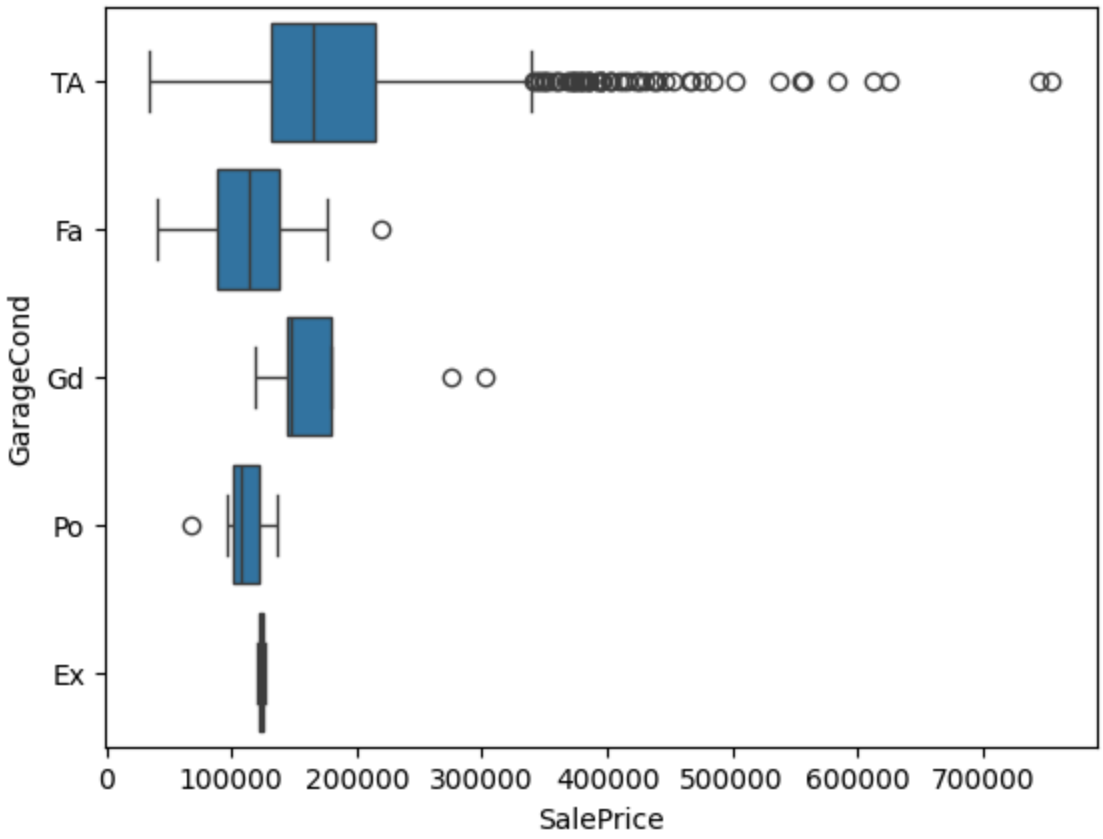

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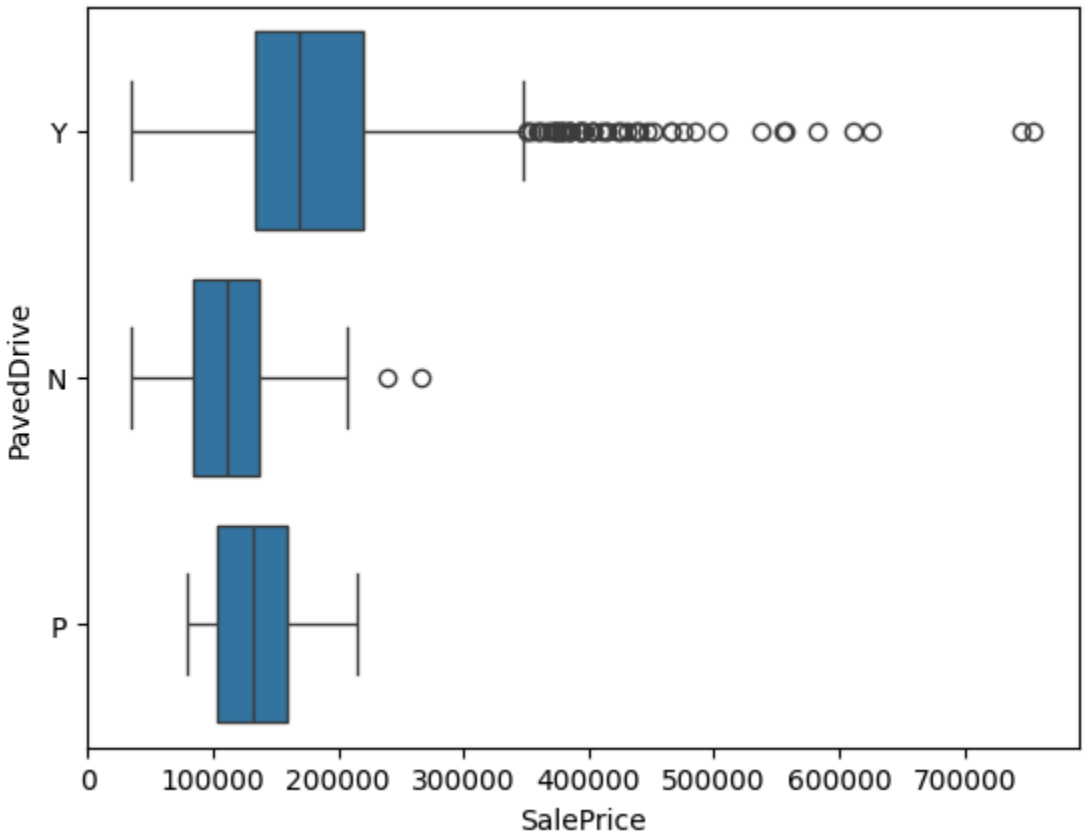

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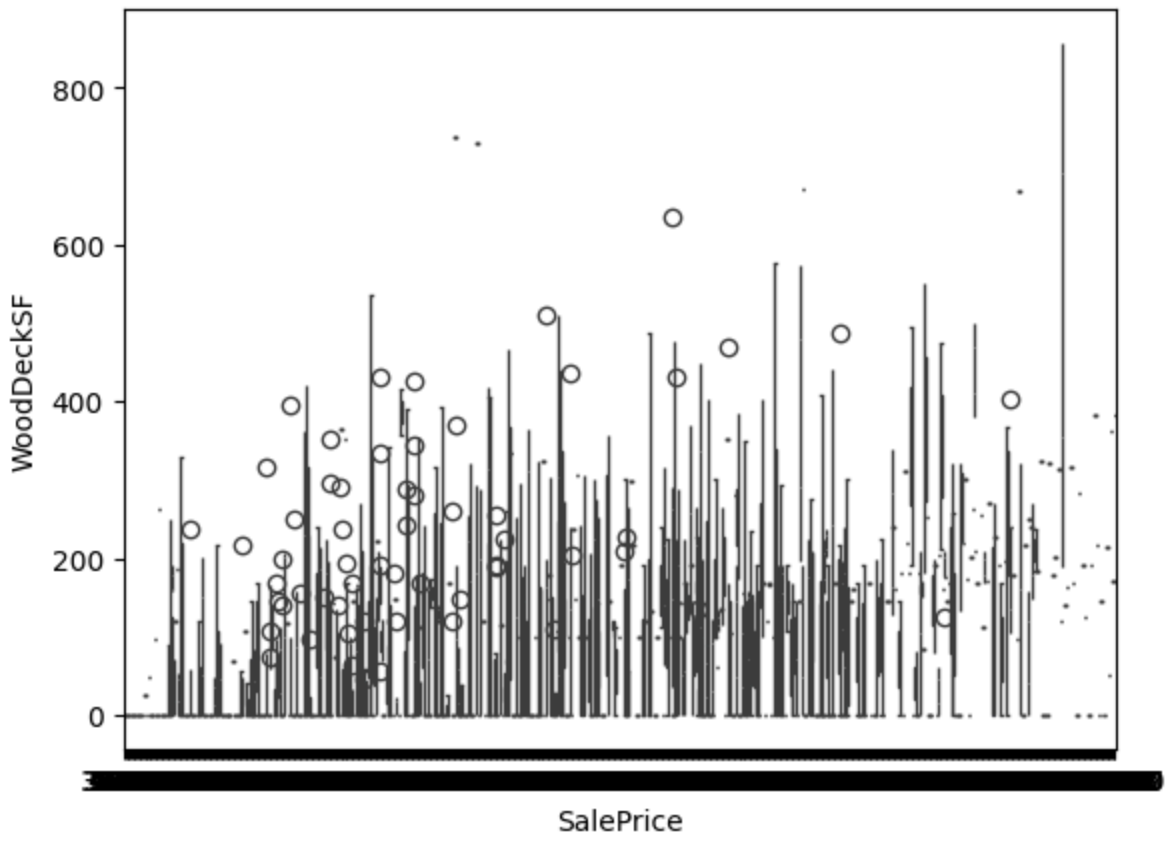

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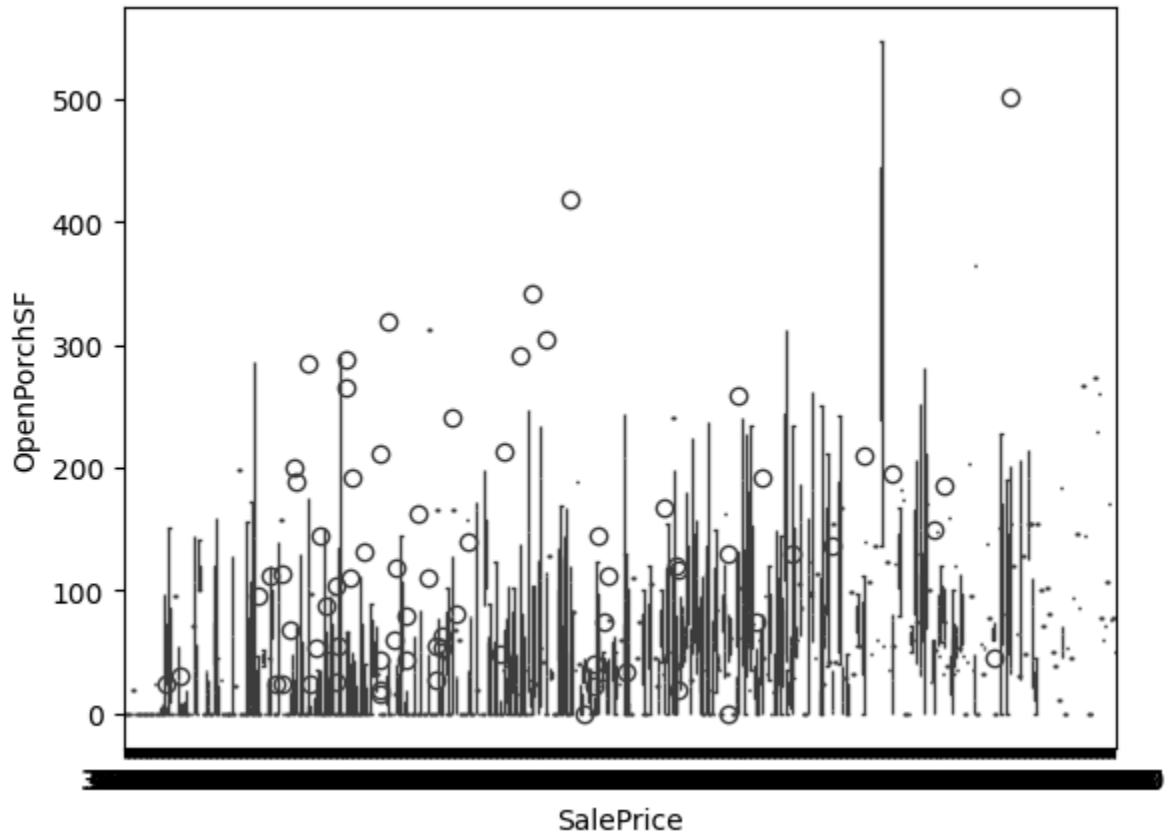

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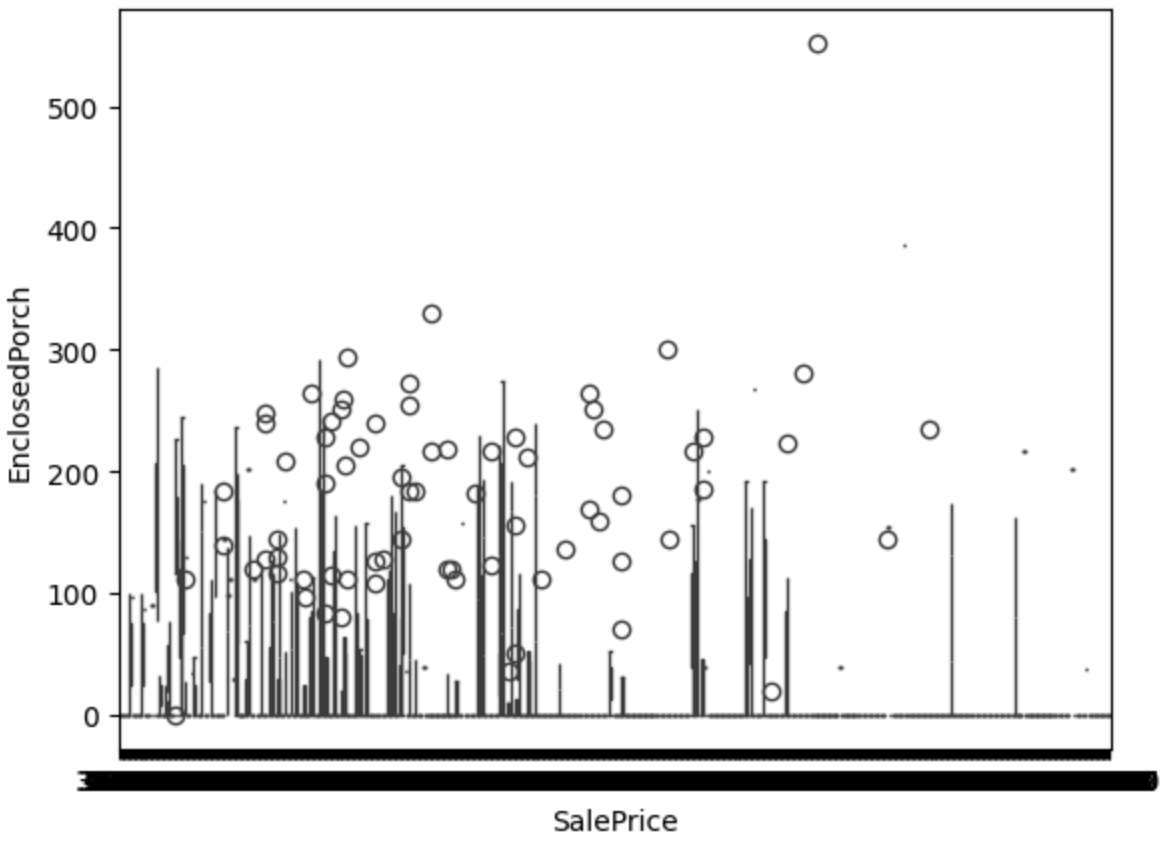

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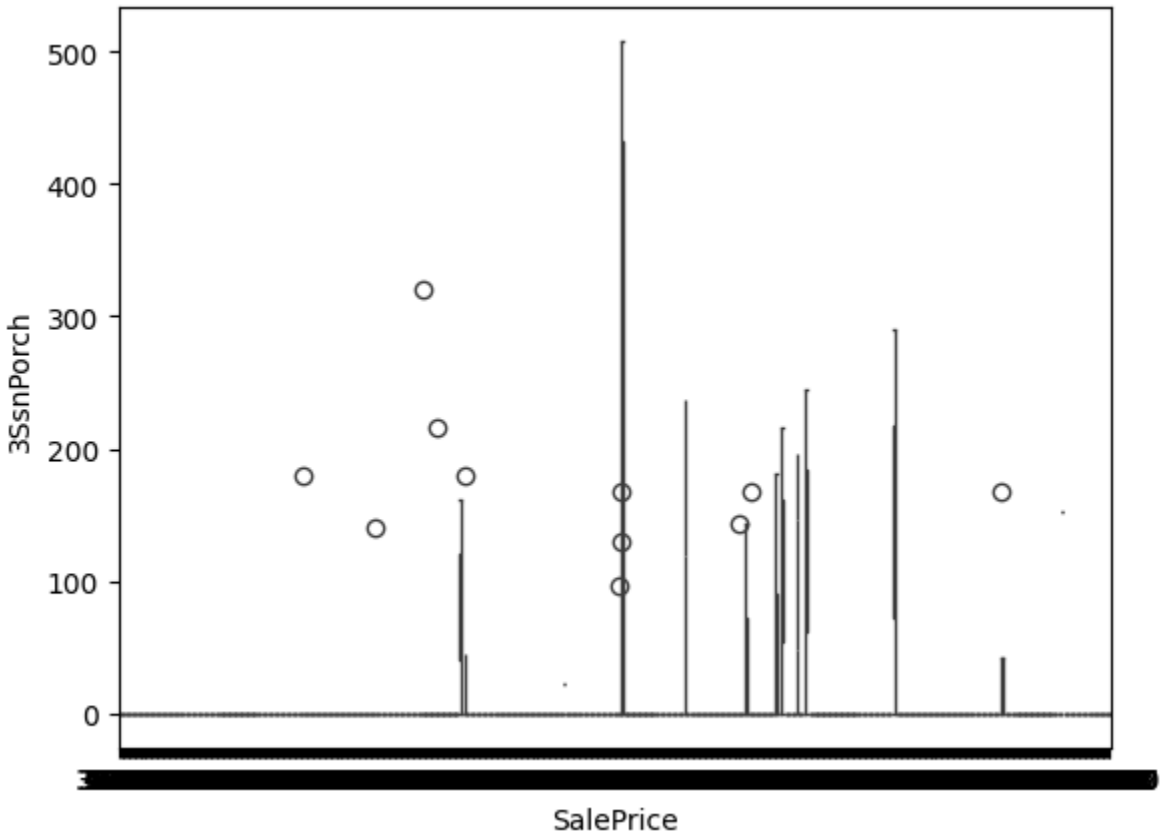

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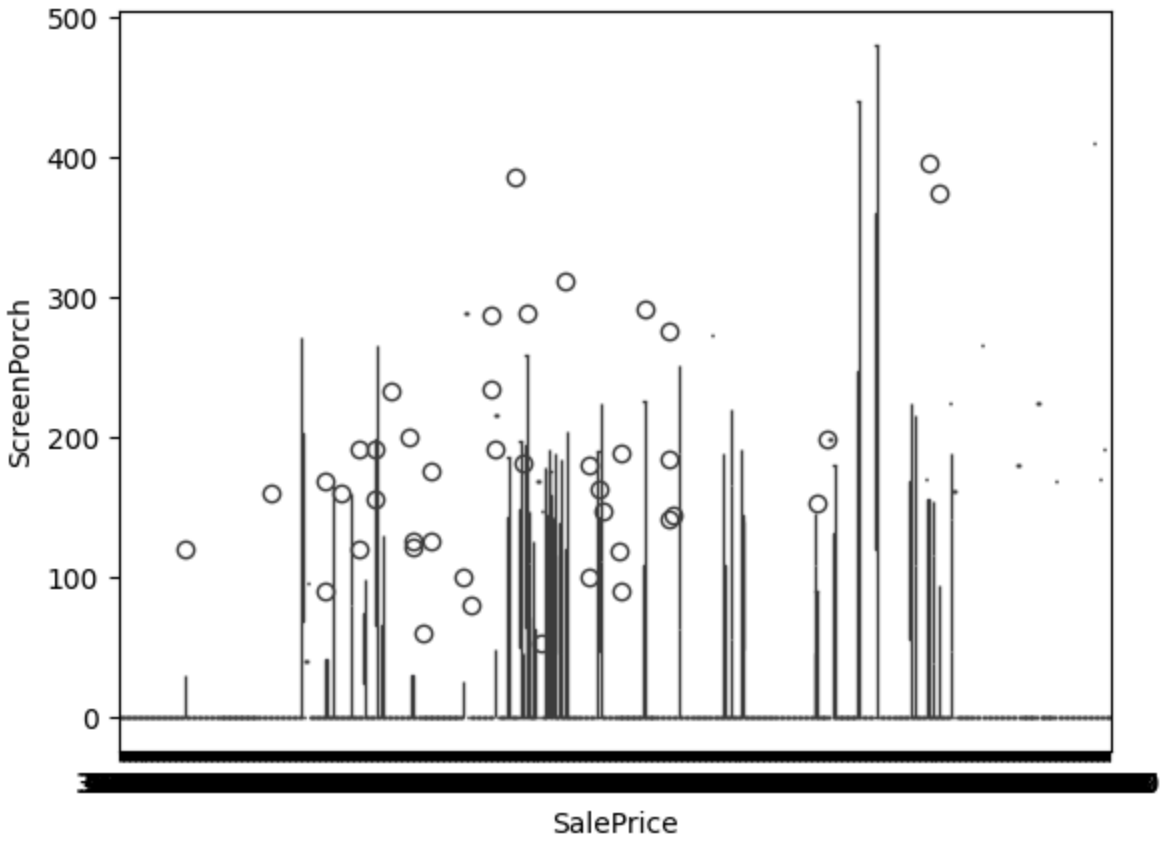

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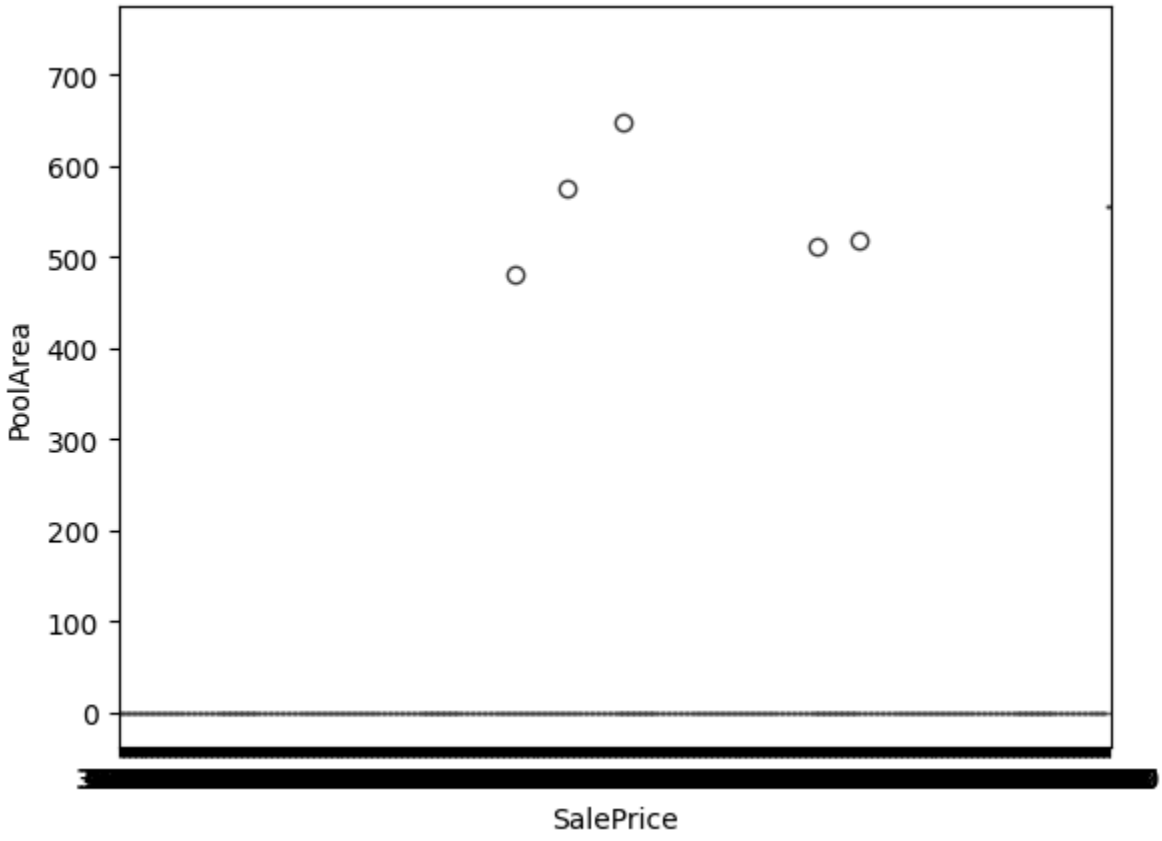

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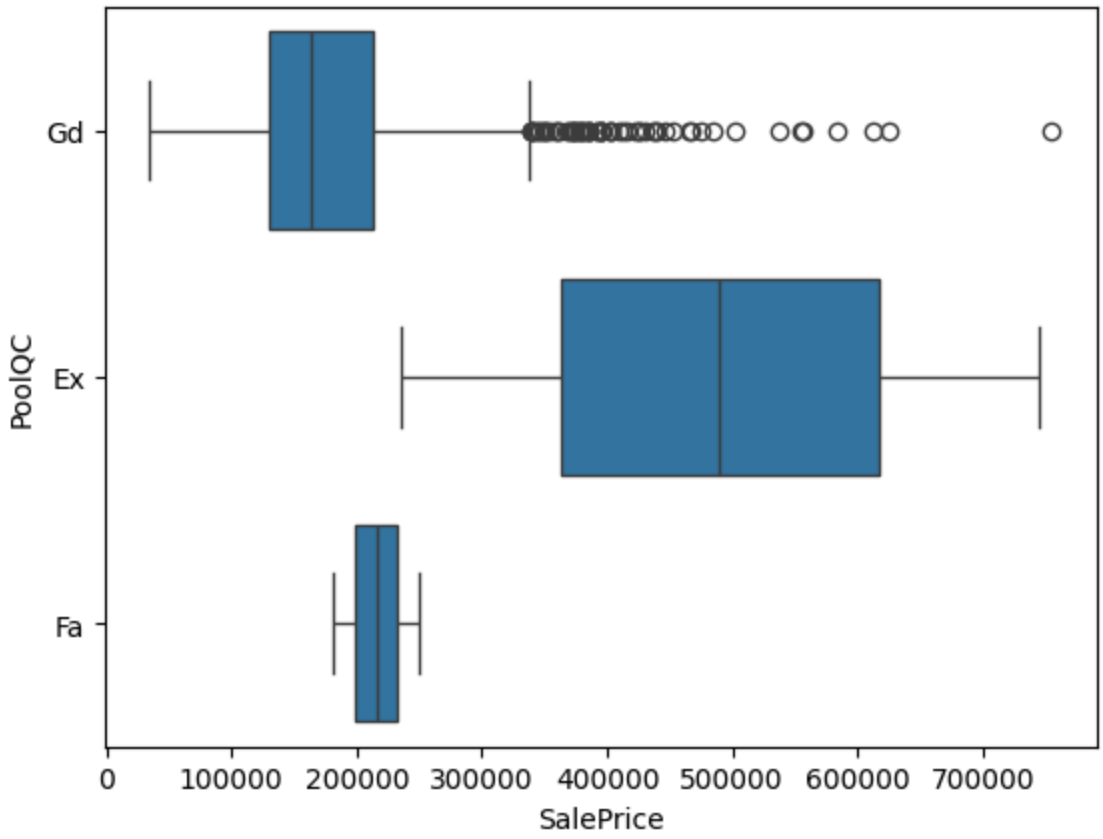

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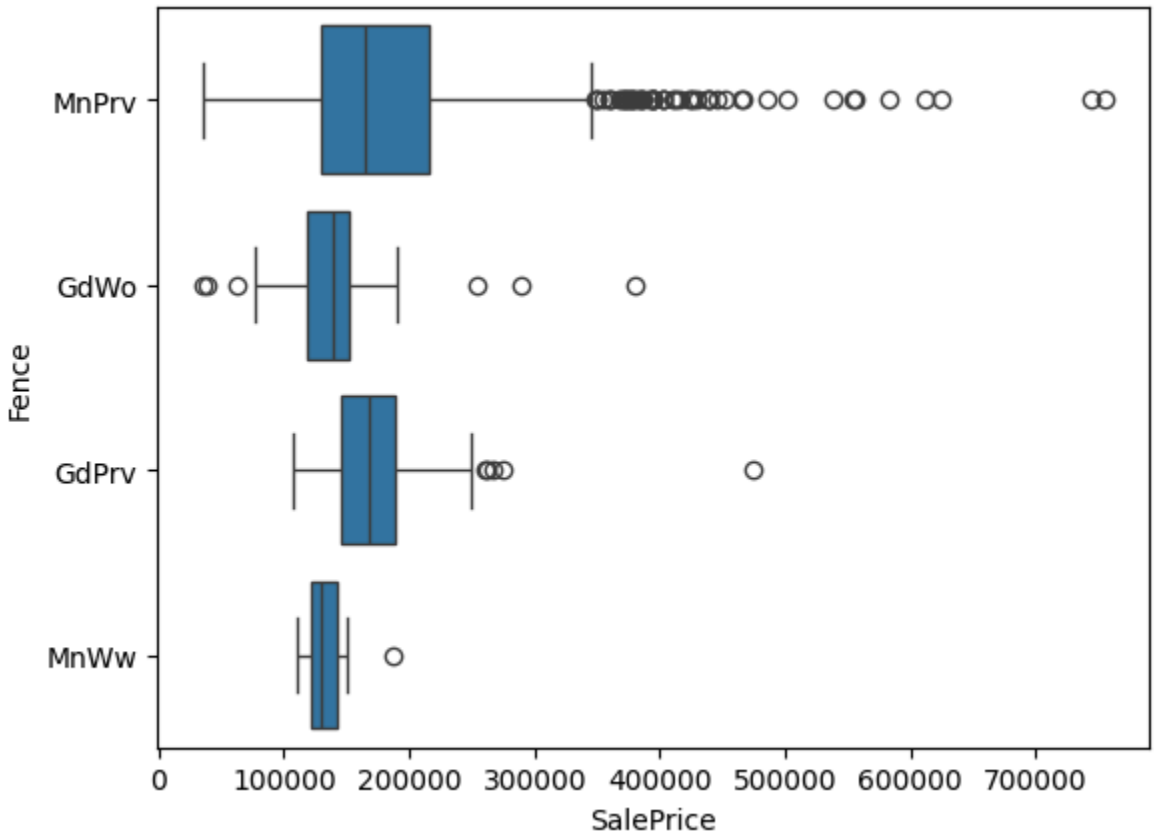

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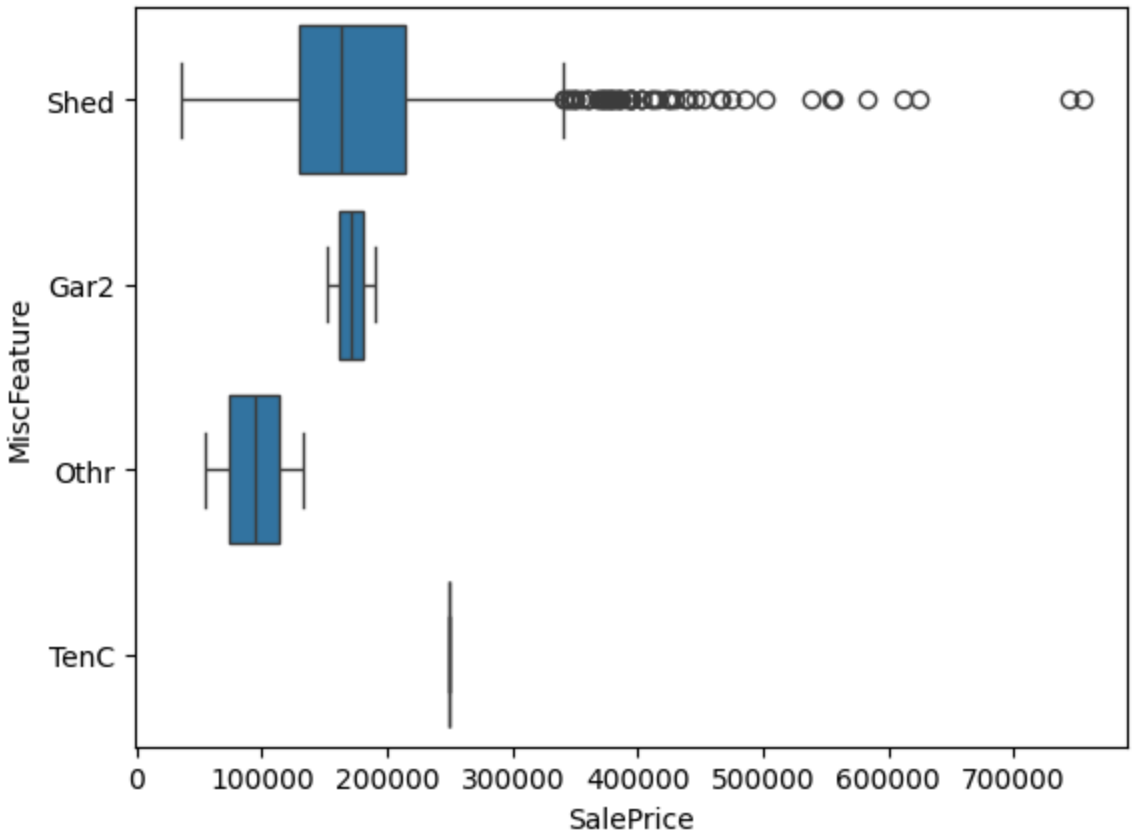

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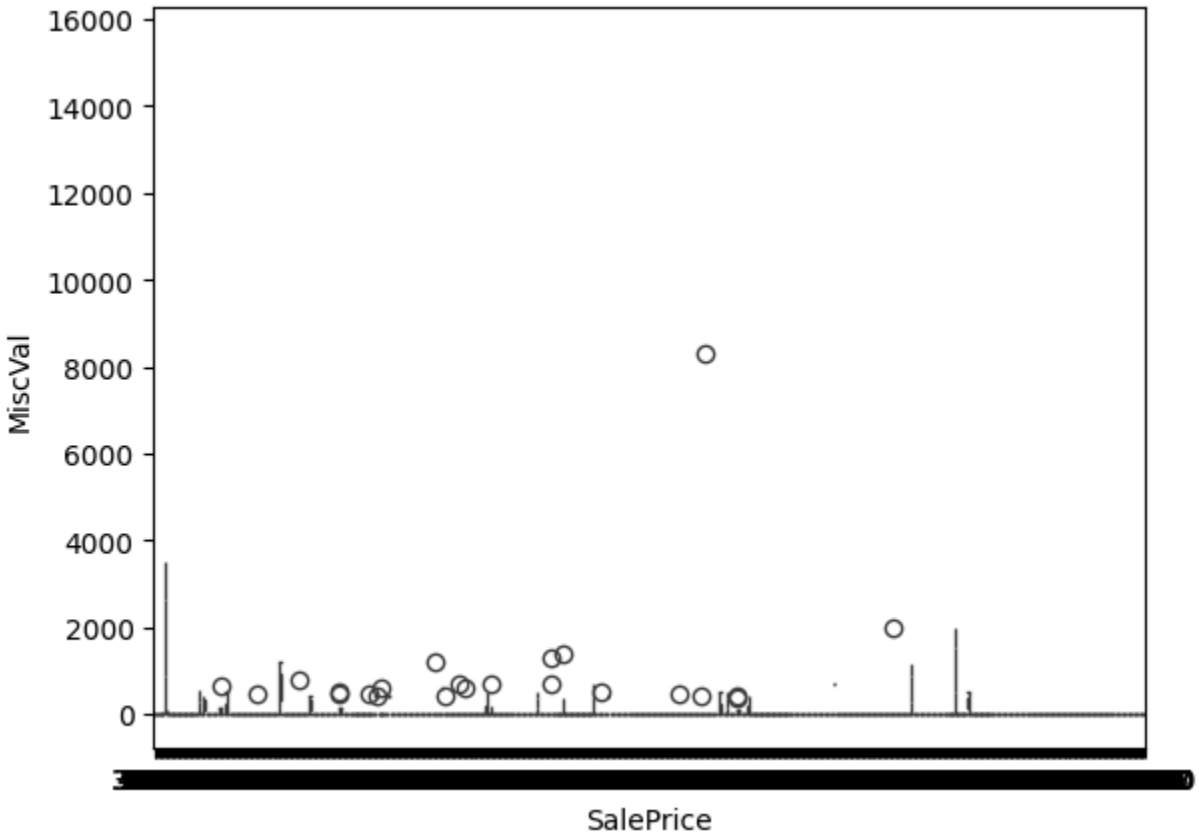

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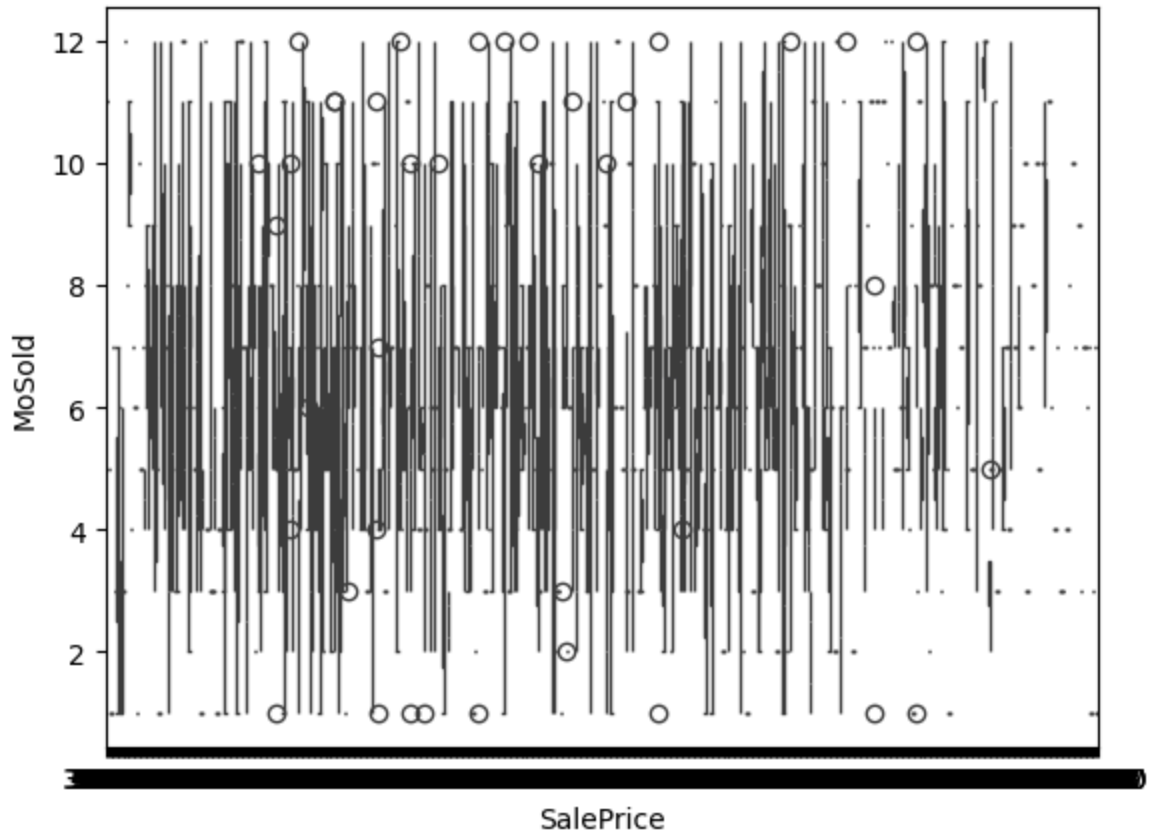

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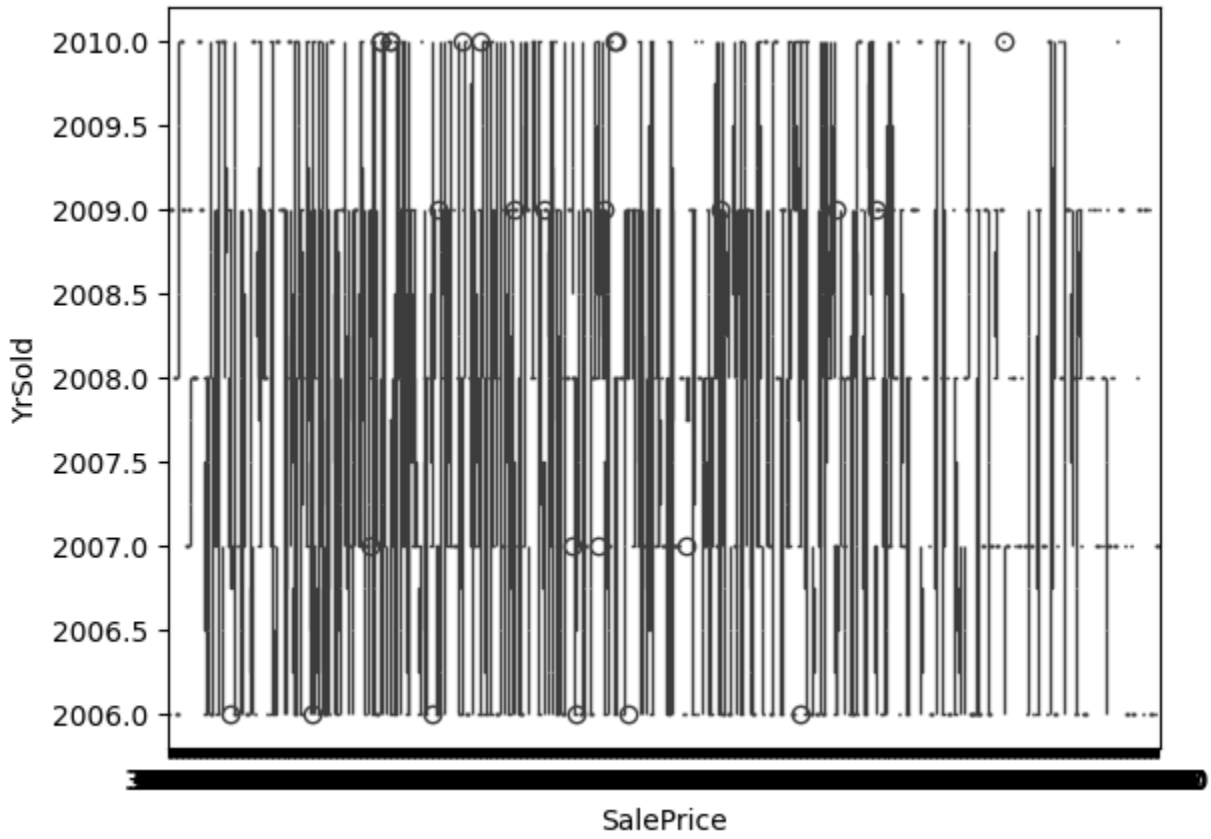

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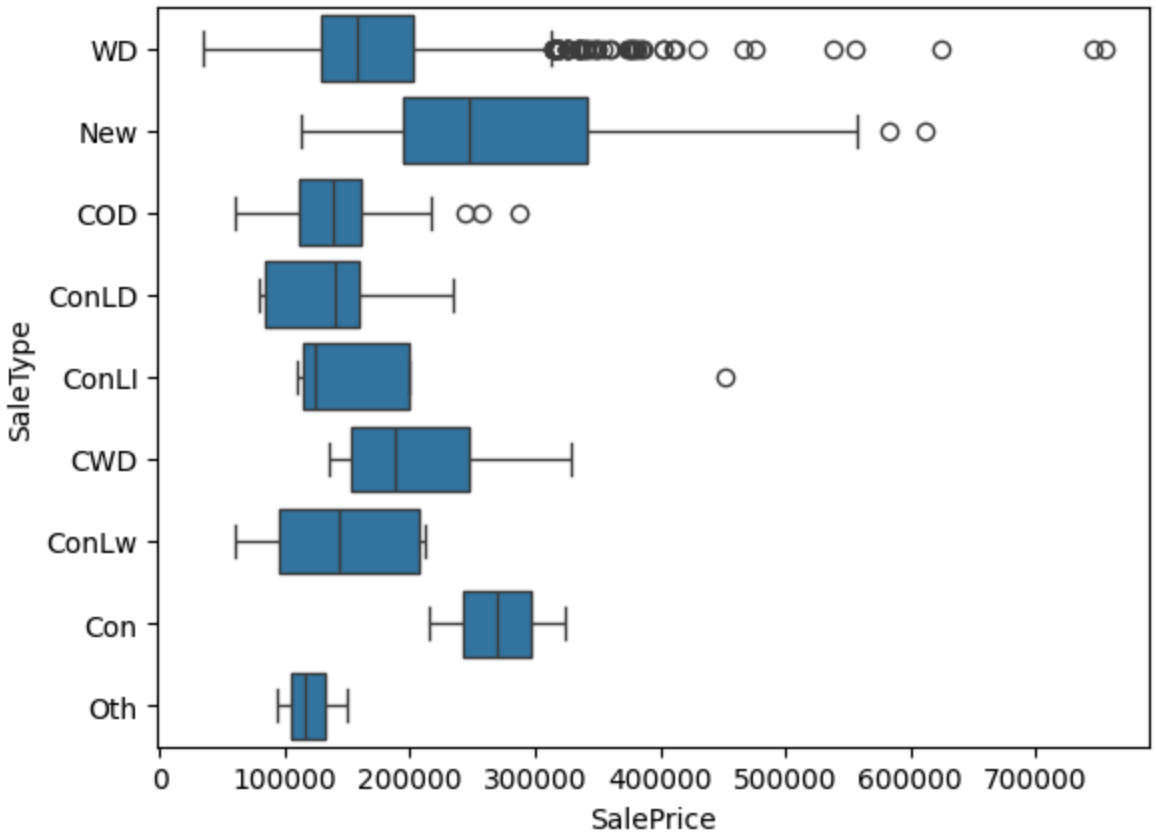

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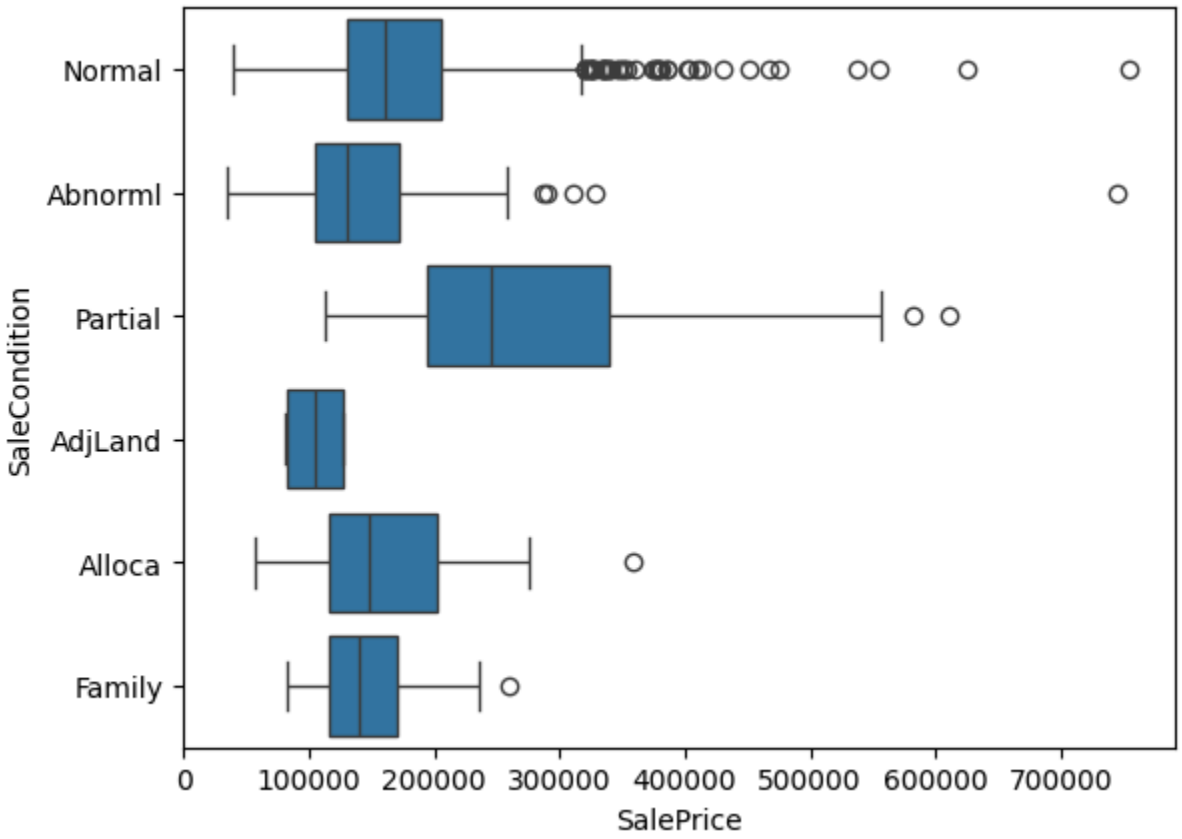

SalePrice

In [320…

```
for i in df[con].columns:
  sns.scatterplot(data=df,x='SalePrice',y=i)
  print(i)
  show()
```

```
Id
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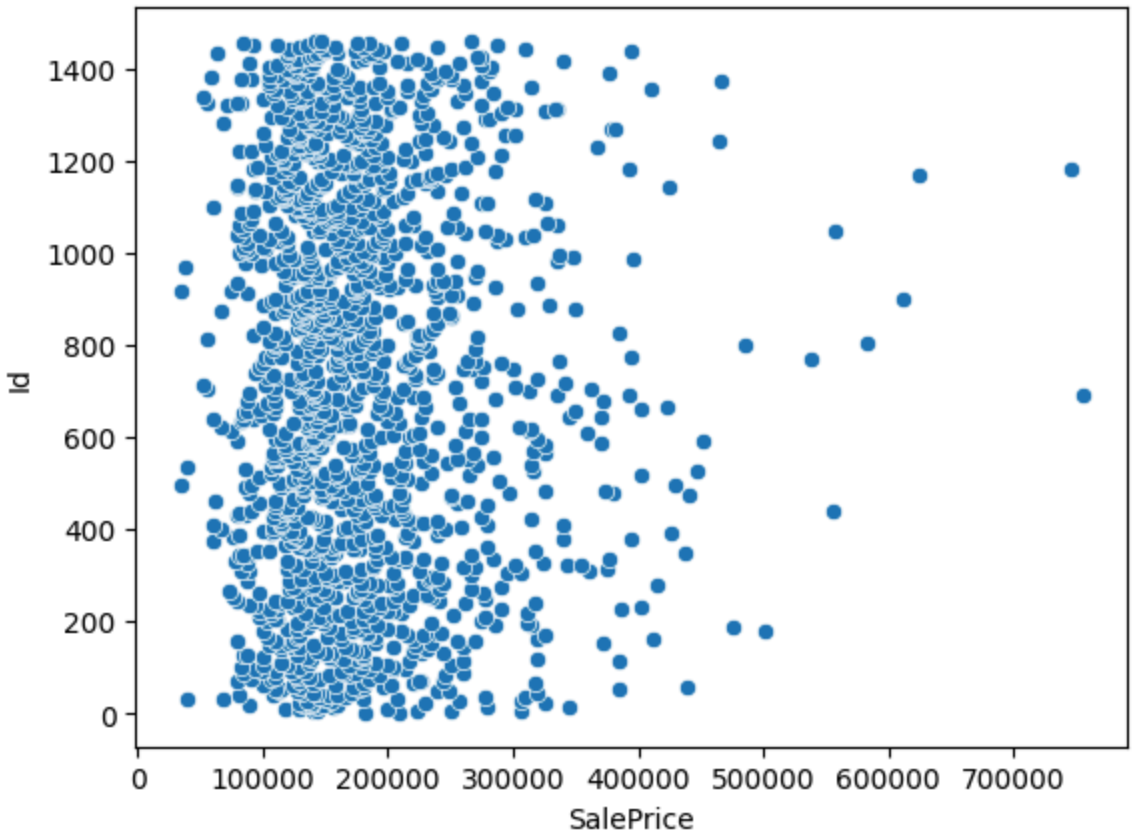

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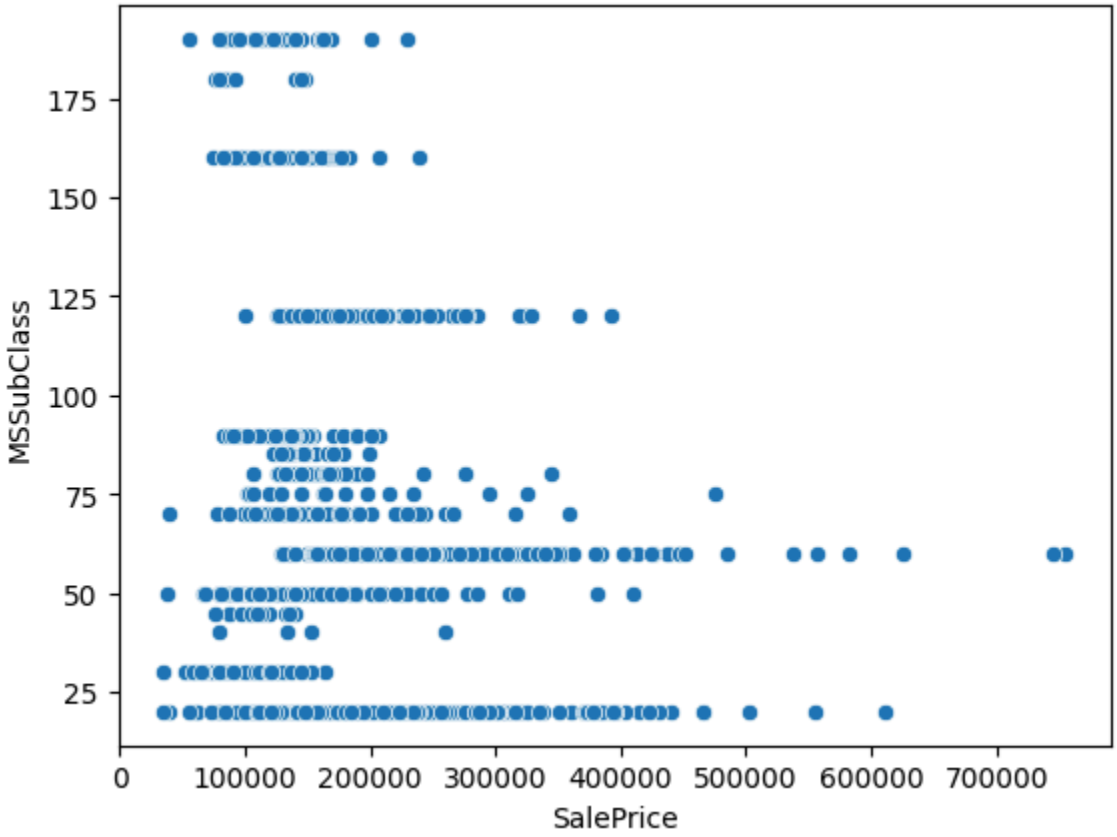
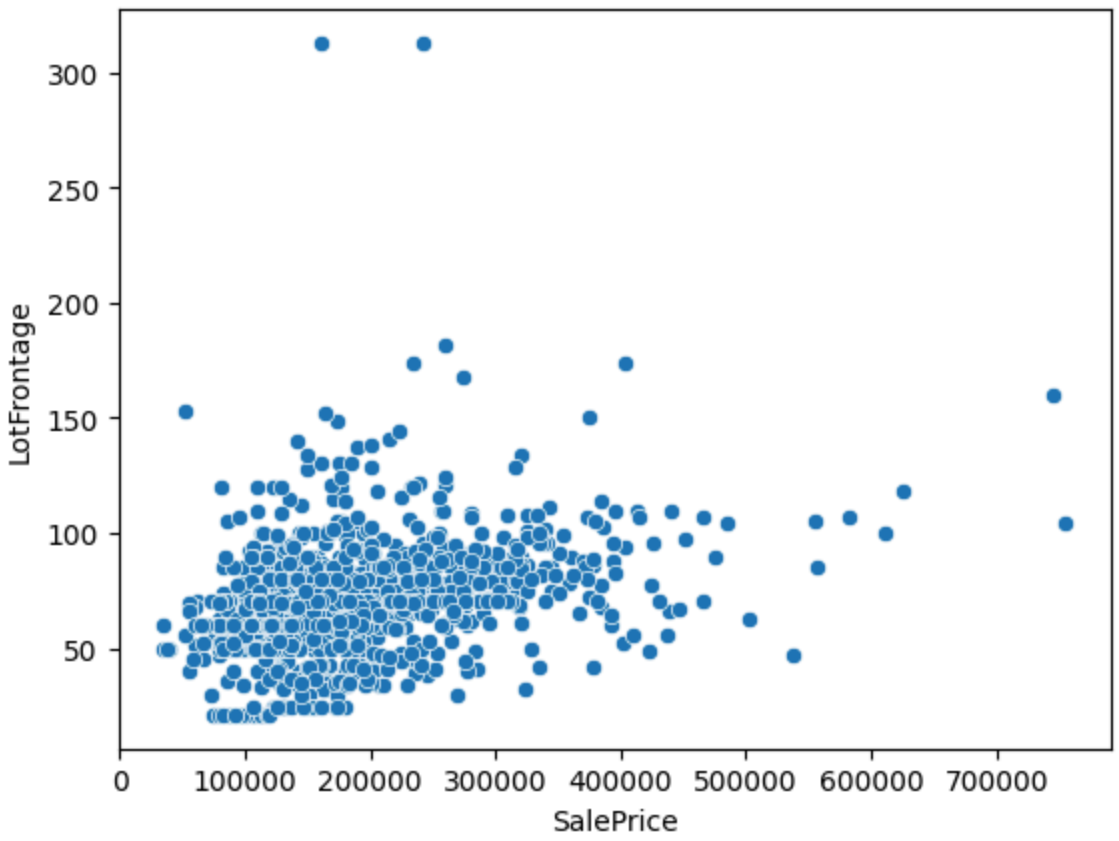


LotFrontage



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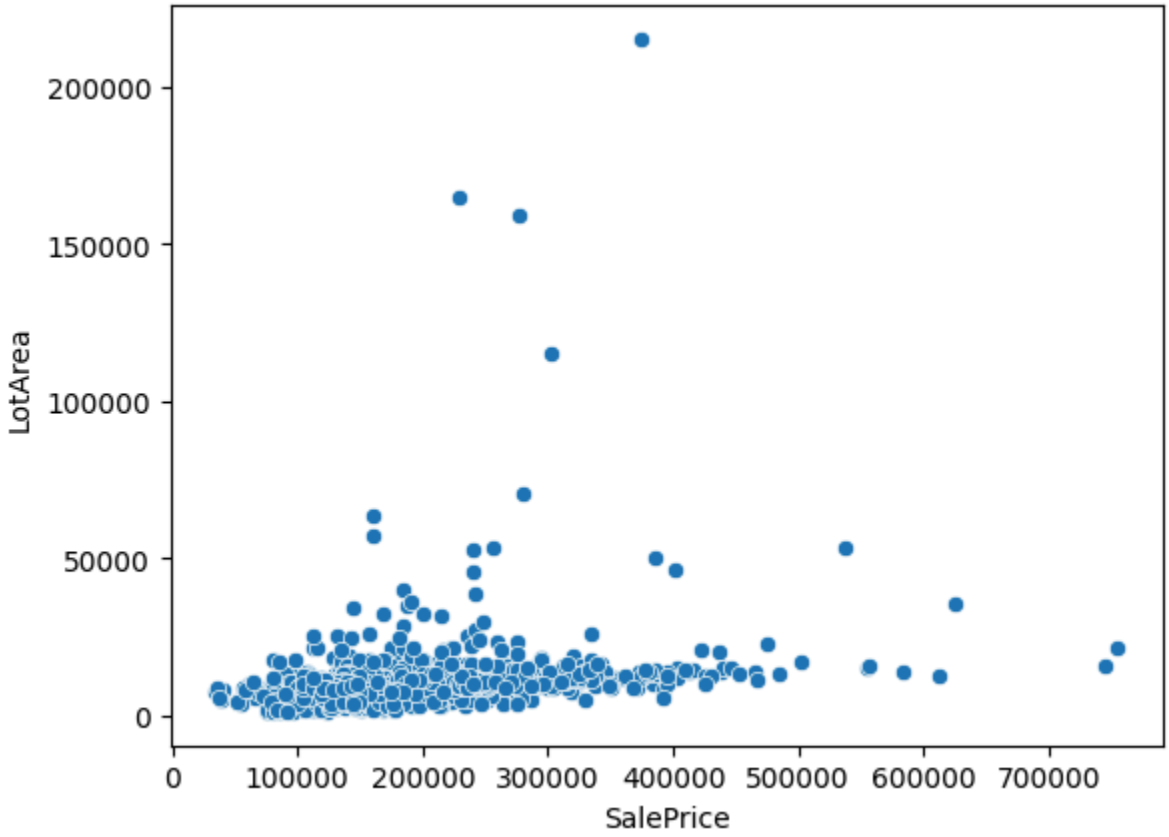
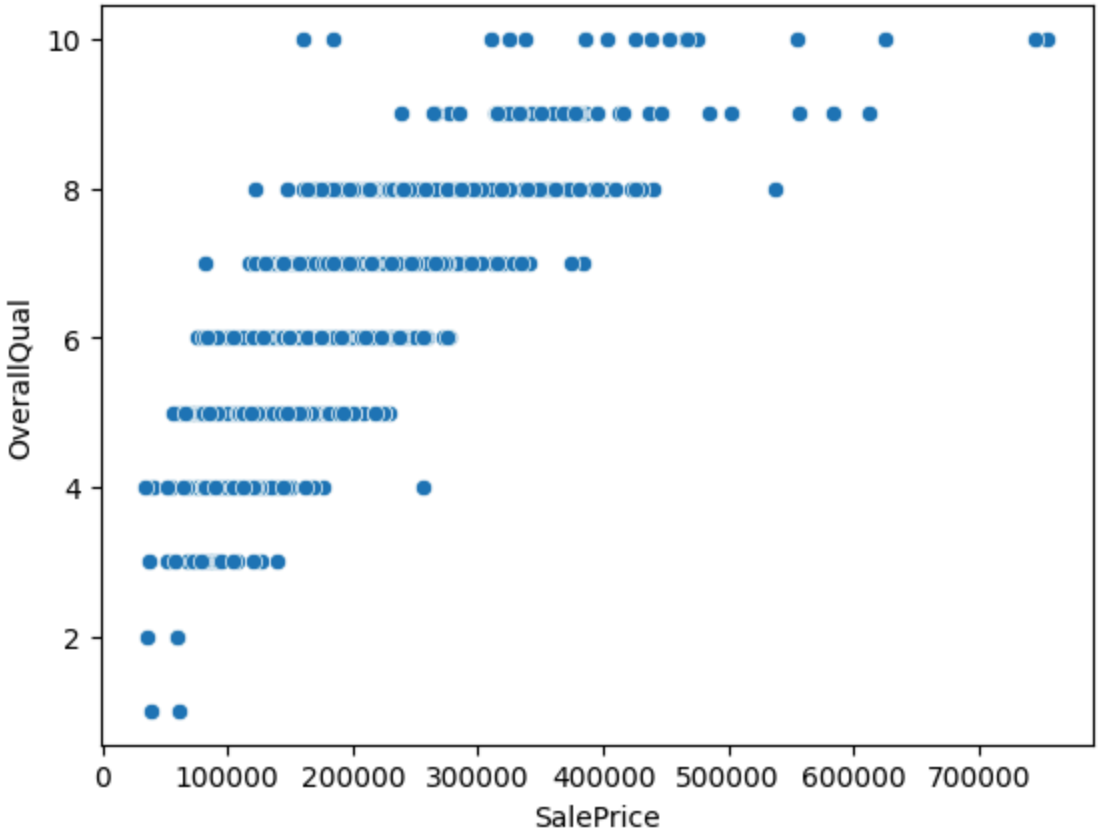


OverallQual



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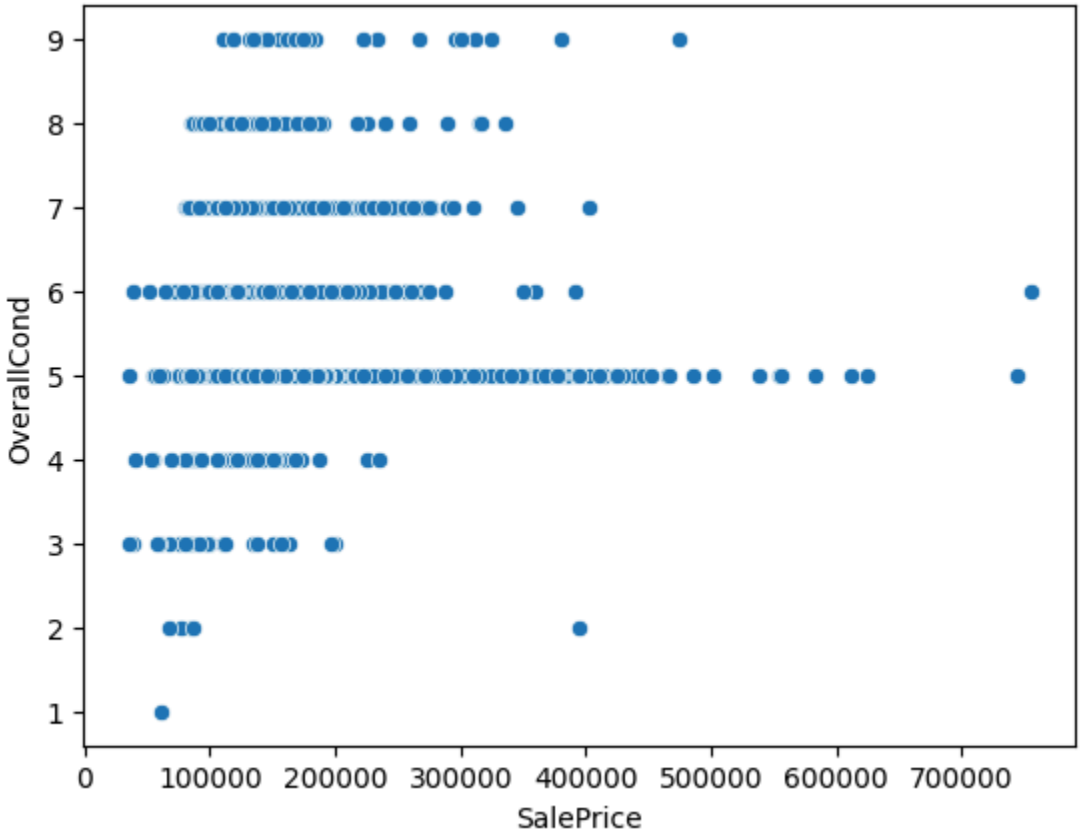
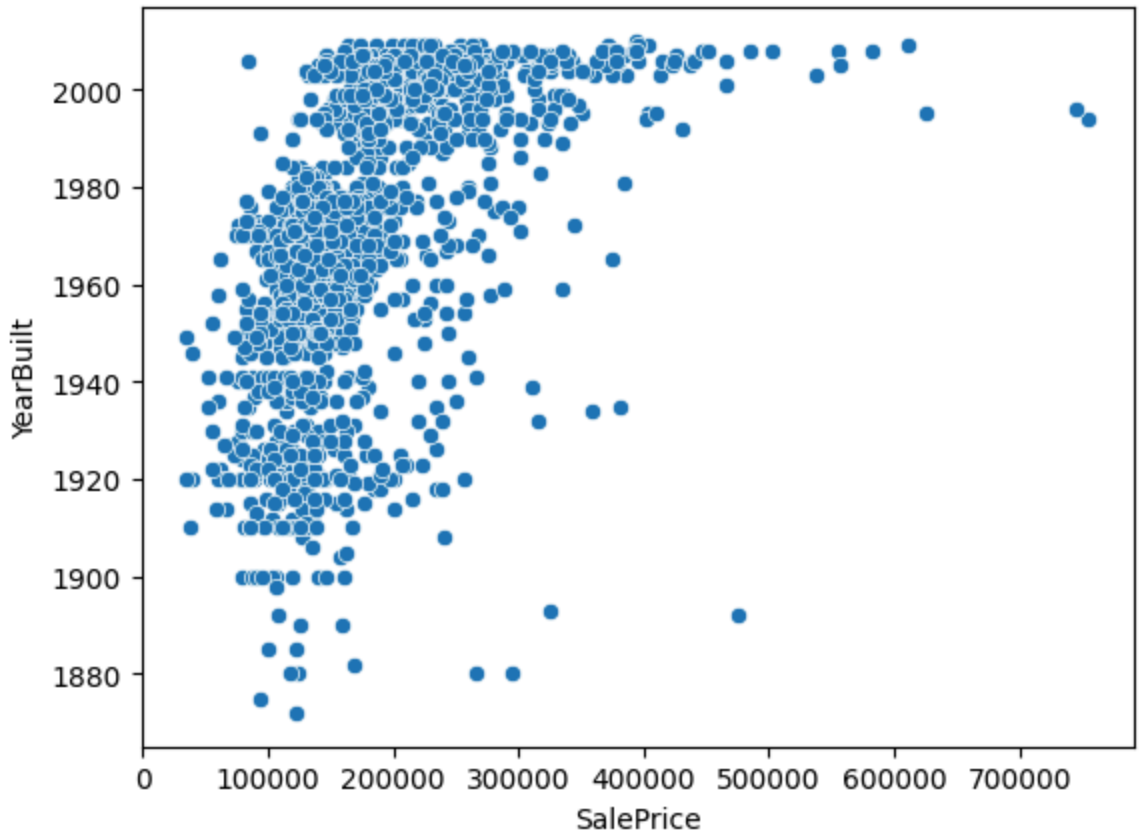


`YearBuilt`



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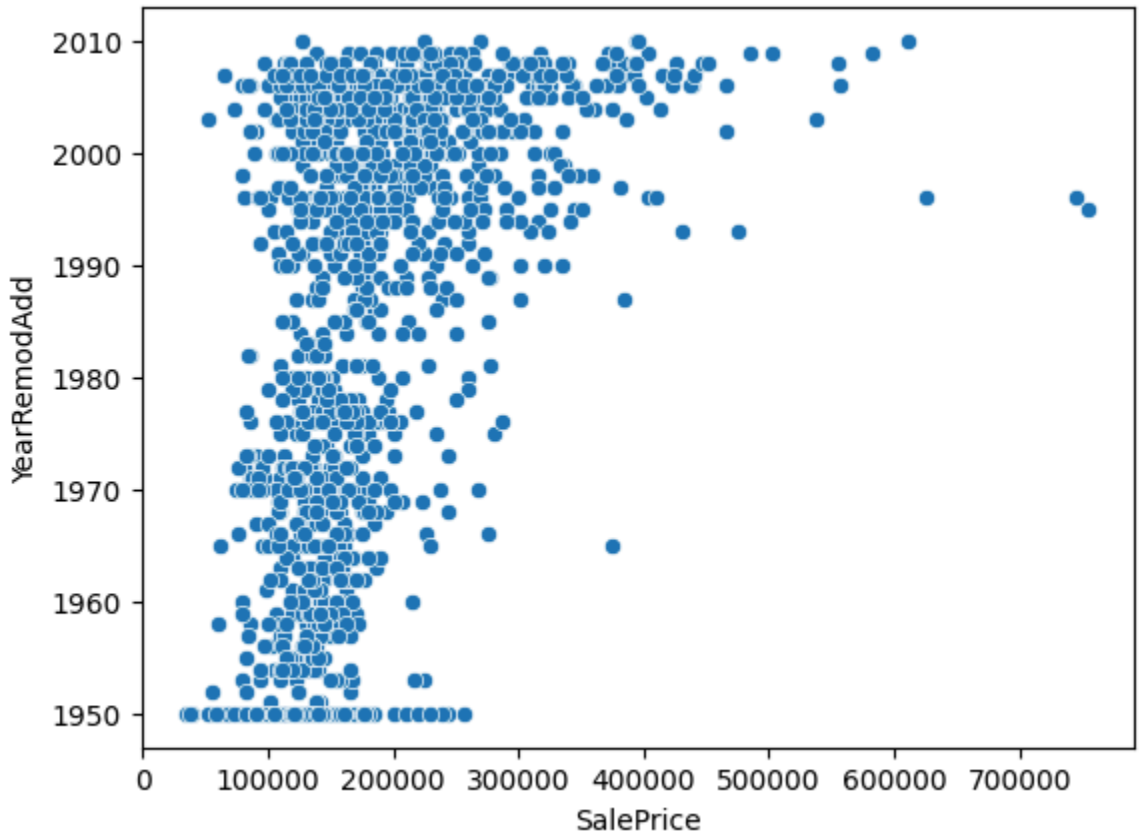

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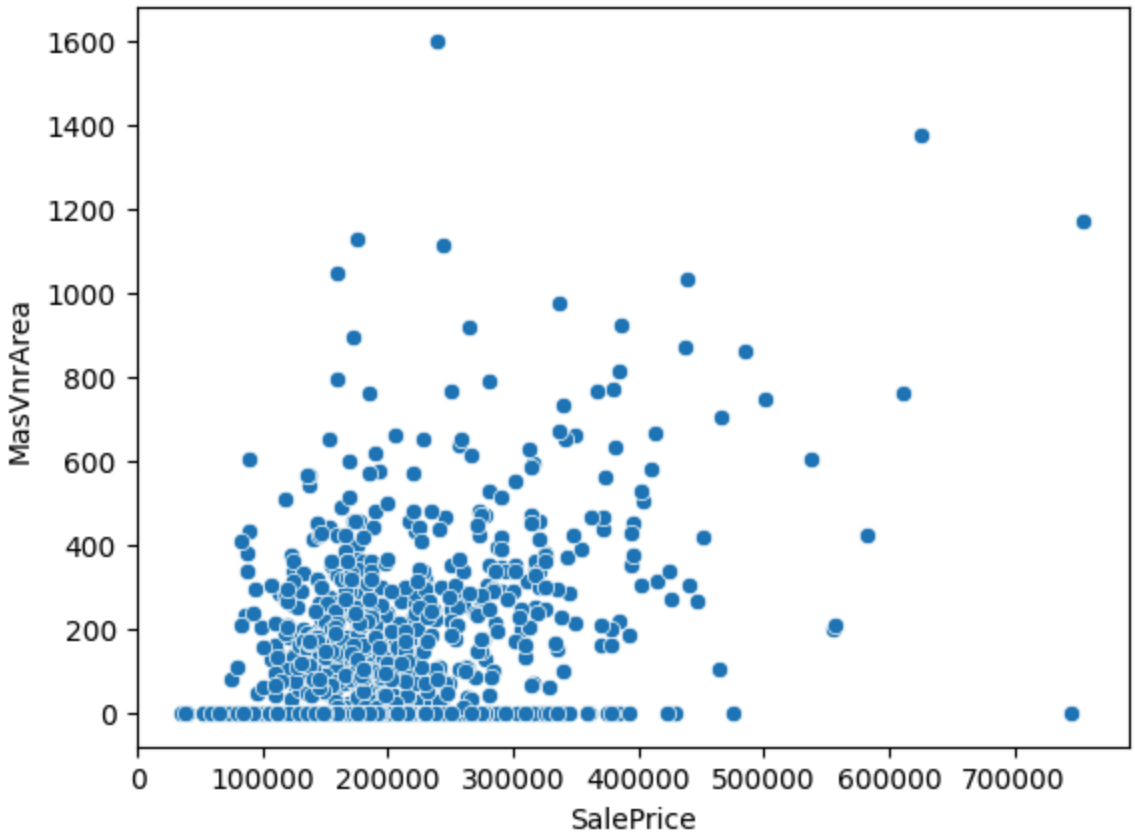

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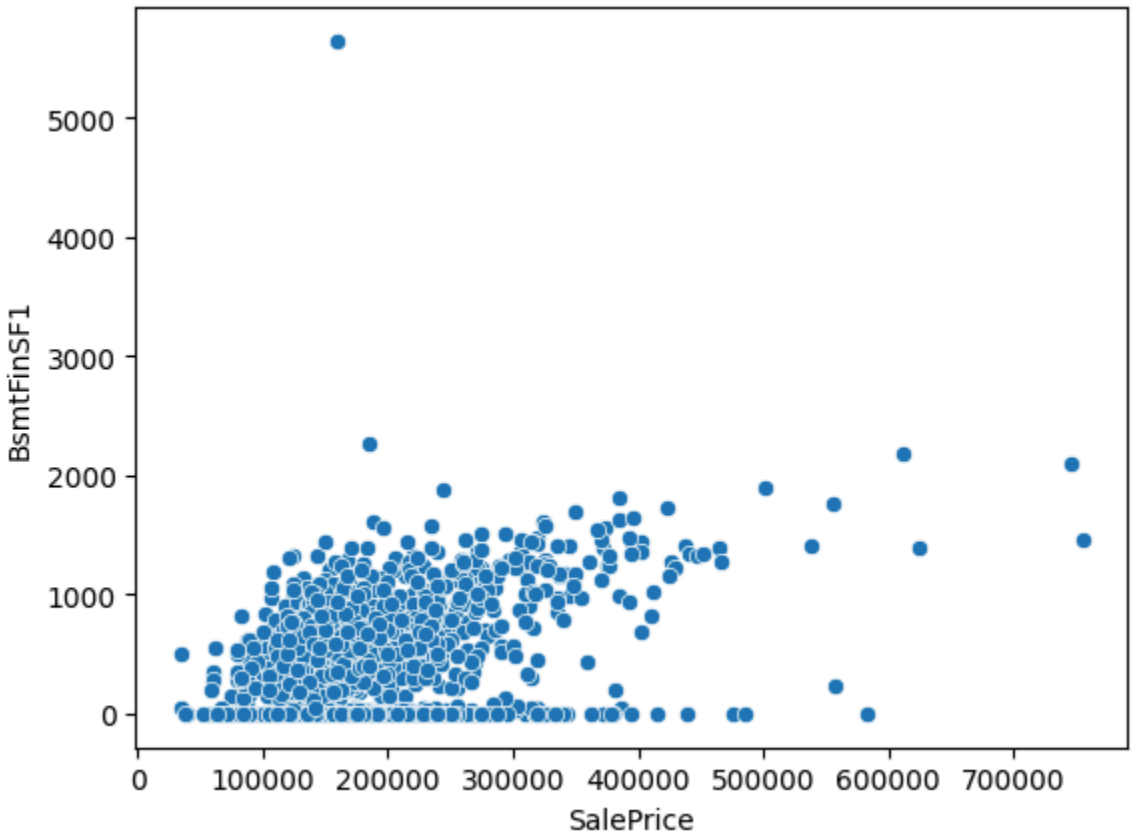

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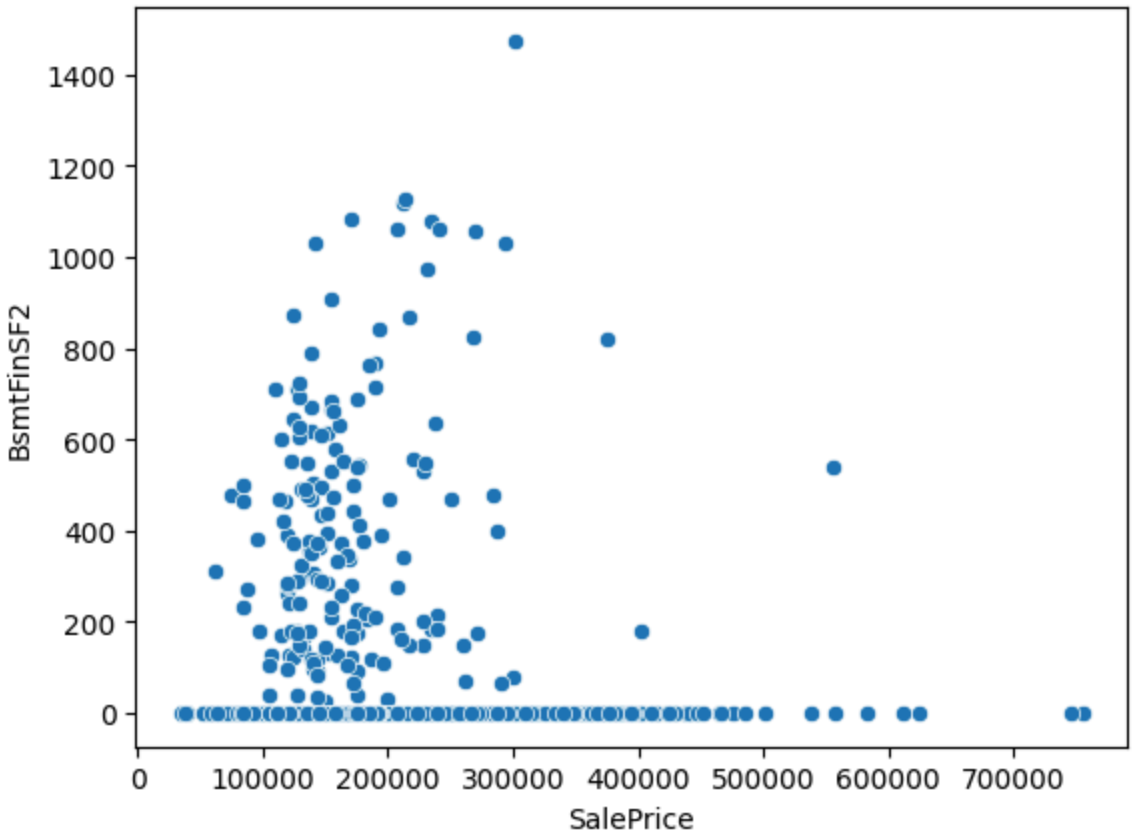

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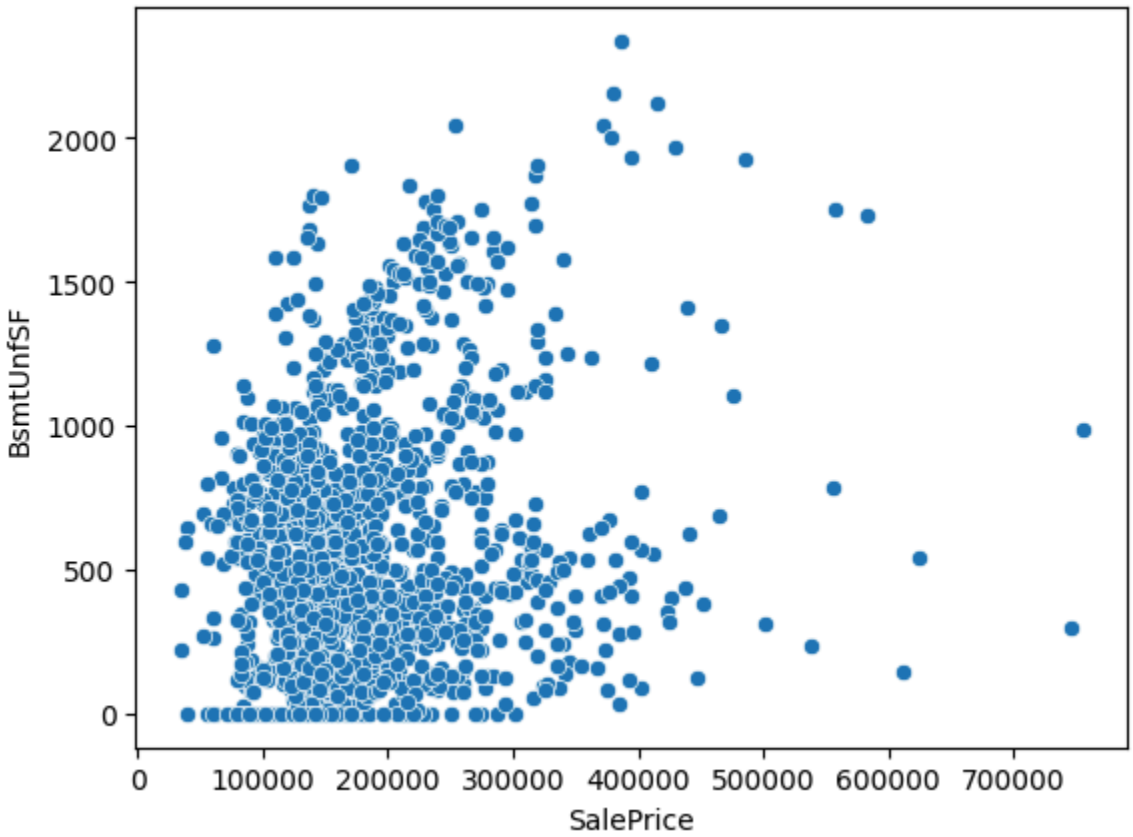

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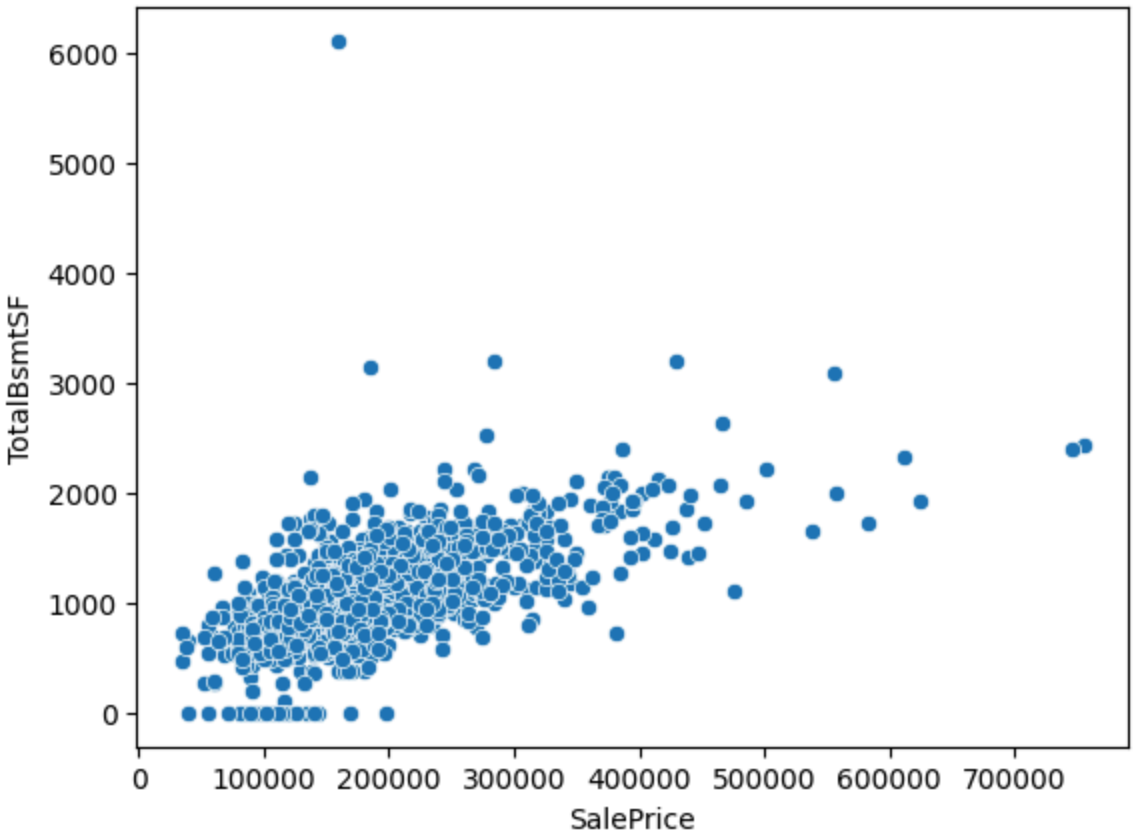

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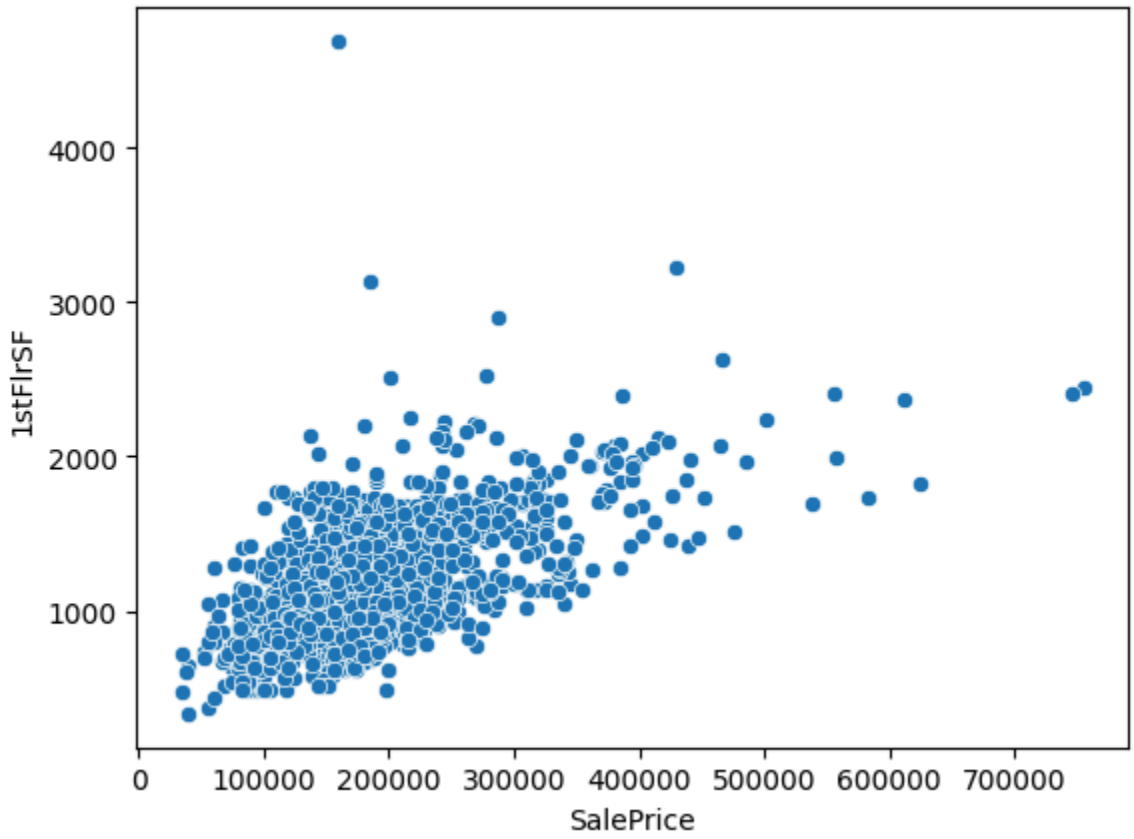
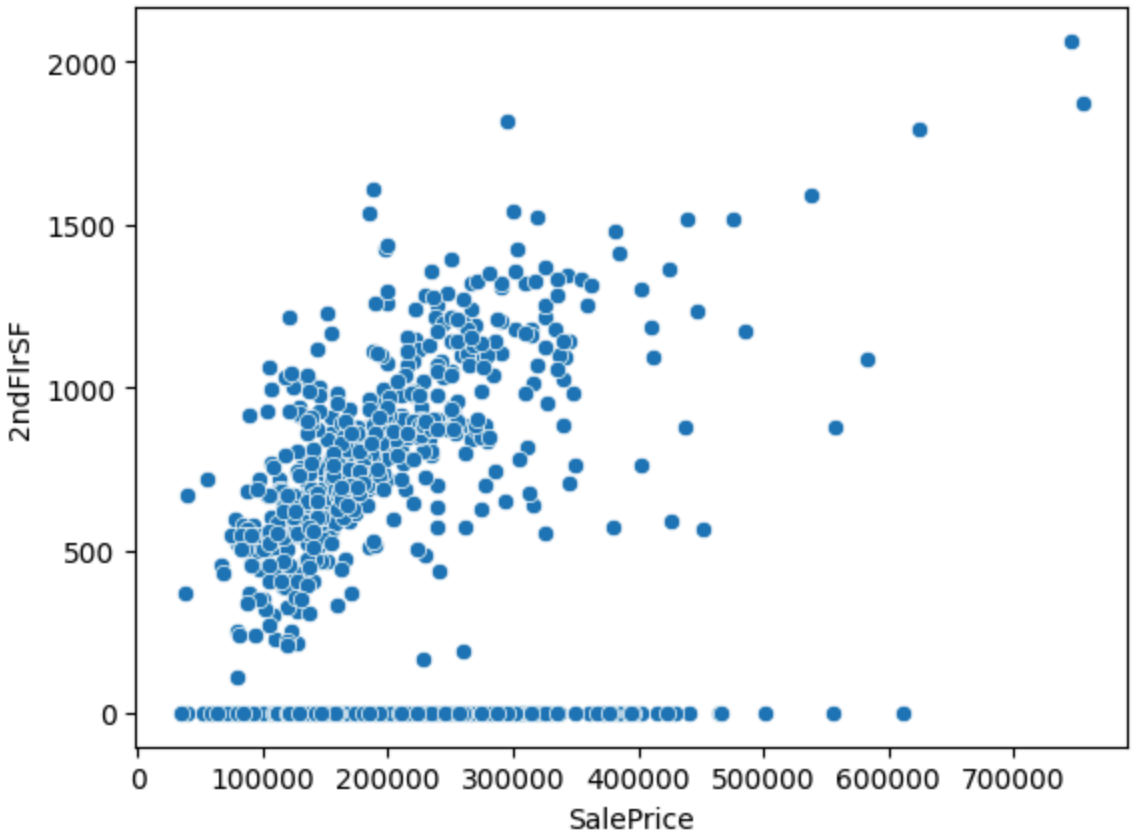


2ndFlrSF



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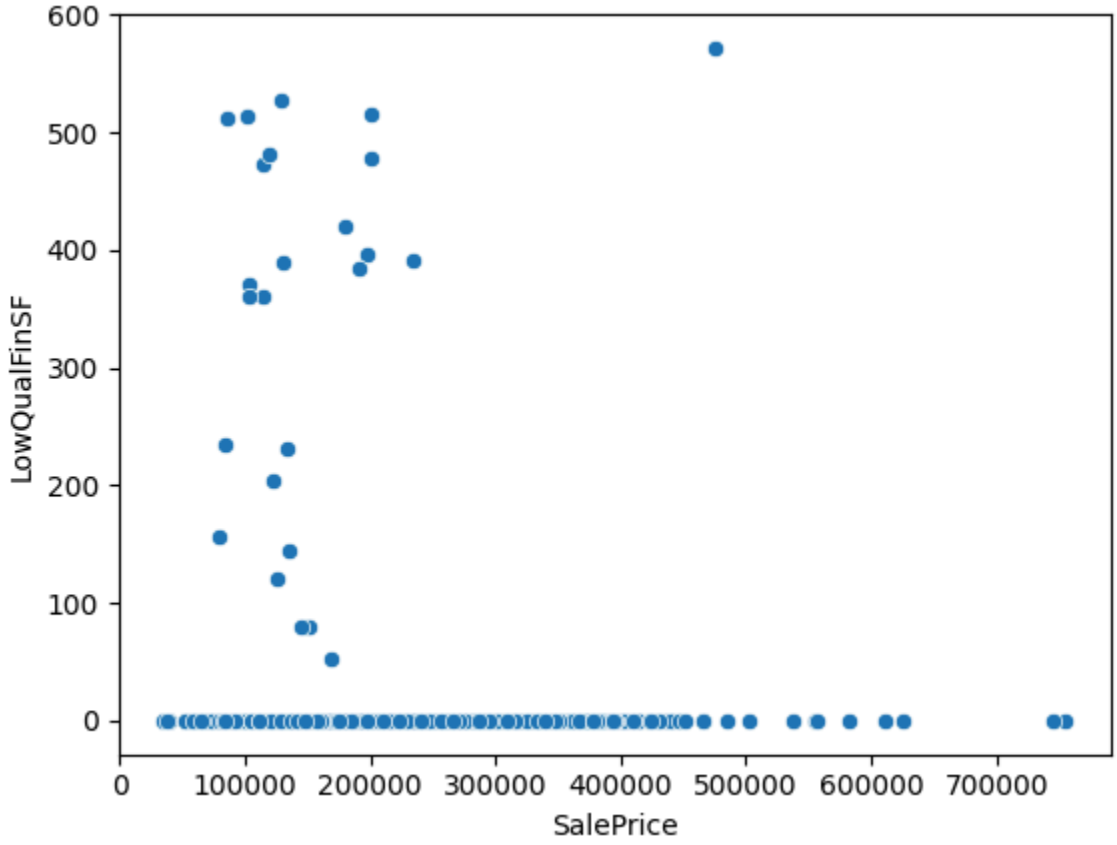

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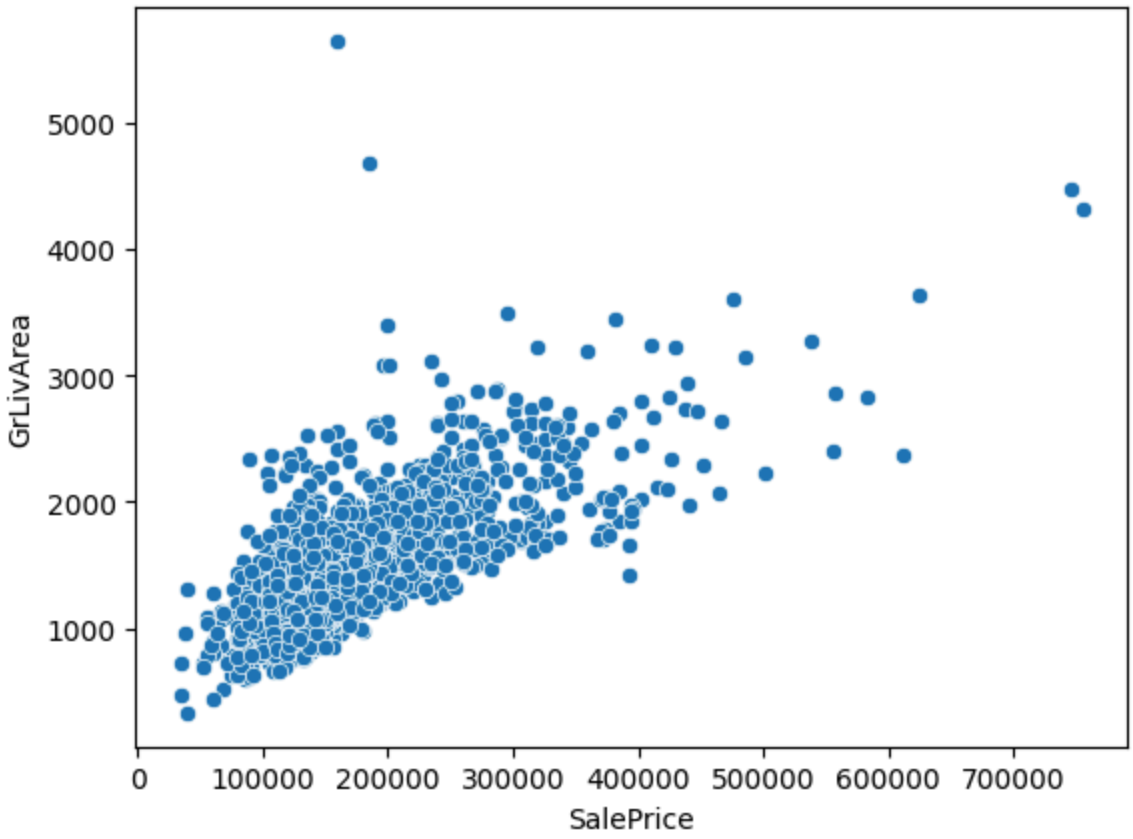
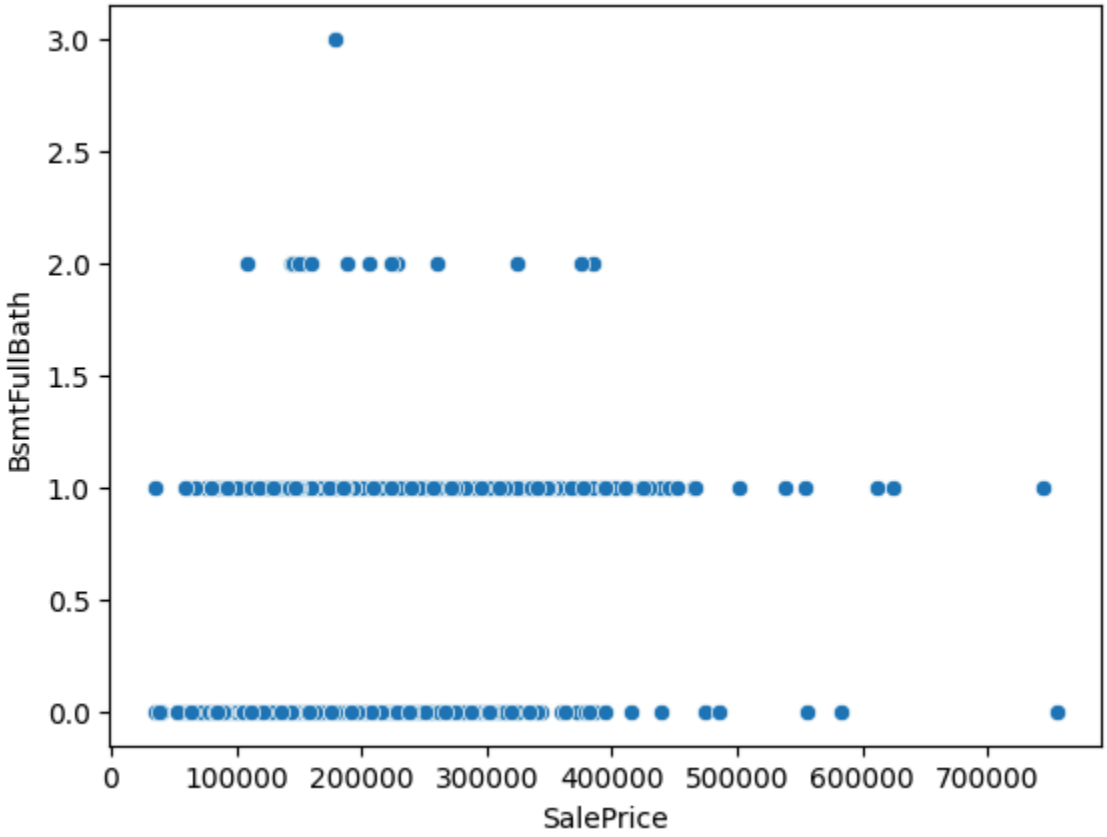


BsmtFullBath



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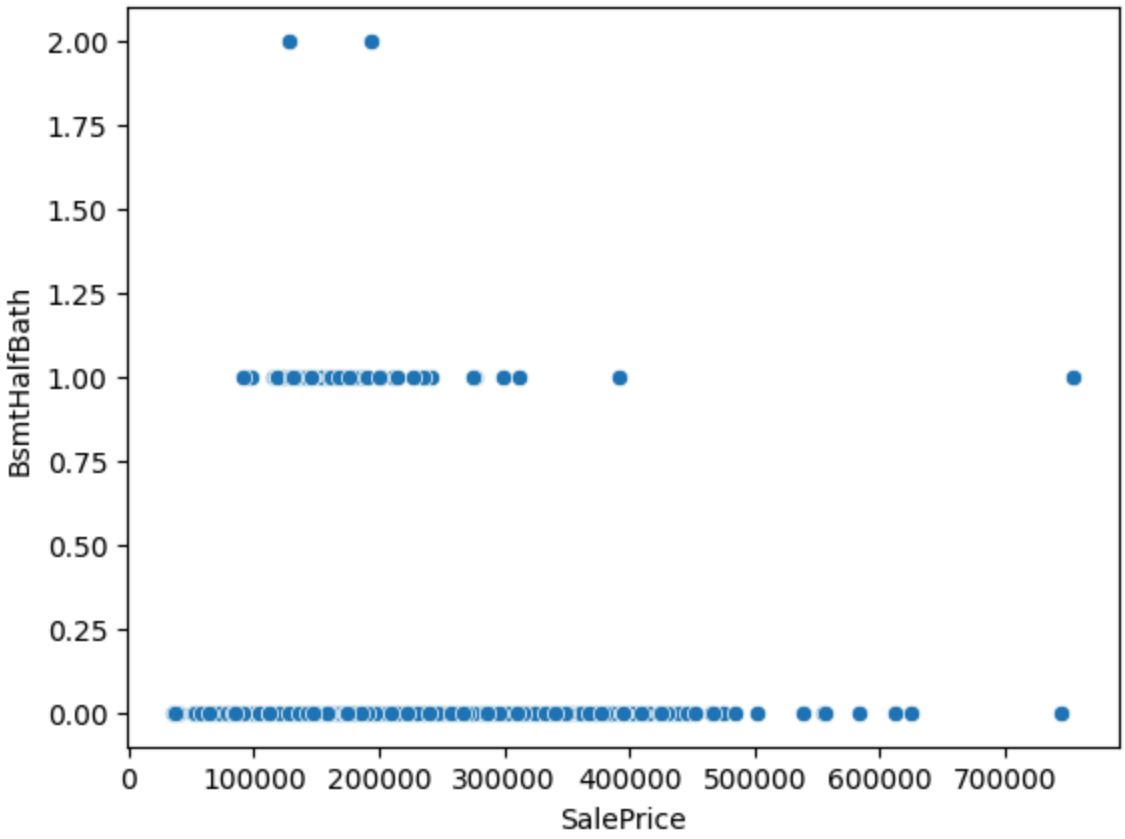

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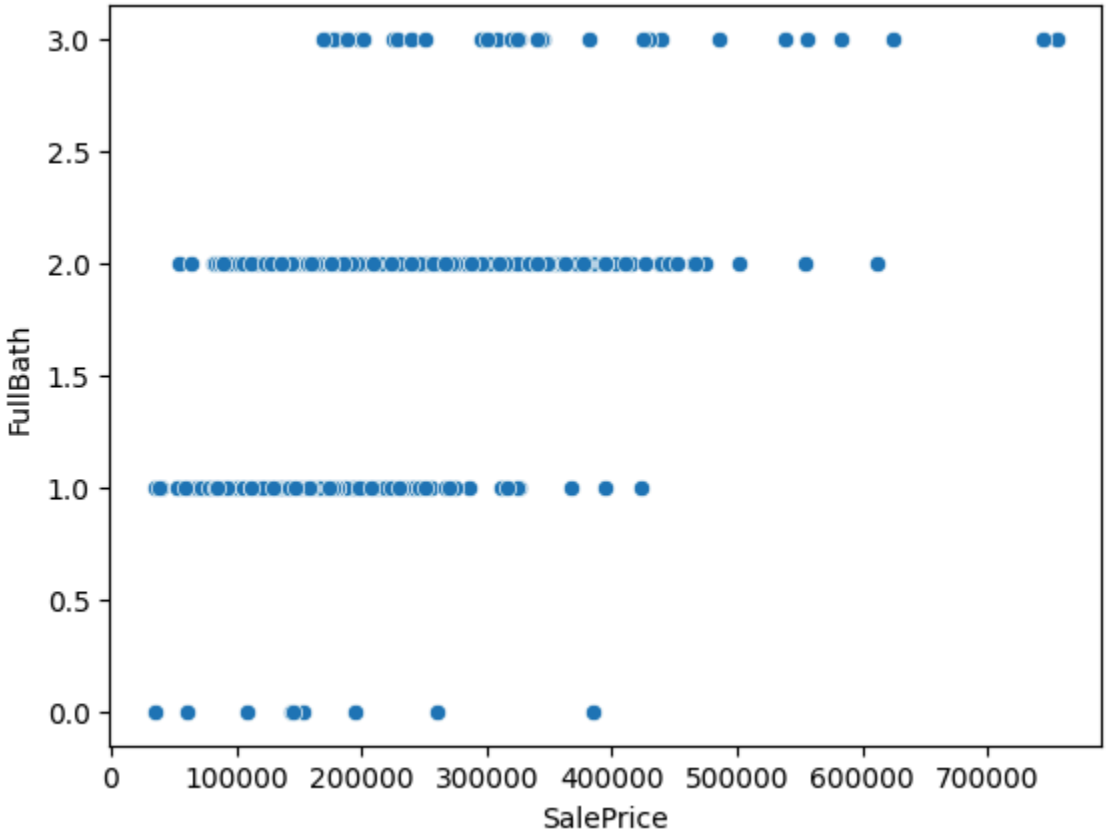
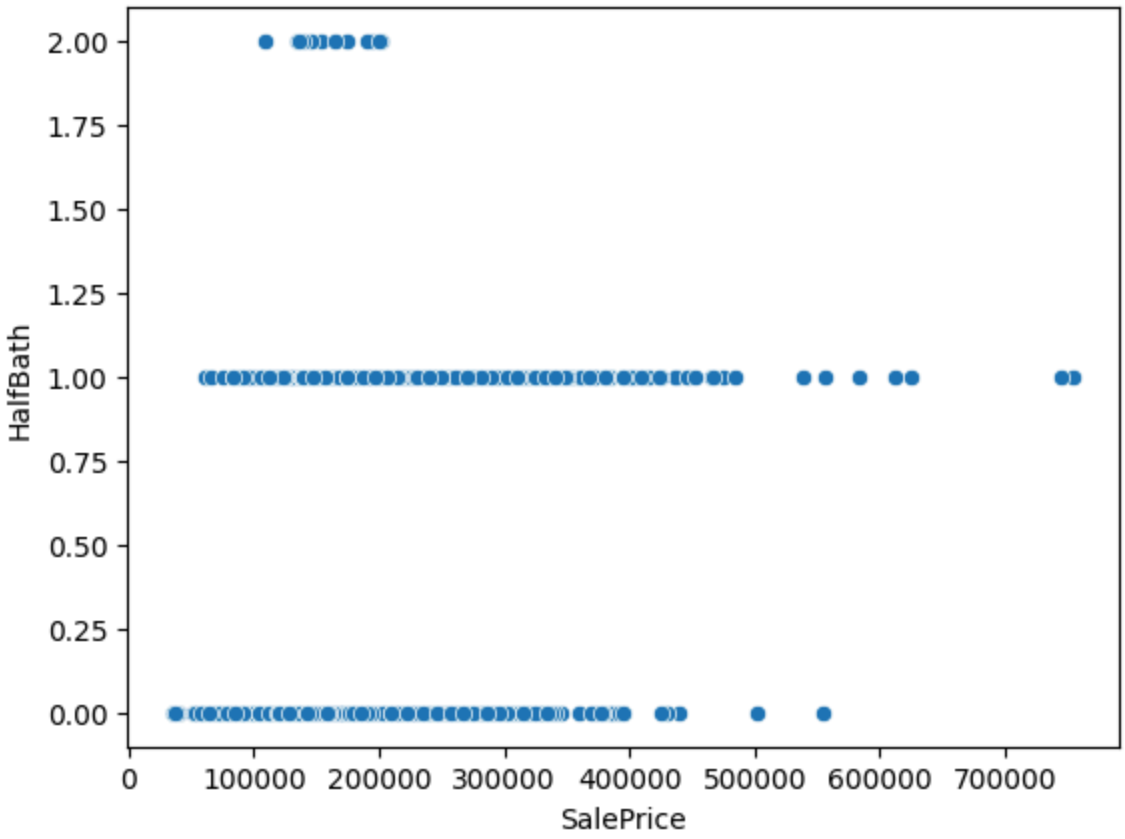
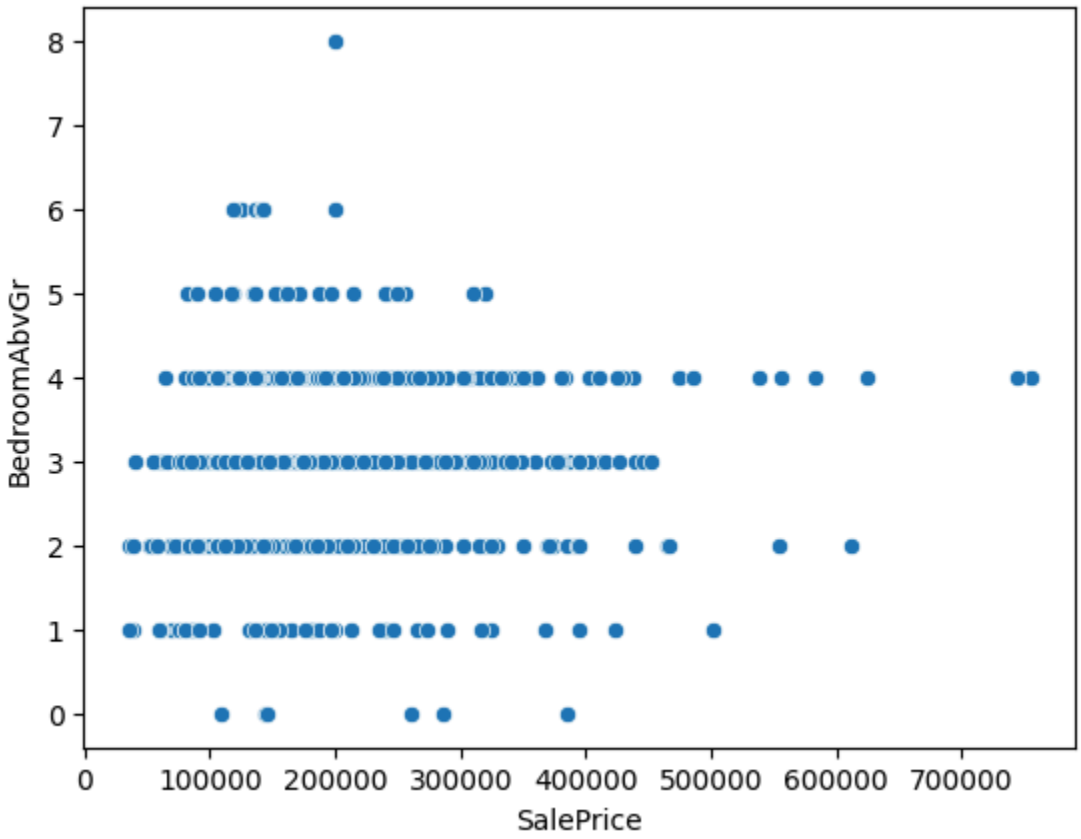


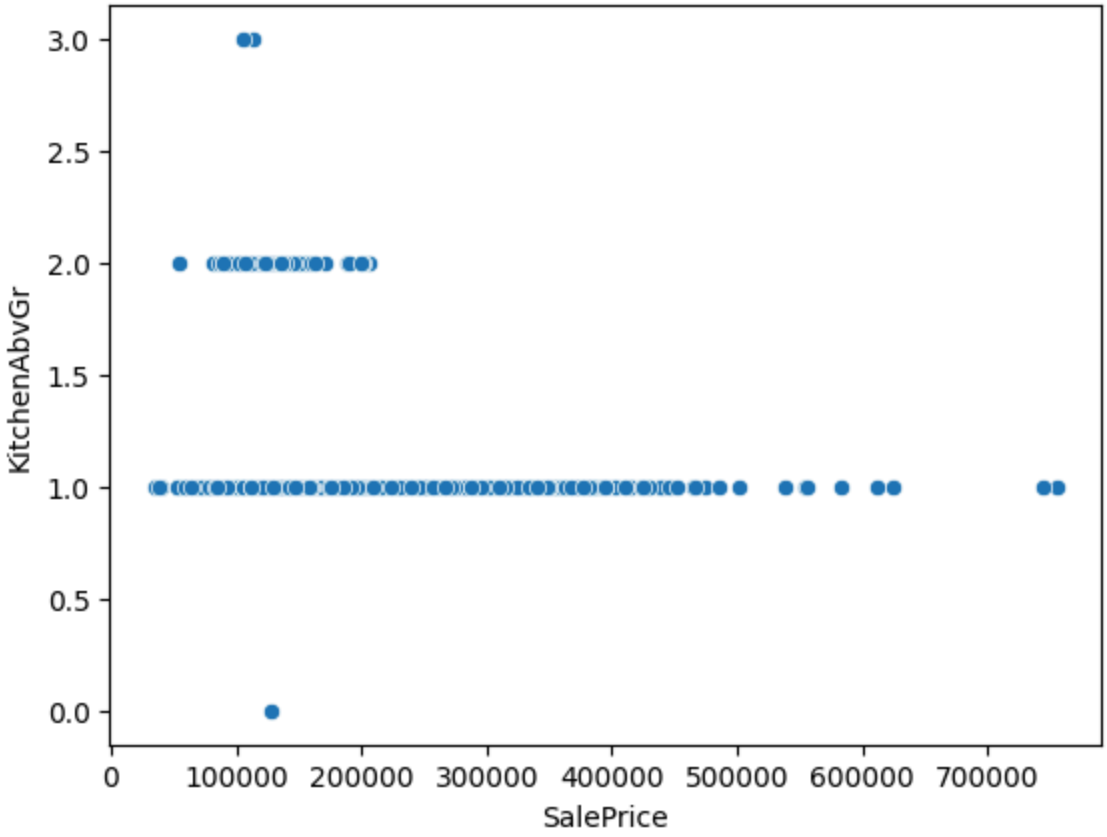
HalfBath



BedroomAbvGr



KitchenAbvGr



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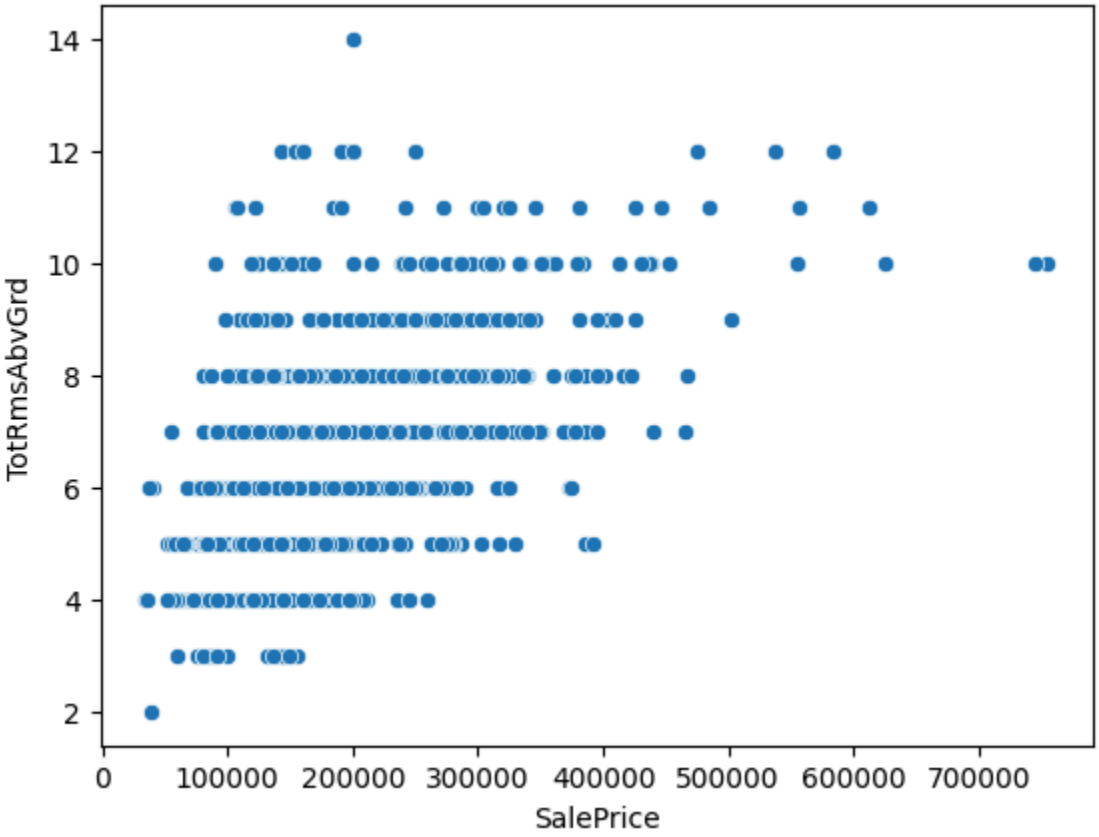
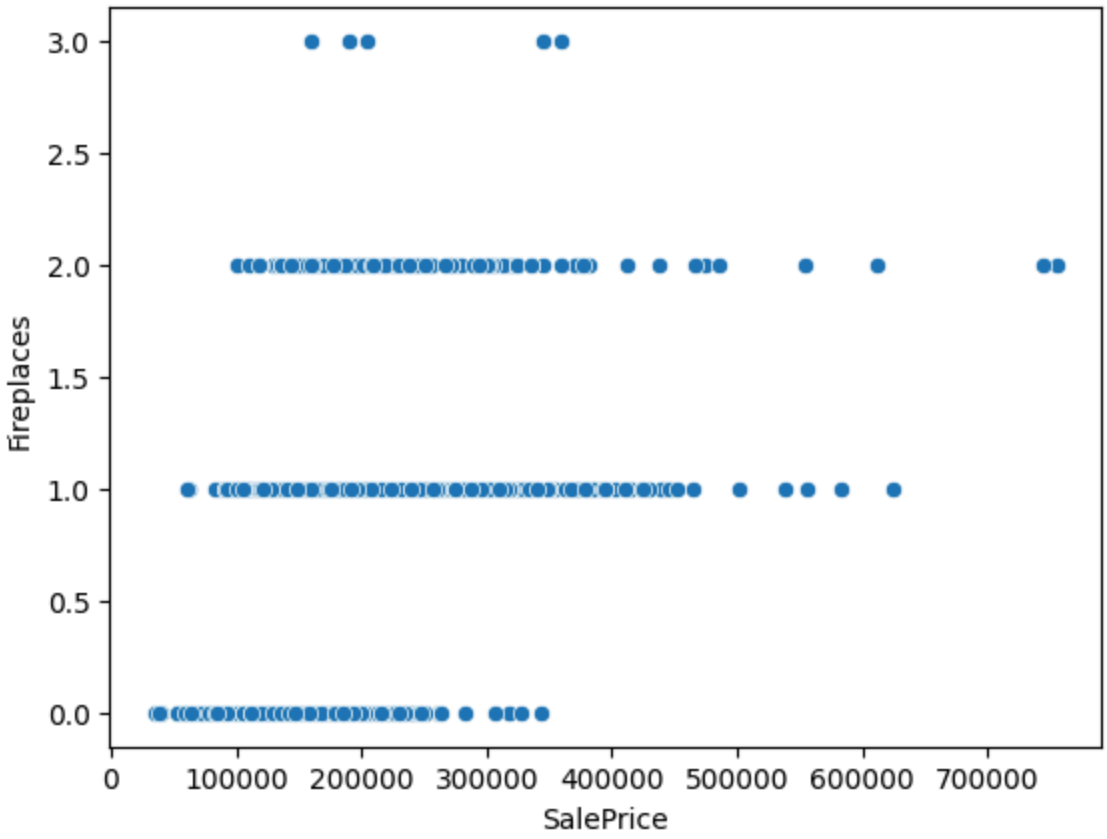
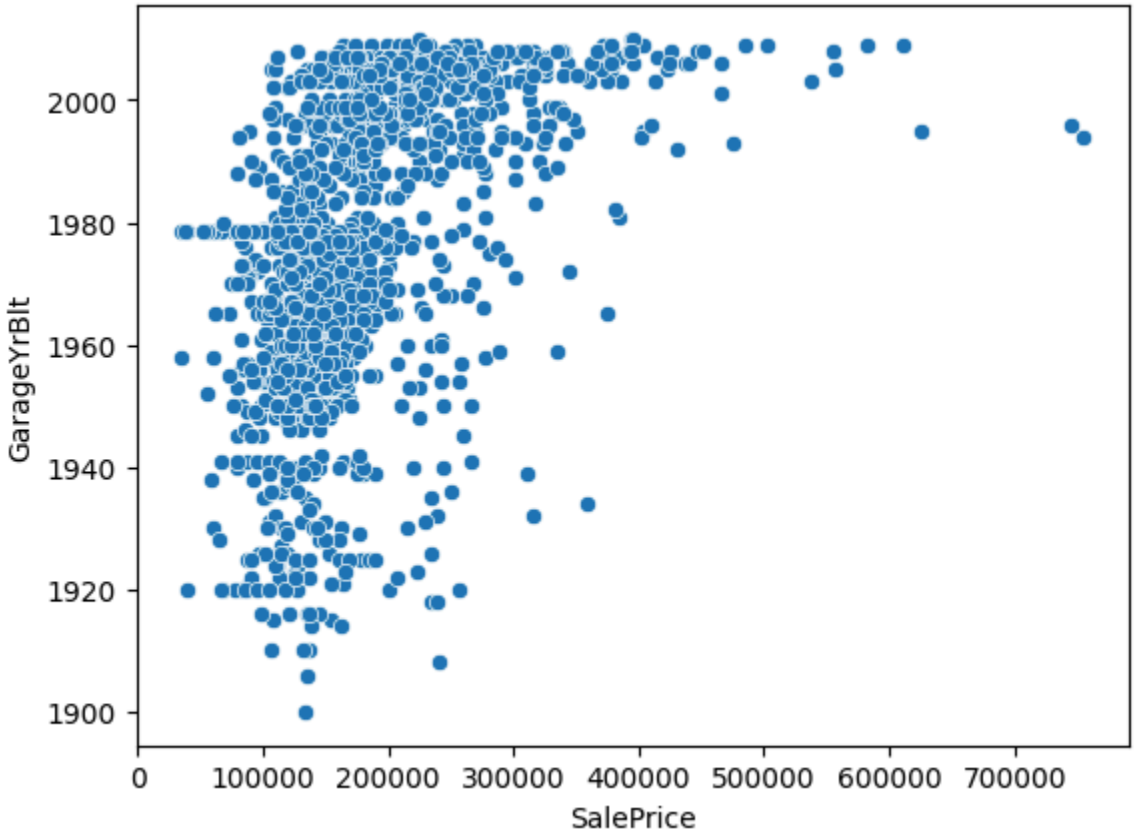


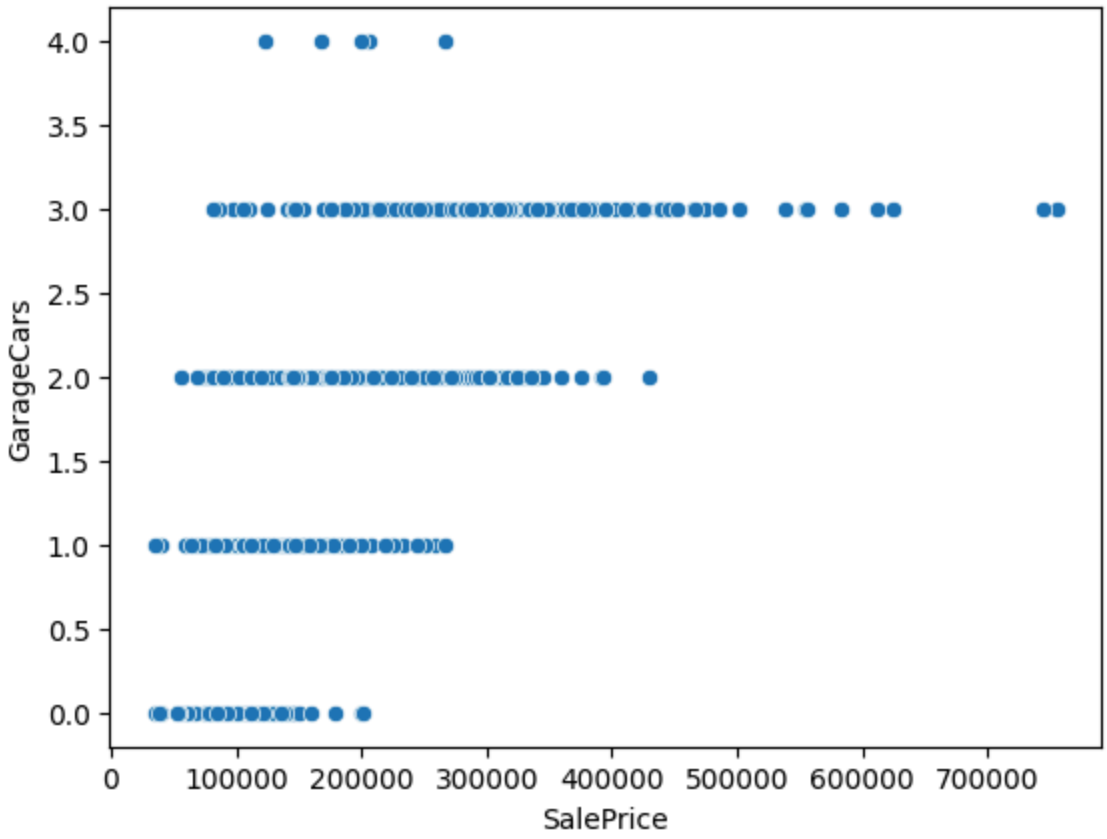
Fireplaces



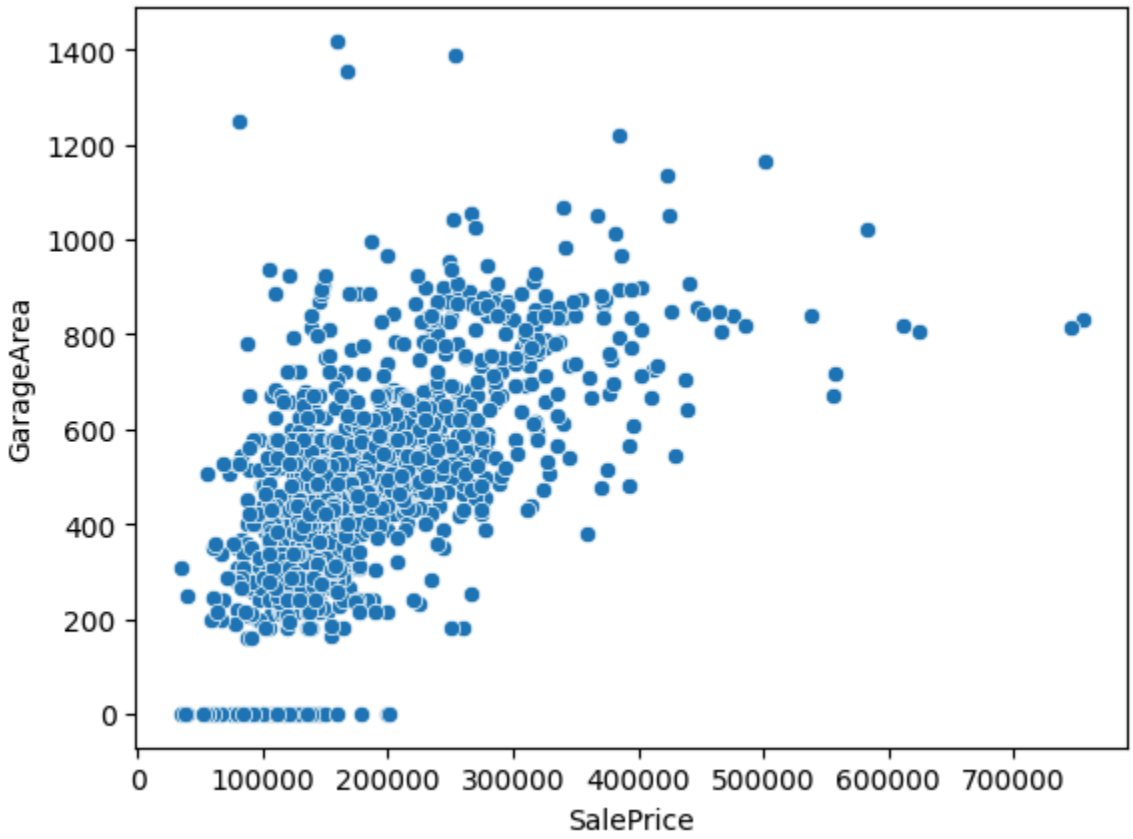
GarageYrBlt



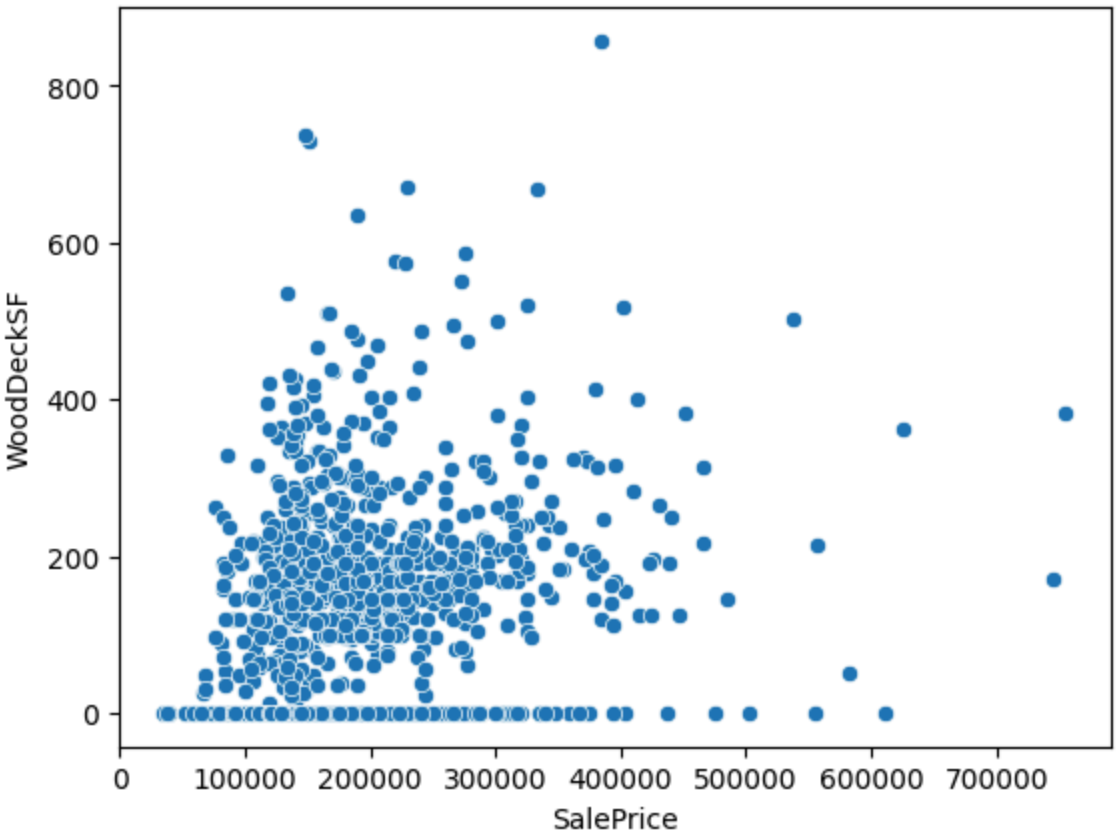
GarageCars



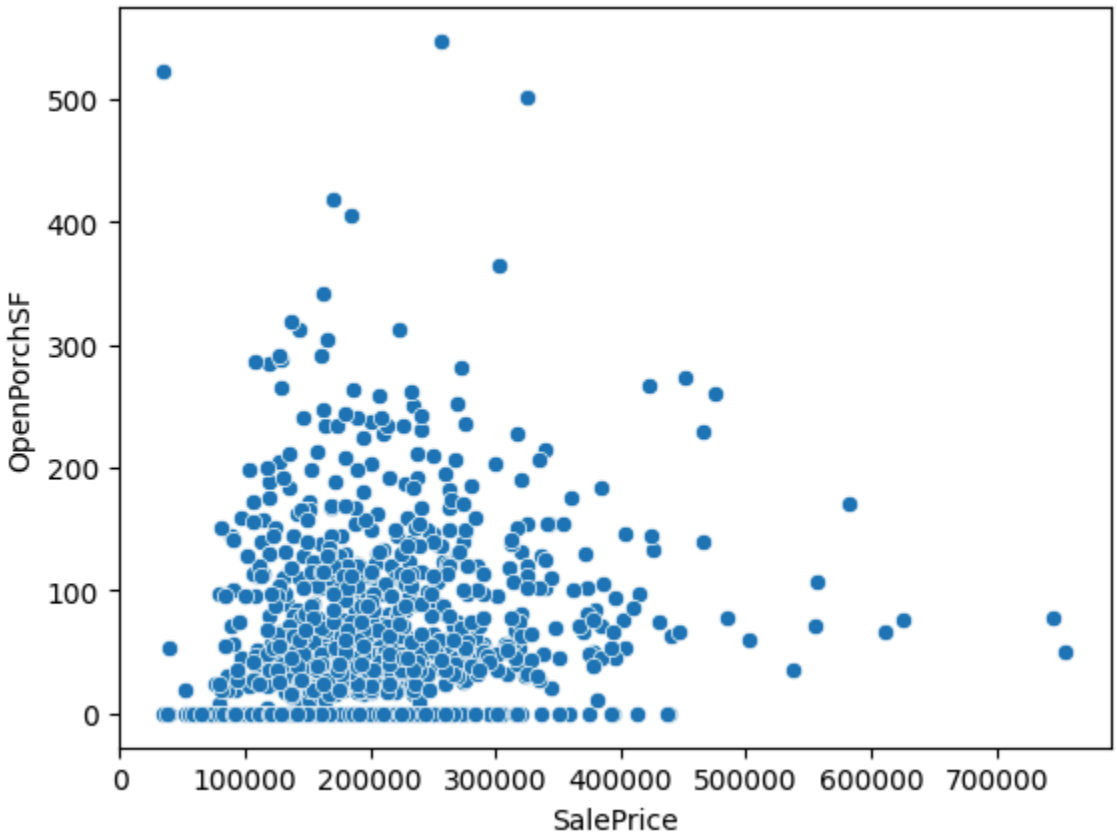
GarageArea



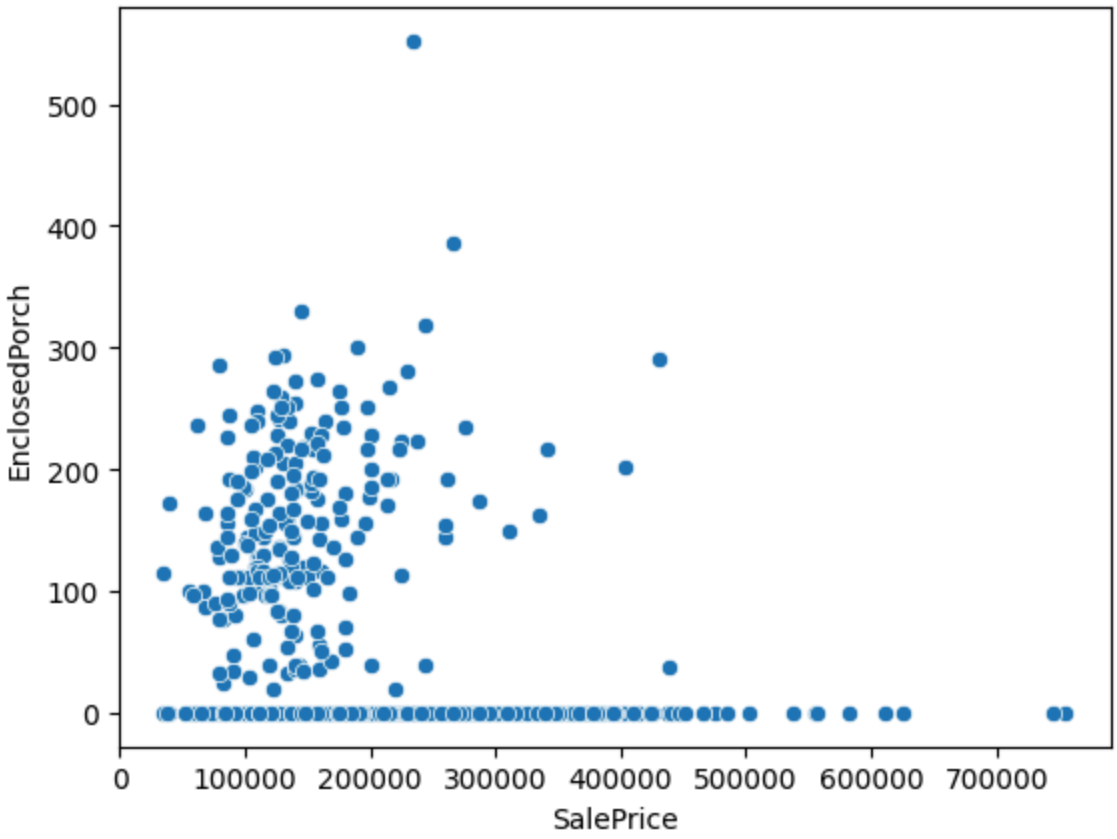
WoodDeckSF



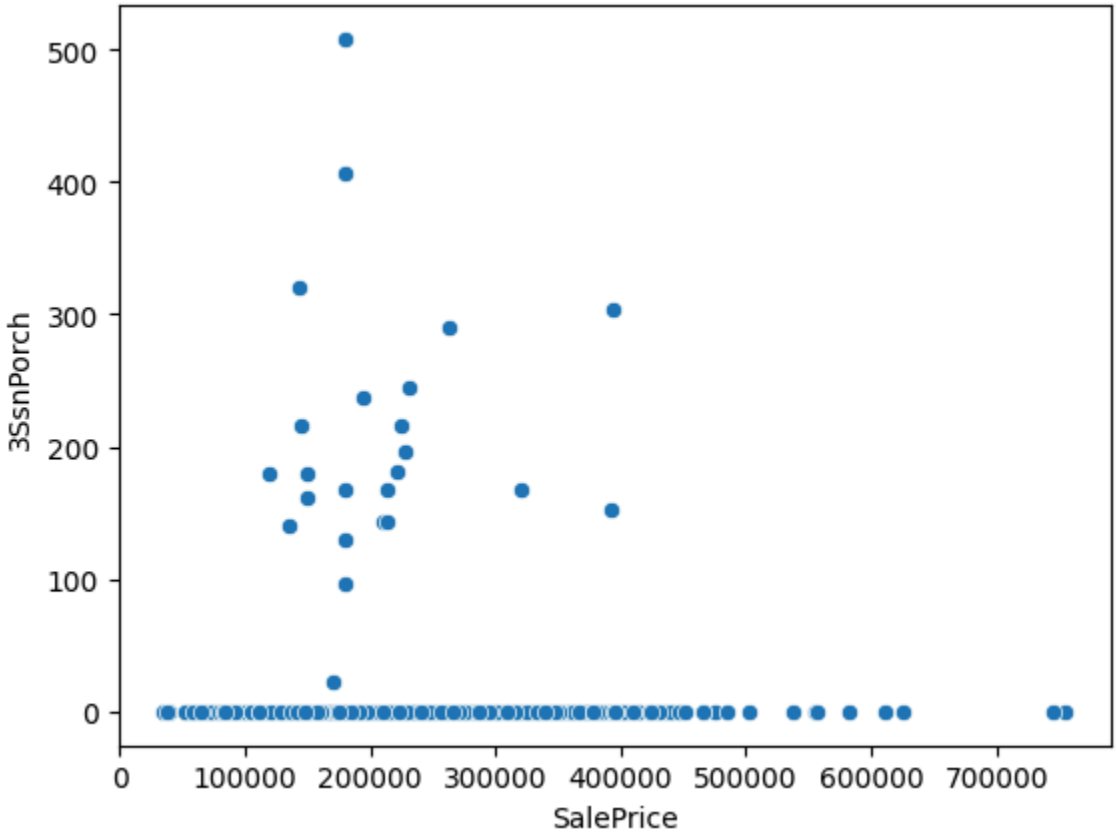
OpenPorchSF



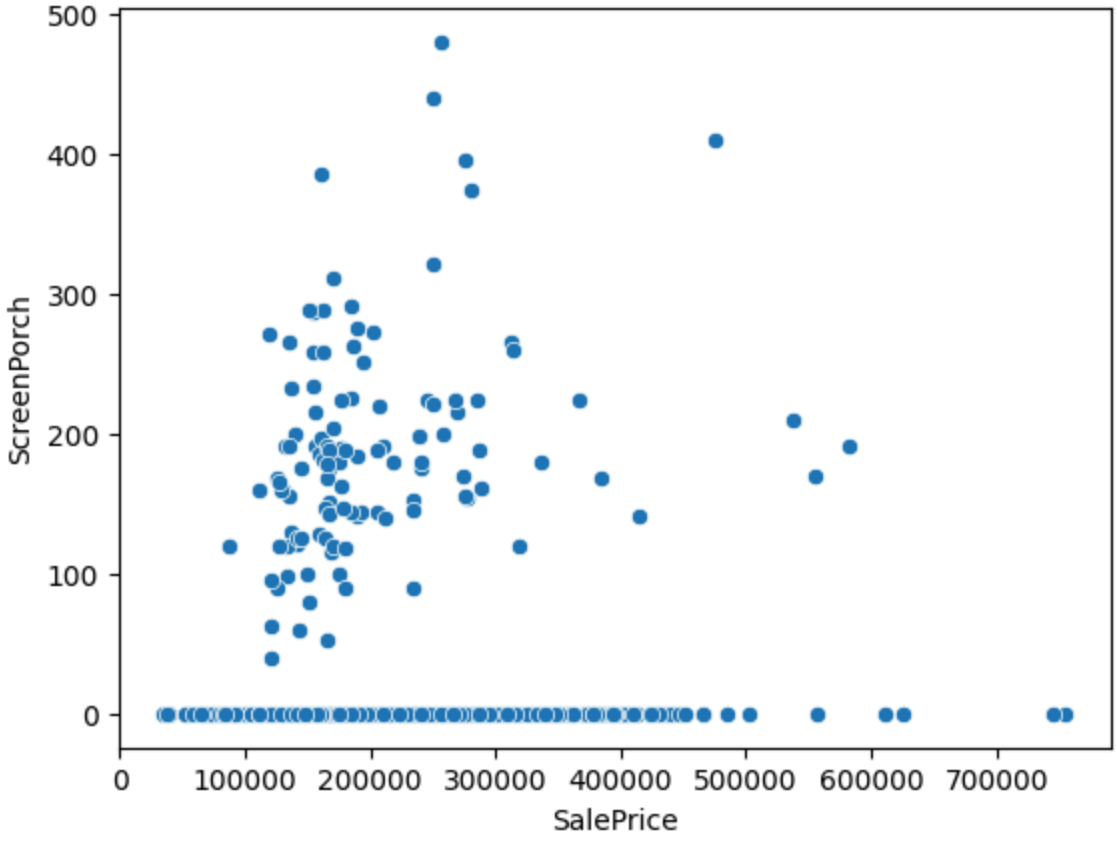
EnclosedPorch



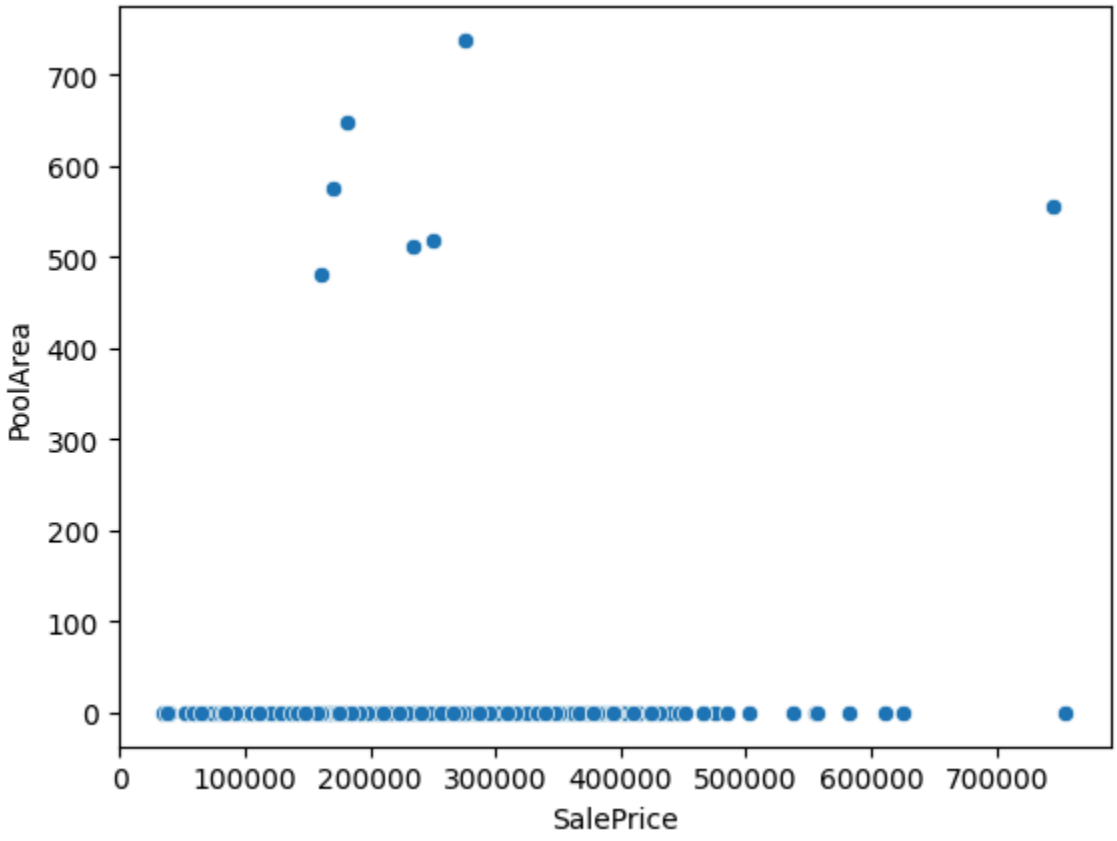
3SsnPorch



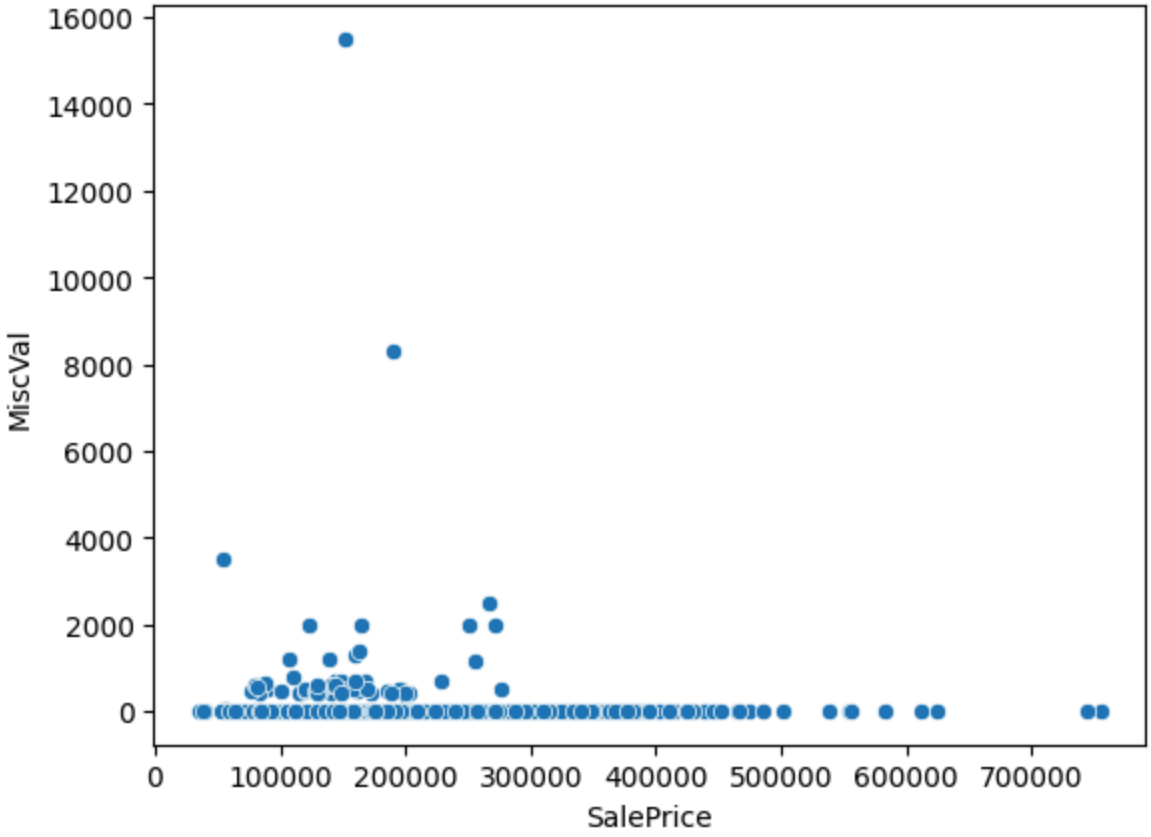
ScreenPorch



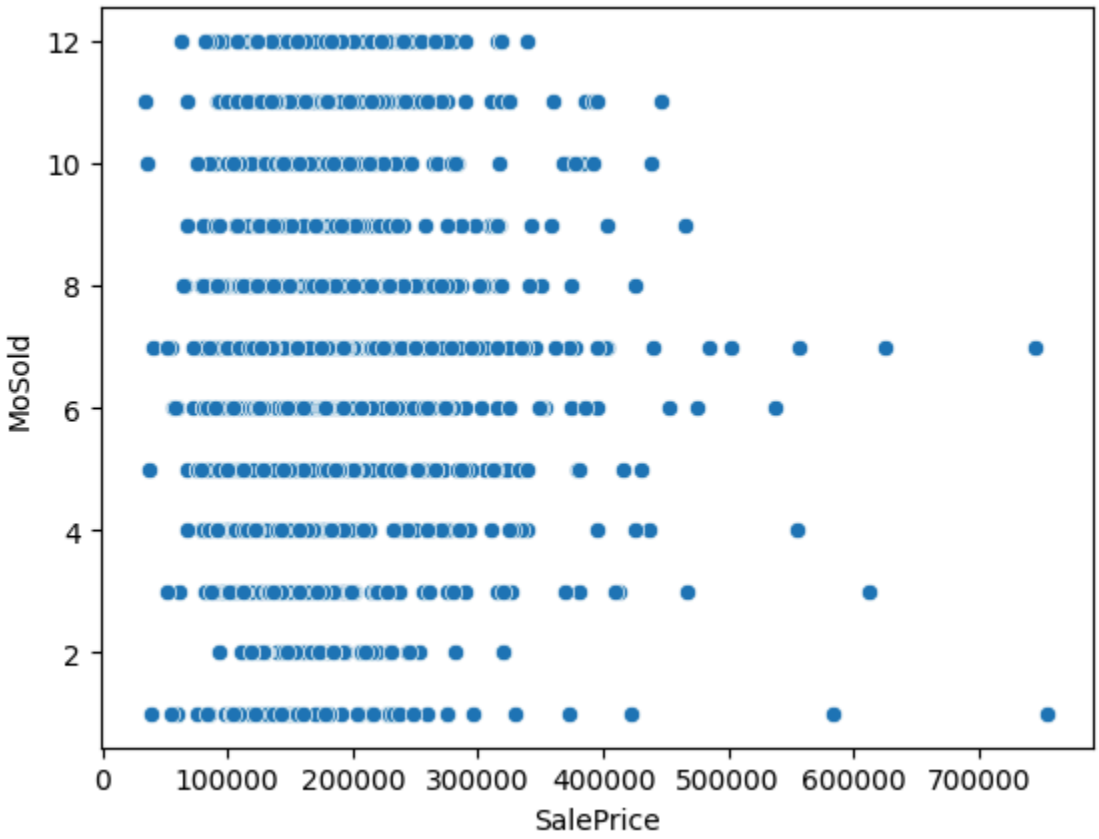
PoolArea



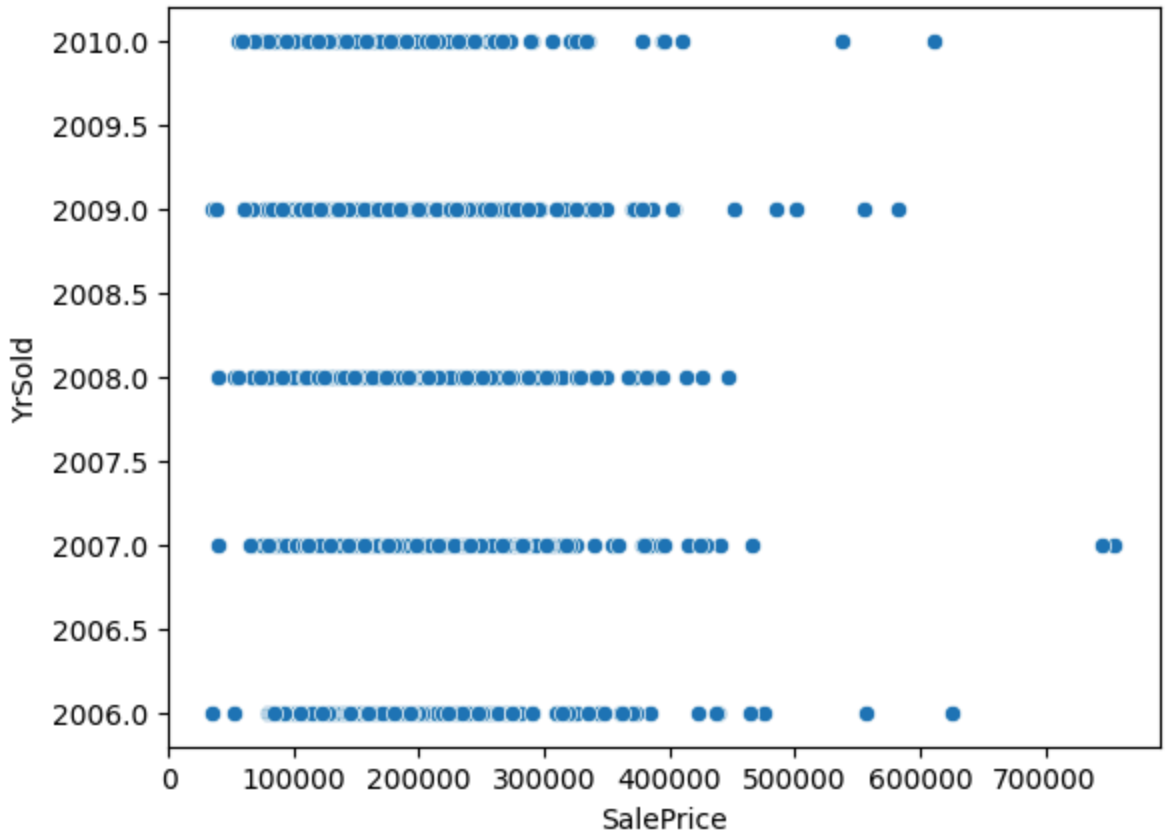
MiscVal



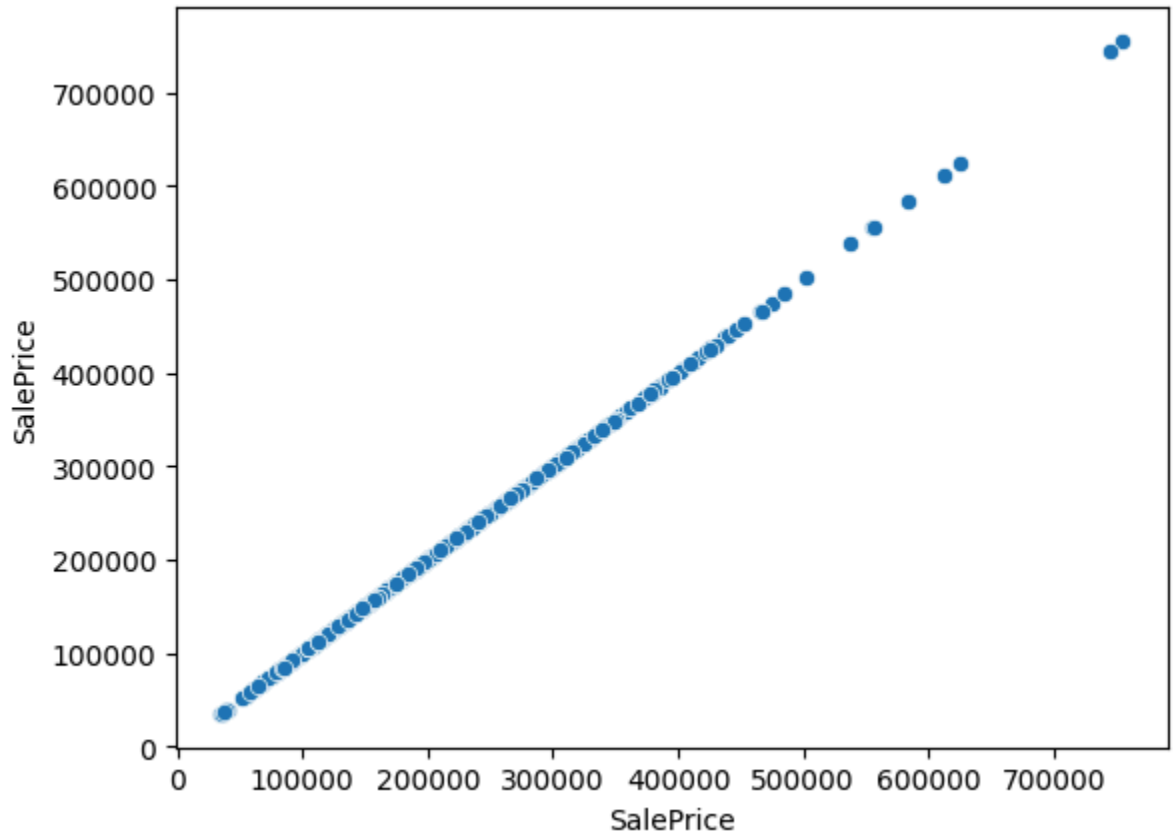
MoSold



YrSold


2010.0
2009.5
2009.0
2008.5
2008.0
2007.5
2007.0
2006.5
2006.0
YrSold
0
100000
200000
300000
400000
500000
600000
700000
SalePrice

SalePrice


700000
600000
500000
400000
300000
200000
100000
0
SalePrice
0
100000
200000
300000
400000
500000
600000
700000
SalePrice

In [321…
```
drop_cols=['MsSubclass','BsmtFinF2','LowQualFinSF','BsmtHalfBath','KitchenAbvG
```

In [322…
```
df[con].corr()['SalePrice'].sort_values(ascending=False)
```

Out[322…

	SalePrice
SalePrice	1.000000
OverallQual	0.790982
GrLivArea	0.708624
GarageCars	0.640409
GarageArea	0.623431
TotalBsmtSF	0.613581
1stFlrSF	0.605852
FullBath	0.560664
TotRmsAbvGrd	0.533723
YearBuilt	0.522897
YearRemodAdd	0.507101
MasVnrArea	0.475241
GarageYrBlt	0.470177
Fireplaces	0.466929
BsmtFinSF1	0.386420
LotFrontage	0.334901
WoodDeckSF	0.324413
2ndFlrSF	0.319334
OpenPorchSF	0.315856
HalfBath	0.284108
LotArea	0.263843
BsmtFullBath	0.227122
BsmtUnfSF	0.214479
BedroomAbvGr	0.168213
ScreenPorch	0.111447
PoolArea	0.092404
MoSold	0.046432
3SsnPorch	0.044584
BsmtFinSF2	-0.011378
BsmtHalfBath	-0.016844
MiscVal	-0.021190

	SalePrice
Id	-0.021917
LowQualFinSF	-0.025606
YrSold	-0.028923
OverallCond	-0.077856
MSSubClass	-0.084284
EnclosedPorch	-0.128578
KitchenAbvGr	-0.135907

dtype: float64

In [322…

In [323…
```
correlations = df[con].corrwith(df['SalePrice']).sort_values(ascending=False)
for col, corr in correlations.items():
    if -0.5 < corr < 0.5 and col != 'SalePrice':
        print(col)
```

```
MasVnrArea
GarageYrBlt
Fireplaces
BsmtFinSF1
LotFrontage
WoodDeckSF
2ndFlrSF
OpenPorchSF
HalfBath
LotArea
BsmtFullBath
BsmtUnfSF
BedroomAbvGr
ScreenPorch
PoolArea
MoSold
3SsnPorch
BsmtFinSF2
BsmtHalfBath
MiscVal
Id
LowQualFinSF
YrSold
OverallCond
MSSubClass
EnclosedPorch
KitchenAbvGr
```

In [324…
```
drop_cols=['MSSubClass','BsmtFinSF2','LowQualFinSF','BsmtHalfBath','KitchenAbv
```

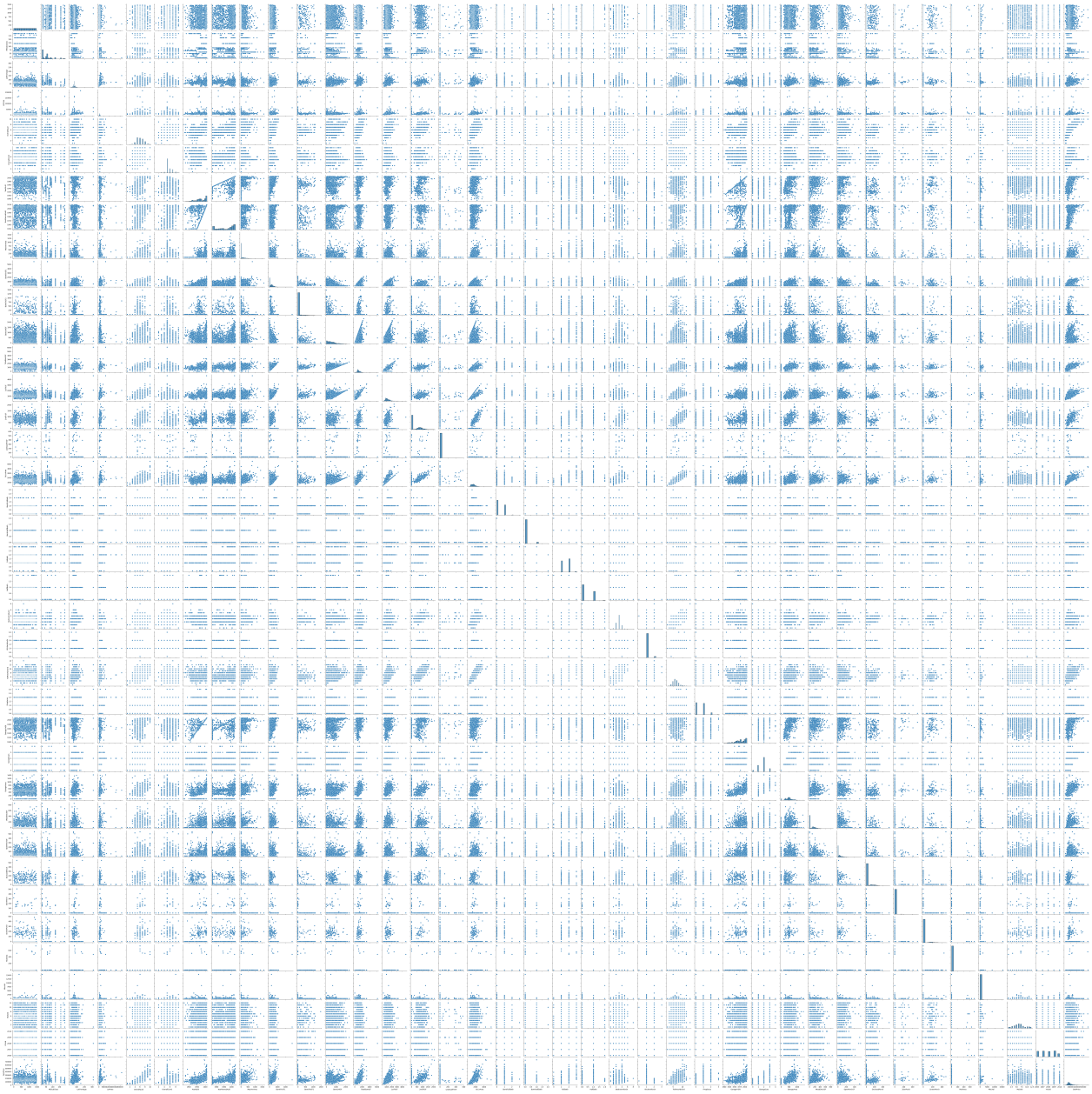
```
drop_cols.extend(['MasVnrArea','GarageYrBlt',
'Fireplaces',
'BsmtFinSF1',
'LotFrontage',
'WoodDeckSF',
'2ndFlrSF',
'OpenPorchSF',
'HalfBath',
'LotArea',
'BsmtFullBath',
'BsmtUnfSF',
'BedroomAbvGr',
'ScreenPorch',
'PoolArea',
'MoSold',
'3SsnPorch',
'BsmtFinSF2',
'BsmtHalfBath',
'MiscVal',
'Id',
'LowQualFinSF',
'YrSold',
'OverallCond',
'MSSubClass',
'EnclosedPorch',
'KitchenAbvGr'])
```

In [325…
```
len(drop_cols)
```

Out[325…
```
38
```

In [326…
```
sns.pairplot(data=df[con])
```

Out[326…
```
<seaborn.axisgrid.PairGrid at 0x7c221c5db200>
```



In [327…
```
drop_cols.append('SalePrice')
```

In [328…
```
X=df.drop(labels=drop_cols,axis=1)
Y=df[['SalePrice']]
```

In [329…
```
X.columns
```

Out[329…
```
Index(['MSZoning', 'Street', 'Alley', 'LotShape', 'LandContour', 'Utilities',
       'LotConfig', 'LandSlope', 'Neighborhood', 'Condition1', 'Condition2',
       'BldgType', 'HouseStyle', 'OverallQual', 'YearBuilt', 'YearRemodAdd',
       'RoofStyle', 'RoofMatl', 'Exterior1st', 'Exterior2nd', 'MasVnrType',
       'ExterQual', 'ExterCond', 'Foundation', 'BsmtQual', 'BsmtCond',
       'BsmtExposure', 'BsmtFinType1', 'BsmtFinType2', 'TotalBsmtSF',
       'Heating', 'HeatingQC', 'CentralAir', 'Electrical', '1stFlrSF',
       'GrLivArea', 'FullBath', 'KitchenQual', 'TotRmsAbvGrd', 'Functional',
       'FireplaceQu', 'GarageType', 'GarageFinish', 'GarageCars', 'GarageAre
a',
       'GarageQual', 'GarageCond', 'PavedDrive', 'PoolQC', 'Fence',
       'MiscFeature', 'SaleType', 'SaleCondition'],
      dtype='object')
```

In [330…
```
Y.columns
```

Out[330…
```
Index(['SalePrice'], dtype='object')
```

In [331…
```
X
```

Out[331…

	MSZoning	Street	Alley	LotShape	LandContour	Utilities	LotConfig	Lar
0	RL	Pave	Grvl	Reg	Lvl	AllPub	Inside	
1	RL	Pave	Grvl	Reg	Lvl	AllPub	FR2	
2	RL	Pave	Grvl	IR1	Lvl	AllPub	Inside	
3	RL	Pave	Grvl	IR1	Lvl	AllPub	Corner	
4	RL	Pave	Grvl	IR1	Lvl	AllPub	FR2	
...	...	...	...	...	...	...	...	
1455	RL	Pave	Grvl	Reg	Lvl	AllPub	Inside	
1456	RL	Pave	Grvl	Reg	Lvl	AllPub	Inside	
1457	RL	Pave	Grvl	Reg	Lvl	AllPub	Inside	
1458	RL	Pave	Grvl	Reg	Lvl	AllPub	Inside	
1459	RL	Pave	Grvl	Reg	Lvl	AllPub	Inside	

1460 rows × 53 columns

In [332…
```
df['SalePrice'].unique()
```

Out[332… array([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, 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,
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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])
```

In [333…
```
df['SalePrice']=df['SalePrice'].replace('rotary',0)
```

In [334…
```
df['SalePrice'].unique()
```

Out[334… array([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, 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,
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370878, 143250, 98300, 205950, 350000, 145500, 97500, 197900,
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 55000, 302000, 254000, 179540, 52000, 102776, 189000, 130500,

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       187100, 161500, 233000, 107900, 160200, 146800, 269790, 143500,
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        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,
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       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])
```

In [335…
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df['SalePrice']=df['SalePrice'].astype(int)
```

In [336…
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df['SalePrice'].unique()
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Out[336… array([208500, 181500, 223500, 140000, 250000, 143000, 307000, 200000,
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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,
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198900, 169500, 100000, 115000, 190000, 136900, 383970, 217000,
259500, 176000, 155000, 320000, 163990, 136000, 153900, 181000,
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166000, 204000, 125000, 105000, 222500, 122000, 372402, 235000,
 79000, 109500, 269500, 254900, 162500, 412500, 103200, 152000,
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184000, 243000, 211000, 501837, 200100, 120000, 475000, 173000,
135000, 153337, 286000, 315000, 192000, 148500, 311872, 104000,
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241500, 137000, 76500, 276000, 151000, 73000, 175500, 179500,
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165600, 119900, 375000, 188500, 270000, 187500, 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,
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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,
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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,
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        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,
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       274970, 182900, 192140, 143750,  64500, 394617, 149700, 149300,
       121000, 179600,  92000, 287090, 266500, 142125, 147500])
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In [337…

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for i in df.columns:
  print(i)
  print(df[i].unique())
  print('****************************************8')
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MSSubClass
[ 60  20  70  50 190  45  90 120  30  85  80 160  75 180  40]
****************************************8
MSZoning
['RL' 'RM' 'C (all)' 'FV' 'RH']
****************************************8
LotFrontage
[ 65.          80.          68.          60.          84.
  85.          75.          70.04995837  51.          50.
  70.          91.          72.          66.         101.
  57.          44.         110.          98.          47.
 108.         112.          74.         115.          61.
  48.          33.          52.         100.          24.
  89.          63.          76.          81.          95.
  69.          21.          32.          78.         121.
 122.          40.         105.          73.          77.
  64.          94.          34.          90.          55.
  88.          82.          71.         120.         107.
  92.         134.          62.          86.         141.
  97.          54.          41.          79.         174.
  99.          67.          83.          43.         103.
  93.          30.         129.         140.          35.
  37.         118.          87.         116.         150.
 111.          49.          96.          59.          36.
  56.         102.          58.          38.         109.
 130.          53.         137.          45.         106.
 104.          42.          39.         144.         114.
 128.         149.         313.         168.         182.
 138.         160.         152.         124.         153.
  46.        ]
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LotArea
[ 8450  9600 11250 ... 17217 13175  9717]
****************************************8
Street
['Pave' 'Grvl']
****************************************8
Alley
['Grvl' 'Pave']
****************************************8
LotShape
['Reg' 'IR1' 'IR2' 'IR3']
****************************************8
LandContour
['Lvl' 'Bnk' 'Low' 'HLS']
****************************************8
Utilities
['AllPub' 'NoSeWa']
****************************************8
LotConfig
['Inside' 'FR2' 'Corner' 'CulDSac' 'FR3']
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LandSlope
['Gtl' 'Mod' 'Sev']
****************************************8
Neighborhood
['CollgCr' 'Veenker' 'Crawfor' 'NoRidge' 'Mitchel' 'Somerst' 'NWAmes'
 'OldTown' 'BrkSide' 'Sawyer' 'NridgHt' 'NAmes' 'SawyerW' 'IDOTRR'
 'MeadowV' 'Edwards' 'Timber' 'Gilbert' 'StoneBr' 'ClearCr' 'NPkVill'
 'Blmngtn' 'BrDale' 'SWISU' 'Blueste']
****************************************8
Condition1
['Norm' 'Feedr' 'PosN' 'Artery' 'RRAe' 'RRNn' 'RRAn' 'PosA' 'RRNe']
****************************************8
Condition2
['Norm' 'Artery' 'RRNn' 'Feedr' 'PosN' 'PosA' 'RRAn' 'RRAe']
****************************************8
BldgType
['1Fam' '2fmCon' 'Duplex' 'TwnhsE' 'Twnhs']
****************************************8
HouseStyle
['2Story' '1Story' '1.5Fin' '1.5Unf' 'SFoyer' 'SLvl' '2.5Unf' '2.5Fin']
****************************************8
OverallQual
[ 7  6  8  5  9  4 10  3  1  2]
****************************************8
OverallCond
[5 8 6 7 4 2 3 9 1]
****************************************8
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]
****************************************8
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]
****************************************8
RoofStyle
['Gable' 'Hip' 'Gambrel' 'Mansard' 'Flat' 'Shed']
****************************************8
RoofMatl
['CompShg' 'WdShngl' 'Metal' 'WdShake' 'Membran' 'Tar&Grv' 'Roll'
 'ClyTile']
****************************************8
Exterior1st
['VinylSd' 'MetalSd' 'Wd Sdng' 'HdBoard' 'BrkFace' 'WdShing' 'CemntBd'
```

```
 'Plywood' 'AsbShng' 'Stucco' 'BrkComm' 'AsphShn' 'Stone' 'ImStucc'
 'CBlock']
****************************************8
Exterior2nd
['VinylSd' 'MetalSd' 'Wd Shng' 'HdBoard' 'Plywood' 'Wd Sdng' 'CmentBd'
 'BrkFace' 'Stucco' 'AsbShng' 'Brk Cmn' 'ImStucc' 'AsphShn' 'Stone'
 'Other' 'CBlock']
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MasVnrType
['BrkFace' 'Stone' 'BrkCmn']
****************************************8
MasVnrArea
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 6.40000000e+02 2.00000000e+02 2.46000000e+02 1.32000000e+02
 6.50000000e+02 1.01000000e+02 4.12000000e+02 2.72000000e+02
 4.56000000e+02 1.03100000e+03 1.78000000e+02 5.73000000e+02
 3.44000000e+02 2.87000000e+02 1.67000000e+02 1.11500000e+03
 4.00000000e+01 1.04000000e+02 5.76000000e+02 4.43000000e+02
 4.68000000e+02 6.60000000e+01 2.20000000e+01 2.84000000e+02
 7.60000000e+01 2.03000000e+02 6.80000000e+01 1.83000000e+02
 4.80000000e+01 2.80000000e+01 3.36000000e+02 6.00000000e+02
 7.68000000e+02 4.80000000e+02 2.20000000e+02 1.84000000e+02
 1.12900000e+03 1.16000000e+02 1.35000000e+02 2.66000000e+02
 8.50000000e+01 3.09000000e+02 1.36000000e+02 2.88000000e+02
 7.00000000e+01 3.20000000e+02 5.00000000e+01 1.20000000e+02
 4.36000000e+02 2.52000000e+02 8.40000000e+01 6.64000000e+02
 2.26000000e+02 3.00000000e+02 6.53000000e+02 1.12000000e+02
 4.91000000e+02 2.68000000e+02 7.48000000e+02 9.80000000e+01
 2.75000000e+02 1.38000000e+02 2.05000000e+02 2.62000000e+02
 1.28000000e+02 2.60000000e+02 1.53000000e+02 6.40000000e+01
 3.12000000e+02 1.60000000e+01 9.22000000e+02 1.42000000e+02
 2.90000000e+02 1.27000000e+02 5.06000000e+02 2.97000000e+02
 1.03685262e+02 6.04000000e+02 2.54000000e+02 3.60000000e+01
 1.02000000e+02 4.72000000e+02 4.81000000e+02 1.08000000e+02
 3.02000000e+02 1.72000000e+02 3.99000000e+02 2.70000000e+02
 4.60000000e+01 2.10000000e+02 1.74000000e+02 3.48000000e+02
 3.15000000e+02 2.99000000e+02 3.40000000e+02 1.66000000e+02
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 1.13000000e+02 1.76000000e+02 6.16000000e+02 3.00000000e+01
 1.06000000e+02 8.70000000e+02 3.62000000e+02 5.30000000e+02
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 2.55000000e+02 1.25000000e+02 1.00000000e+02 4.32000000e+02
 1.26000000e+02 4.73000000e+02 7.40000000e+01 1.45000000e+02
 2.32000000e+02 3.76000000e+02 4.20000000e+01 1.61000000e+02
 1.10000000e+02 1.80000000e+01 2.24000000e+02 2.48000000e+02
 8.00000000e+01 3.04000000e+02 2.15000000e+02 7.72000000e+02
 4.35000000e+02 3.78000000e+02 5.62000000e+02 1.68000000e+02
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 3.33000000e+02 9.21000000e+02 7.62000000e+02 5.94000000e+02
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 2.93000000e+02 6.30000000e+02 4.66000000e+02 1.09000000e+02
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 1.69000000e+02 9.50000000e+01 4.42000000e+02 2.02000000e+02
 3.38000000e+02 8.94000000e+02 3.28000000e+02 6.73000000e+02
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 1.30000000e+02 1.48000000e+02 8.60000000e+02 4.24000000e+02
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 2.23000000e+02 1.58000000e+02 1.37000000e+02 1.15000000e+02
 1.89000000e+02 2.74000000e+02 1.17000000e+02 6.00000000e+01
 1.22000000e+02 9.20000000e+01 4.15000000e+02 7.60000000e+02
 2.70000000e+01 7.50000000e+01 3.61000000e+02 1.05000000e+02
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 1.44000000e+02 4.23000000e+02 4.40000000e+01 1.51000000e+02
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 3.24000000e+02 2.95000000e+02 3.96000000e+02 6.70000000e+01
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 3.37000000e+02 1.49000000e+02 1.43000000e+02 5.10000000e+01
 1.71000000e+02 2.34000000e+02 6.30000000e+01 7.66000000e+02
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 8.60000000e+01 7.96000000e+02 3.91000000e+02 2.28000000e+02
 8.80000000e+01 1.65000000e+02 4.28000000e+02 4.10000000e+02
 5.64000000e+02 3.68000000e+02 3.18000000e+02 5.79000000e+02
 6.50000000e+01 7.05000000e+02 4.08000000e+02 2.44000000e+02
 1.23000000e+02 3.66000000e+02 7.31000000e+02 4.48000000e+02
 2.94000000e+02 3.10000000e+02 2.37000000e+02 4.26000000e+02
 9.60000000e+01 4.38000000e+02 1.94000000e+02 1.19000000e+02]
****************************************8
ExterQual
['Gd' 'TA' 'Ex' 'Fa']
****************************************8
ExterCond
['TA' 'Gd' 'Fa' 'Po' 'Ex']
****************************************8
Foundation
['PConc' 'CBlock' 'BrkTil' 'Wood' 'Slab' 'Stone']
****************************************8
BsmtQual
['Gd' 'TA' 'Ex' 'Fa']
****************************************8
BsmtCond
```

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['TA' 'Gd' 'Fa' 'Po']
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BsmtExposure
['No' 'Gd' 'Mn' 'Av']
****************************************8
BsmtFinType1
['GLQ' 'ALQ' 'Unf' 'Rec' 'BLQ' 'LwQ']
****************************************8
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
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 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]
****************************************8
BsmtFullBath
[1 0 2 3]
****************************************8
BsmtHalfBath
[0 1 2]
****************************************8
FullBath
[2 1 3 0]
****************************************8
HalfBath
[1 0 2]
****************************************8
BedroomAbvGr
[3 4 1 2 0 5 6 8]
****************************************8
KitchenAbvGr
[1 2 3 0]
****************************************8
KitchenQual
['Gd' 'TA' 'Ex' 'Fa']
****************************************8
TotRmsAbvGrd
[ 8  6  7  9  5 11  4 10 12  3  2 14]
****************************************8
Functional
['Typ' 'Min1' 'Maj1' 'Min2' 'Mod' 'Maj2' 'Sev']
```

```
****************************************8
Fireplaces
[0 1 2 3]
****************************************8
FireplaceQu
['Gd' 'TA' 'Fa' 'Ex' 'Po']
****************************************8
GarageType
['Attchd' 'Detchd' 'BuiltIn' 'CarPort' 'Basment' '2Types']
****************************************8
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.         1978.50616389 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.         1996.         1940.         1949.
 1994.         1910.         1978.         1982.         1992.
 1925.         1941.         2010.         1927.         1947.
 1937.         1942.         1938.         1952.         1928.
 1922.         1934.         1906.         1914.         1946.
 1908.         1929.         1933.        ]
****************************************8
GarageFinish
['RFn' 'Unf' 'Fin']
****************************************8
GarageCars
[2 3 1 0 4]
****************************************8
GarageArea
[ 548  460  608  642  836  480  636  484  468  205  384  736  352  840
  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]
****************************************8
GarageQual
['TA' 'Fa' 'Gd' 'Ex' 'Po']
****************************************8
GarageCond
['TA' 'Fa' 'Gd' 'Po' 'Ex']
****************************************8
PavedDrive
['Y' 'N' 'P']
****************************************8
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]
****************************************8
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]
****************************************8
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
  80 115 291 116 158 210  36 200  84 148 136 240  54 100 189 293 164 216
 239  67  90  56 129  98 143  70 386 154 185 134 196 264 275 230 254  68
 194 318  48  94 138 226 174  19 170 220 214 280 190 330 208 145 259  81
  42 123 162 286 168  20 301 198 221 212  50  99]
****************************************8
3SsnPorch
[  0 320 407 130 180 168 140 508 238 245 196 144 182 162  23 216  96 153
 290 304]
****************************************8
ScreenPorch
[  0 176 198 291 252  99 184 168 130 142 192 410 224 266 170 154 153 144
 128 259 160 271 234 374 185 182  90 396 140 276 180 161 145 200 122  95
 120  60 126 189 260 147 385 287 156 100 216 210 197 204 225 152 175 312
 222 265 322 190 233  63  53 143 273 288 263  80 163 116 480 178 440 155
 220 119 165  40]
****************************************8
PoolArea
[  0 512 648 576 555 480 519 738]
****************************************8
PoolQC
['Gd' 'Ex' 'Fa']
****************************************8
Fence
['MnPrv' 'GdWo' 'GdPrv' 'MnWw']
****************************************8
MiscFeature
['Shed' 'Gar2' 'Othr' 'TenC']
****************************************8
MiscVal
[    0   700   350   500   400   480   450 15500  1200   800  2000   600
  3500  1300    54   620   560  1400  8300  1150  2500]
****************************************8
MoSold
[ 2  5  9 12 10  8 11  4  1  7  3  6]
****************************************8
YrSold
[2008 2007 2006 2009 2010]
****************************************8
SaleType
['WD' 'New' 'COD' 'ConLD' 'ConLI' 'CWD' 'ConLw' 'Con' 'Oth']
****************************************8
SaleCondition
['Normal' 'Abnorml' 'Partial' 'AdjLand' 'Alloca' 'Family']
****************************************8
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
 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]
****************************************8
```

In [338…
```
X.columns
```

Out[338…
```
Index(['MSZoning', 'Street', 'Alley', 'LotShape', 'LandContour', 'Utilities',
       'LotConfig', 'LandSlope', 'Neighborhood', 'Condition1', 'Condition2',
       'BldgType', 'HouseStyle', 'OverallQual', 'YearBuilt', 'YearRemodAdd',
       'RoofStyle', 'RoofMatl', 'Exterior1st', 'Exterior2nd', 'MasVnrType',
       'ExterQual', 'ExterCond', 'Foundation', 'BsmtQual', 'BsmtCond',
       'BsmtExposure', 'BsmtFinType1', 'BsmtFinType2', 'TotalBsmtSF',
       'Heating', 'HeatingQC', 'CentralAir', 'Electrical', '1stFlrSF',
       'GrLivArea', 'FullBath', 'KitchenQual', 'TotRmsAbvGrd', 'Functional',
       'FireplaceQu', 'GarageType', 'GarageFinish', 'GarageCars', 'GarageAre
a',
       'GarageQual', 'GarageCond', 'PavedDrive', 'PoolQC', 'Fence',
       'MiscFeature', 'SaleType', 'SaleCondition'],
      dtype='object')
```

In [339…
```
X['avg_Year']=(X['YearBuilt']+X['YearRemodAdd'])/2
```

In [340…
```
X.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1460 entries, 0 to 1459
Data columns (total 54 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   MSZoning       1460 non-null   object
 1   Street         1460 non-null   object
 2   Alley          1460 non-null   object
 3   LotShape       1460 non-null   object
 4   LandContour    1460 non-null   object
 5   Utilities      1460 non-null   object
 6   LotConfig      1460 non-null   object
 7   LandSlope      1460 non-null   object
 8   Neighborhood   1460 non-null   object
 9   Condition1     1460 non-null   object
 10  Condition2     1460 non-null   object
 11  BldgType       1460 non-null   object
 12  HouseStyle     1460 non-null   object
 13  OverallQual    1460 non-null   int64
 14  YearBuilt      1460 non-null   int64
 15  YearRemodAdd   1460 non-null   int64
 16  RoofStyle      1460 non-null   object
 17  RoofMatl       1460 non-null   object
 18  Exterior1st    1460 non-null   object
 19  Exterior2nd    1460 non-null   object
 20  MasVnrType     1460 non-null   object
 21  ExterQual      1460 non-null   object
 22  ExterCond      1460 non-null   object
 23  Foundation     1460 non-null   object
 24  BsmtQual       1460 non-null   object
 25  BsmtCond       1460 non-null   object
 26  BsmtExposure   1460 non-null   object
 27  BsmtFinType1   1460 non-null   object
 28  BsmtFinType2   1460 non-null   object
 29  TotalBsmtSF    1460 non-null   int64
 30  Heating        1460 non-null   object
 31  HeatingQC      1460 non-null   object
 32  CentralAir     1460 non-null   object
 33  Electrical     1460 non-null   object
 34  1stFlrSF       1460 non-null   int64
 35  GrLivArea      1460 non-null   int64
 36  FullBath       1460 non-null   int64
 37  KitchenQual    1460 non-null   object
 38  TotRmsAbvGrd   1460 non-null   int64
 39  Functional     1460 non-null   object
 40  FireplaceQu    1460 non-null   object
 41  GarageType     1460 non-null   object
 42  GarageFinish   1460 non-null   object
 43  GarageCars     1460 non-null   int64
 44  GarageArea     1460 non-null   int64
 45  GarageQual     1460 non-null   object
 46  GarageCond     1460 non-null   object
 47  PavedDrive     1460 non-null   object
 48  PoolQC         1460 non-null   object
```

```
 49  Fence          1460 non-null   object
 50  MiscFeature    1460 non-null   object
 51  SaleType       1460 non-null   object
 52  SaleCondition  1460 non-null   object
 53  avg_Year       1460 non-null   float64
dtypes: float64(1), int64(10), object(43)
memory usage: 616.1+ KB
```

In [341…
```
X['avg_area']=(X['GrLivArea']+X['GarageCars'])/2
```

In [342…
```
X=X.drop(labels=['YearBuilt','YearRemodAdd','GrLivArea','GarageCars'],axis=1)
```

In [343…
```
len(X.columns)
```

Out[343… 51

In [344…
```
Y['SalePrice'].mean()
```

Out[344… np.float64(180921.19589041095)

In [345…
```
cat=[]
con=[]
for i in X.columns:
  if X[i].dtype==object:
      cat.append(i)
  else:
    con.append(i)
```

In [346…
```
Xcat=X[cat]
X[con]=X[con]
```

In [347…
```
for i in Xcat.columns:
  Xcat[i]=le.fit_transform(Xcat[i])
```

```
/tmp/ipython-input-2553683435.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/sta
ble/user_guide/indexing.html#returning-a-view-versus-a-copy
  Xcat[i]=le.fit_transform(Xcat[i])
/tmp/ipython-input-2553683435.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/sta
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  Xcat[i]=le.fit_transform(Xcat[i])
```

In [348…

```
Xcon=pd.DataFrame(ss.fit_transform(X[con]),columns=con)
```

In [349…

```
X = Xcat.join(Xcon)
```

In [350…

```
out=[]
for i in Xcon.columns:
  a=Xcon[(Xcon[i]<-3)|(Xcon[i]>3)].index
  out.extend(a)


  out
```

In [351…

```
outlier=list(set(out))
```

In [352…

```
len(outlier)
```

Out[352…

```
40
```

In [353…

```
X=X.drop(index=outlier,axis=0)
Y=Y.drop(index=outlier,axis=0)
```

In [354…
```
X.index=range(X.shape[0])
Y.index=range(Y.shape[0])
```

In [355…
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score,mean_absolute_error
```

In [356…
```
lr=LinearRegression()
```

In [357…
```
xtrain,xtest,ytrain,ytest=train_test_split(X,Y,test_size=0.2)
```

In [358…
```
model=lr.fit(xtrain,ytrain)
```

In [359…
```
tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)
```

In [360…
```
tr_score=r2_score(ytrain,tr_pred)
ts_score=r2_score(ytest,ts_pred)

print(tr_score)
print(ts_score)
```

```
0.8797437581826576
0.8646999337694159
```

In [361…
```
from statsmodels.api import OLS,add_constant
```

In [362…
```
for i in df.columns:
    if df[i].dtypes==object:
        df[i]=df[i].fillna(df[i].mode()[0])
    else:
        df[i]=df[i].fillna(df[i].mean())
```

In [363…
```
X
```

Out[363…

	MSZoning	Street	Alley	LotShape	LandContour	Utilities	LotConfig	Lar
0	3	1	0	3	3	0	4	
1	3	1	0	3	3	0	2	
2	3	1	0	0	3	0	4	
3	3	1	0	0	3	0	0	
4	3	1	0	0	3	0	2	
...	...	...	...	...	...	...	...	
1415	3	1	0	3	3	0	4	
1416	3	1	0	3	3	0	4	
1417	3	1	0	3	3	0	4	
1418	3	1	0	3	3	0	4	
1419	3	1	0	3	3	0	4	

1420 rows × 51 columns

In [364…

```
X=df.drop(labels='SalePrice',axis=1)
Y=df[['SalePrice']]
```

In [365…

```
X
```

Out[365…

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotSha
0	1	60	RL	65.0	8450	Pave	Grvl	
1	2	20	RL	80.0	9600	Pave	Grvl	
2	3	60	RL	68.0	11250	Pave	Grvl	
3	4	70	RL	60.0	9550	Pave	Grvl	
4	5	60	RL	84.0	14260	Pave	Grvl	
...	...	...	...	...	...	...	...	
1455	1456	60	RL	62.0	7917	Pave	Grvl	
1456	1457	20	RL	85.0	13175	Pave	Grvl	
1457	1458	70	RL	66.0	9042	Pave	Grvl	
1458	1459	20	RL	68.0	9717	Pave	Grvl	
1459	1460	20	RL	75.0	9937	Pave	Grvl	

1460 rows × 80 columns

In [366…
```
cat=[]
con=[]
for i in X.columns:
    if X[i].dtype==object:
        cat.append(i)
    else:
        con.append(i)
```

In [367…
```
Xcat=X[cat]
Xcon=X[con]
```

In [368…
```
for i in Xcat.columns:
    Xcat[i]=le.fit_transform(Xcat[i])
```

```
/tmp/ipython-input-188807692.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
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```

```
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  Xcat[i]=le.fit_transform(Xcat[i])
```

In [369…

```
Xcon=pd.DataFrame(ss.fit_transform(Xcon),columns=con)
```

In [370…

```
X=Xcat.join(Xcon)
```

In [371…

```
out=[]
for i in Xcon.columns:
    a=Xcon[(Xcon[i]<-3)|(Xcon[i]>3)].index
    out.extend(a)

out
```

Out[371… [9,
 48,
 93,
 125,
 165,
 246,
 291,
 300,
 312,
 335,
 411,
 488,
 520,
 535,
 635,
 637,
 703,
 705,
 713,
 861,
 969,
 985,
 1030,
 1062,
 1144,
 1186,
 1190,
 1266,
 1393,
 1416,
 171,
 197,
 231,
 277,
 313,
 446,
 807,
 909,
 934,
 1107,
 1127,
 1173,
 1182,
 1211,
 1298,
 1337,
 53,
 249,
 313,
 335,
 384,
 451,
 457,
 661,

706,
769,
848,
1298,
1396,
375,
533,
88,
185,
191,
218,
241,
250,
304,
375,
378,
398,
461,
508,
519,
583,
676,
703,
726,
745,
980,
991,
1123,
1149,
1213,
1268,
1327,
1352,
1435,
1457,
304,
630,
747,
1132,
1137,
1349,
37,
58,
70,
105,
115,
161,
169,
178,
224,
297,
349,
403,
477,

517,
523,
654,
691,
718,
755,
763,
798,
808,
825,
898,
981,
1111,
1169,
1228,
1289,
1298,
1373,
1417,
70,
178,
523,
898,
1182,
1298,
24,
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113,
116,
153,
166,
233,
253,
260,
263,
271,
273,
313,
322,
355,
414,
440,
446,
470,
493,
542,
548,
577,
586,
599,
666,
697,
764,
785,

828,
842,
854,
888,
918,
923,
924,
1040,
1059,
1077,
1152,
1220,
1253,
1299,
1308,
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1387,
1418,
1445,
1458,
137,
224,
278,
477,
496,
581,
678,
774,
798,
932,
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224,
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440,
496,
523,
691,
1044,
1182,
1298,
1373,
224,
440,
496,
523,
529,
691,
898,
1024,
1044,
1182,
1298,
1373,

304,
691,
1169,
1182,
51,
88,
125,
170,
185,
197,
198,
263,
267,
406,
589,
635,
729,
873,
883,
1009,
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1173,
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1440,
118,
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188,
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326,
335,
420,
454,
588,
634,
738,
807,
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942,
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116,
129,
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215,
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414,
421,
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691,
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1080,
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1415,
188,
298,
597,
624,
628,
921,
1154,
1163,
1230,
1283,
1350,
1450,
53,
144,
189,
291,
330,
570,
634,
635,
843,
897,
1163,
1213,

1270,
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8,
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17,
39,
48,
74,
78,
93,
102,
137,
144,
165,
188,
246,
330,
342,
420,
441,
454,
488,
505,
520,
529,
570,
634,
635,
637,
676,
703,
705,
728,
736,
778,
809,
843,
886,
894,
897,
910,
913,
921,
940,
942,
943,
954,
955,
984,
1003,
1011,
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1062,
1090,

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1275,
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1412,
1416,
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635,
769,
803,
897,
910,
1031,
1173,
1230,
1298,
1350,
1386,
166,
309,
605,
642,
1298,
93,
653,
178,
581,
664,
825,
1061,
1190,
1298,
53,
64,
166,
169,
335,
343,
357,
480,
661,
769,
828,
848,

893,
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974,
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499,
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591,
645,
664,
666,
713,
735,
775,
784,
807,
854,
875,
947,
961,
996,
1184,
1193,
1292,
1298,
1328,
1369,
3,
7,
154,
197,
260,
306,
314,
325,
328,
358,
365,
380,
459,
462,
496,
520,
577,

630,
648,
653,
660,
662,
718,
720,
747,
799,
813,
836,
840,
918,
939,
945,
1013,
1030,
1081,
1119,
1139,
1150,
1152,
1185,
1197,
1202,
1248,
1266,
1326,
1360,
1382,
1393,
1419,
1439,
1445,
5,
55,
120,
129,
159,
182,
187,
205,
237,
258,
280,
546,
704,
726,
744,
889,
941,
1080,
1156,
1161,

1181,
1346,
1437,
46,
72,
80,
104,
176,
185,
189,
196,
289,
297,
312,
339,
351,
359,
360,
366,
400,
426,
471,
475,
550,
605,
618,
625,
647,
673,
764,
769,
785,
795,
803,
828,
830,
854,
859,
887,
888,
907,
919,
944,
1037,
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1067,
1070,
1154,
1171,
1184,
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1282,
1293,
1301,

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 1320,
 1328,
 1386,
 1414,
 197,
 810,
 1170,
 1182,
 1298,
 1386,
 1423,
 346,
 510,
 539,
 705,
 890,
 1230,
 1386,
 1457]
```

In [372…
```
len(out)
```

Out[372…
```
667
```

In [373…
```
outlier=list(set(out))
outlier
```

Out[373… [1,
 3,
 5,
 7,
 8,
 9,
 17,
 24,
 26,
 28,
 33,
 37,
 39,
 41,
 46,
 48,
 50,
 51,
 52,
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 64,
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```
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```

In [374…
```
X=X.drop(index=outlier,axis=0)
Y=Y.drop(index=outlier,axis=0)
```

In [375…
```
X.index=range(0,X.shape[0])
Y.index=range(0,Y.shape[0])
```

In [376…
```
X=X.drop(labels='Id',axis=1)
```

In [377…
```
ols=OLS(ytrain,add_constant(xtrain))
```

In [378…
```
model=ols.fit()
```

In [379…
```
model.summary()
```

Out[379…

OLS Regression Results

Dep. Variable:	SalePrice	**R-squared:**	0.880
Model:	OLS	**Adj. R-squared:**	0.874
Method:	Least Squares	**F-statistic:**	155.5
Date:	Sun, 31 Aug 2025	**Prob (F-statistic):**	0.00
Time:	14:24:07	**Log-Likelihood:**	-13115.
No. Observations:	1136	**AIC:**	2.633e+04
Df Residuals:	1084	**BIC:**	2.660e+04
Df Model:	51		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	1.628e+05	6.07e+04	2.682	0.007	4.37e+04	2.82e+05
MSZoning	-1632.2106	1468.837	-1.111	0.267	-4514.296	1249.875
Street	2.897e+04	1.34e+04	2.163	0.031	2692.426	5.52e+04
Alley	-1.016e+04	5332.999	-1.905	0.057	-2.06e+04	303.887
LotShape	-949.4663	595.721	-1.594	0.111	-2118.363	219.431
LandContour	-1084.7631	1301.997	-0.833	0.405	-3639.483	1469.957
Utilities	-1.635e+04	2.65e+04	-0.618	0.537	-6.83e+04	3.56e+04
LotConfig	-235.2081	492.816	-0.477	0.633	-1202.189	731.773
LandSlope	1.144e+04	3392.046	3.374	0.001	4788.402	1.81e+04
Neighborhood	171.5622	140.550	1.221	0.222	-104.219	447.344
Condition1	325.9474	969.083	0.336	0.737	-1575.544	2227.439
Condition2	3975.7545	3757.775	1.058	0.290	-3397.582	1.13e+04
BldgType	-4555.0994	728.877	-6.249	0.000	-5985.268	-3124.930
HouseStyle	-645.9856	546.951	-1.181	0.238	-1719.189	427.218
RoofStyle	3563.5489	1029.184	3.462	0.001	1544.131	5582.967
RoofMatl	1281.4222	1453.221	0.882	0.378	-1570.022	4132.867
Exterior1st	-1169.8477	450.272	-2.598	0.010	-2053.351	-286.344
Exterior2nd	296.2540	413.997	0.716	0.474	-516.072	1108.581
MasVnrType	6269.9106	2806.408	2.234	0.026	763.303	1.18e+04
ExterQual	-1.056e+04	1804.994	-5.850	0.000	-1.41e+04	-7017.174
ExterCond	704.9064	1173.202	0.601	0.548	-1597.098	3006.911

Foundation	177.4043	1465.775	0.121	0.904	-2698.673	3053.481
BsmtQual	-8784.5939	1296.048	-6.778	0.000	-1.13e+04	-6241.547
BsmtCond	1306.0953	1200.989	1.088	0.277	-1050.431	3662.622
BsmtExposure	-3094.0371	795.736	-3.888	0.000	-4655.395	-1532.679
BsmtFinType1	-2752.6625	475.061	-5.794	0.000	-3684.805	-1820.520
BsmtFinType2	-572.9849	892.100	-0.642	0.521	-2323.424	1177.454
Heating	2879.2027	2733.891	1.053	0.293	-2485.114	8243.520
HeatingQC	-581.0257	559.240	-1.039	0.299	-1678.342	516.290
CentralAir	9729.2694	3955.300	2.460	0.014	1968.358	1.75e+04
Electrical	-152.1745	820.566	-0.185	0.853	-1762.252	1457.903
KitchenQual	-6601.4797	1290.747	-5.114	0.000	-9134.124	-4068.835
Functional	5389.6432	869.662	6.197	0.000	3683.232	7096.054
FireplaceQu	-761.2115	965.060	-0.789	0.430	-2654.808	1132.385
GarageType	162.9020	552.750	0.295	0.768	-921.678	1247.482
GarageFinish	-2883.7757	1312.125	-2.198	0.028	-5458.367	-309.184
GarageQual	1095.7379	1571.681	0.697	0.486	-1988.144	4179.620
GarageCond	765.7776	1769.211	0.433	0.665	-2705.688	4237.244
PavedDrive	-957.1764	1808.449	-0.529	0.597	-4505.634	2591.281
PoolQC	9832.1287	2.61e+04	0.377	0.706	-4.13e+04	6.1e+04
Fence	-1421.1016	1762.084	-0.806	0.420	-4878.584	2036.381
MiscFeature	-3328.7197	1.16e+04	-0.288	0.773	-2.6e+04	1.93e+04
SaleType	-391.9810	511.312	-0.767	0.443	-1395.254	611.292
SaleCondition	3136.8713	765.112	4.100	0.000	1635.602	4638.140
OverallQual	1.515e+04	1488.816	10.176	0.000	1.22e+04	1.81e+04
TotalBsmtSF	8365.4009	1724.371	4.851	0.000	4981.917	1.17e+04
1stFlrSF	3485.9582	1790.440	1.947	0.052	-27.163	6999.079
FullBath	-2439.0587	1204.309	-2.025	0.043	-4802.100	-76.018
TotRmsAbvGrd	-3010.4574	1581.863	-1.903	0.057	-6114.318	93.403
GarageArea	5781.3418	1157.017	4.997	0.000	3511.094	8051.589
avg_Year	6769.9750	1707.737	3.964	0.000	3419.131	1.01e+04
avg_area	3.217e+04	2041.422	15.757	0.000	2.82e+04	3.62e+04

Omnibus:	162.594	**Durbin-Watson:**	1.980
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	1038.471
Skew:	0.473	**Prob(JB):**	3.15e-226
Kurtosis:	7.587	**Cond. No.**	2.22e+03

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.22e+03. This might indicate that there are strong multicollinearity or other numerical problems.

In [380…

```
model.pvalues
```

Out[380…

	0
const	7.432471e-03
MSZoning	2.667173e-01
Street	3.074425e-02
Alley	5.702205e-02
LotShape	1.112701e-01
LandContour	4.049419e-01
Utilities	5.368662e-01
LotConfig	6.332634e-01
LandSlope	7.675793e-04
Neighborhood	2.224856e-01
Condition1	7.366750e-01
Condition2	2.902877e-01
BldgType	5.909135e-10
HouseStyle	2.378357e-01
RoofStyle	5.560616e-04
RoofMatl	3.780908e-01
Exterior1st	9.501492e-03
Exterior2nd	4.743959e-01
MasVnrType	2.567710e-02
ExterQual	6.511168e-09
ExterCond	5.480724e-01
Foundation	9.036888e-01
BsmtQual	1.997145e-11
BsmtCond	2.770504e-01
BsmtExposure	1.070981e-04
BsmtFinType1	8.983290e-09
BsmtFinType2	5.208222e-01
Heating	2.925060e-01
HeatingQC	2.990572e-01
CentralAir	1.405646e-02
Electrical	8.529103e-01

	0
KitchenQual	3.718355e-07
Functional	8.142588e-10
FireplaceQu	4.304180e-01
GarageType	7.682703e-01
GarageFinish	2.817490e-02
GarageQual	4.858423e-01
GarageCond	6.652203e-01
PavedDrive	5.967195e-01
PoolQC	7.061655e-01
Fence	4.201379e-01
MiscFeature	7.733710e-01
SaleType	4.434753e-01
SaleCondition	4.442347e-05
OverallQual	2.719369e-23
TotalBsmtSF	1.406098e-06
1stFlrSF	5.179466e-02
FullBath	4.308370e-02
TotRmsAbvGrd	5.729110e-02
GarageArea	6.792645e-07
avg_Year	7.843582e-05
avg_area	1.598466e-50

dtype: float64

In [381…

```
model.pvalues.sort_values()
```

Out[381…

	0
avg_area	1.598466e-50
OverallQual	2.719369e-23
BsmtQual	1.997145e-11
BldgType	5.909135e-10
Functional	8.142588e-10
ExterQual	6.511168e-09
BsmtFinType1	8.983290e-09
KitchenQual	3.718355e-07
GarageArea	6.792645e-07
TotalBsmtSF	1.406098e-06
SaleCondition	4.442347e-05
avg_Year	7.843582e-05
BsmtExposure	1.070981e-04
RoofStyle	5.560616e-04
LandSlope	7.675793e-04
const	7.432471e-03
Exterior1st	9.501492e-03
CentralAir	1.405646e-02
MasVnrType	2.567710e-02
GarageFinish	2.817490e-02
Street	3.074425e-02
FullBath	4.308370e-02
1stFlrSF	5.179466e-02
Alley	5.702205e-02
TotRmsAbvGrd	5.729110e-02
LotShape	1.112701e-01
Neighborhood	2.224856e-01
HouseStyle	2.378357e-01
MSZoning	2.667173e-01
BsmtCond	2.770504e-01
Condition2	2.902877e-01

	0
Heating	2.925060e-01
HeatingQC	2.990572e-01
RoofMatl	3.780908e-01
LandContour	4.049419e-01
Fence	4.201379e-01
FireplaceQu	4.304180e-01
SaleType	4.434753e-01
Exterior2nd	4.743959e-01
GarageQual	4.858423e-01
BsmtFinType2	5.208222e-01
Utilities	5.368662e-01
ExterCond	5.480724e-01
PavedDrive	5.967195e-01
LotConfig	6.332634e-01
GarageCond	6.652203e-01
PoolQC	7.061655e-01
Condition1	7.366750e-01
GarageType	7.682703e-01
MiscFeature	7.733710e-01
Electrical	8.529103e-01
Foundation	9.036888e-01

dtype: float64

In [382…
```
c=[ "OverallQual", "BsmtQual", "BldgType", "Functional", "GarageArea", "BsmtFi
```

In [383…
```
#"avg_area","avg_Year",const
```

In [384…
```
X=X.drop(labels=c,axis=1)
```

In [385…
```
X
```

Out[385…

	LandContour	ExterCond	Foundation	Electrical	FireplaceQu	GarageQual
0	3	4	2	4	2	4
1	3	4	2	4	4	4
2	3	4	2	4	4	4
3	3	4	2	4	2	4
4	3	4	1	4	2	4
...	...	...	...	...	...	...
1016	3	4	2	4	2	4
1017	3	4	2	4	2	4
1018	3	4	2	4	2	4
1019	3	4	2	4	4	4
1020	3	4	1	4	4	4

1021 rows × 41 columns

In [386…
```
xtrain,xtest,ytrain,ytest=train_test_split(X,Y,test_size=0.2,random_state=42)
# random state was compelsary or else error occurs
```

In [387…
```
model=lr.fit(xtrain,ytrain)
```

In [388…
```
tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)
```

In [389…
```
tr_score=r2_score(ytrain,tr_pred)
ts_score=r2_score(ytest,ts_pred)
```

In [390…
```
print(tr_score)
print(ts_score)
```

```
0.8670730445150556
0.8474499245639848
```

ridge,Lasso

In [391…
```
xtrain,xtest,ytrain,ytest=train_test_split(X,Y,test_size=0.2)
```

In [392…
```
ll=Lasso(alpha=0.2)
model=ll.fit(xtrain,ytrain)
```

In [393…
```
r_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)
```

In [394…
```
tr_score=r2_score(ytrain,tr_pred)
ts_score=r2_score(ytest,ts_pred)
```

In [395…
```
print(tr_score)
print(ts_score)
```

```
-0.7613502881854366
0.8514622643883529
```

grid searchcv

In [396…
```
from sklearn.model_selection import GridSearchCV
import numpy as np
```

In [397…
```
a=[]
e=0.01
for i in range(0,1000):
  a.append(e)
  e=round(e+0.01,4)
```

In [398…
```
rr=Ridge()
hp={'alpha':a,'random_state':np.arange(1,40)} # hyyper parameters
```

In [399…
```
cv=GridSearchCV(rr,hp,scoring='neg_mean_squared_error',cv=4)
cvmodel=cv.fit(X,Y)
```

In [400…
```
from sklearn.metrics import mean_squared_error,mean_absolute_error
```

mean absolute error

In [401…
```
rr=Ridge(alpha=1,random_state=1)
model=rr.fit(xtrain,ytrain)
tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)

tr_err=mean_absolute_error(ytrain,tr_pred)
ts_err=mean_absolute_error(ytest,ts_pred)


print(tr_err)
print(ts_err)
```

```
16979.70828740654
18201.877463275414
```

mean square error

In [402…

```
ll=Lasso(alpha=1,random_state=1)
model=ll.fit(xtrain,ytrain)

tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)

tr_err=mean_squared_error(ytrain,tr_pred)
ts_err=mean_squared_error(ytest,ts_pred)


print(tr_err)
print(ts_err)
```

```
599616014.7163607
678009340.3618506
```

R_mean square error

In [403…

```
model=lr.fit(xtrain,ytrain)
tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)

tr_rmse=np.sqrt(mean_squared_error(ytrain,tr_pred))
ts_rmse=np.sqrt(mean_squared_error(ytest,ts_pred))


print(tr_rmse)
print(ts_rmse)
```

```
24487.02520364694
26039.969367127607
```

r2_score

In [404…

```
model=lr.fit(xtrain,ytrain)
tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)

tr_score=r2_score(ytrain,tr_pred)
ts_score=r2_score(ytest,ts_pred)

print(tr_score)
print(ts_score)
```

```
0.8662277037283583
0.8514591617591415
```

r2_adj

In [405…

```
model=lr.fit(xtrain,ytrain)
tr_pred=model.predict(xtrain)
ts_pred=model.predict(xtest)

def adjusted_r2(y_true, y_pred, X):# ytrue n y pred are in formula
  r2=r2_score(y_true,y_pred)
  n,p=X.shape
  return 1-(1-r2)*((n-1)/(n-p-1))

tr_r2_score=adjusted_r2(ytrain,tr_pred,xtrain)
ts_r2_score=adjusted_r2(ytest,ts_pred,xtest)

print(tr_r2_score)
print(ts_r2_score)
```

```
0.8591415743392921
0.8140961288273918
```

In [406…

```
df_test
```

Out[406…

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotSha
0	1461	20	RH	80.0	11622	Pave	NaN	
1	1462	20	RL	81.0	14267	Pave	NaN	
2	1463	60	RL	74.0	13830	Pave	NaN	
3	1464	60	RL	78.0	9978	Pave	NaN	
4	1465	120	RL	43.0	5005	Pave	NaN	
...	...	...	...	...	...	...	...	
1454	2915	160	RM	21.0	1936	Pave	NaN	
1455	2916	160	RM	21.0	1894	Pave	NaN	
1456	2917	20	RL	160.0	20000	Pave	NaN	
1457	2918	85	RL	62.0	10441	Pave	NaN	
1458	2919	60	RL	74.0	9627	Pave	NaN	

1459 rows × 80 columns

In [407…

```
df_test.isna().sum()
```

Out[407…

	0
Id	0
MSSubClass	0
MSZoning	4
LotFrontage	227
LotArea	0
...	...
MiscVal	0
MoSold	0
YrSold	0
SaleType	1
SaleCondition	0

80 rows × 1 columns

dtype: int64

In [408…
```
df3.columns
```

Out[408…
```
Index(['LandContour', 'ExterCond', 'Foundation', 'Electrical', 'FireplaceQu',
       'GarageQual', 'GarageCond', 'PavedDrive', 'PoolQC', 'Fence',
       'MiscFeature', 'MSSubClass', 'LotFrontage', 'LotArea', 'OverallCond',
       'YearBuilt', 'YearRemodAdd', 'MasVnrArea', 'BsmtFinSF1', 'BsmtFinSF2',
       'BsmtUnfSF', '2ndFlrSF', 'LowQualFinSF', 'GrLivArea', 'BsmtFullBath',
       'BsmtHalfBath', 'HalfBath', 'BedroomAbvGr', 'KitchenAbvGr',
       'Fireplaces', 'GarageYrBlt', 'GarageCars', 'WoodDeckSF', 'OpenPorchS
F',
       'EnclosedPorch', '3SsnPorch', 'ScreenPorch', 'PoolArea', 'MiscVal',
       'MoSold', 'YrSold', 'SalePrice', 'Id'],
      dtype='object')
```

In [409…
```
from sklearn.preprocessing import LabelEncoder, StandardScaler
import pandas as pd

# 1) Keep only common columns with training data
df3 = df3[[c for c in X.columns if c in df_test.columns]]

# 2) Fill missing values (mean for numbers, mode for categorical)
for col in df3.columns:
    if df3[col].dtype == 'object':
        df3[col] = df3[col].fillna(df3[col].mode()[0])
    else:
        df3[col] = df3[col].fillna(df3[col].mean())
```

```
# 3) Encode categoricals
for col in df3.columns:
    if df3[col].dtype == 'object':
        le = LabelEncoder()
        df3[col] = le.fit_transform(df3[col].astype(str))

# 4) Scale numbers
scaler = StandardScaler()
df3[df3.columns] = scaler.fit_transform(df3)

# 5) Predict
preds = model.predict(df3)
```

In [410…
```
model.predict(df3)
```

Out[410…
```
array([[145686.55417016],
       [234266.94959077],
       [235165.33330418],
       ...,
       [229994.73291435],
       [151623.05665104],
       [280490.05402953]])
```

In [411…
```
df3['SalePrice'] =model.predict(df3)
```

In [412…
```
df3.head(20)
```

Out[412…

	LandContour	ExterCond	Foundation	Electrical	FireplaceQu	GarageQual	G
0	0.31870	0.388852	-0.533007	0.296079	-0.401521	0.250409	
1	0.31870	0.388852	-0.533007	0.296079	-0.401521	0.250409	
2	0.31870	0.388852	0.833702	0.296079	1.918553	0.250409	
3	0.31870	0.388852	0.833702	0.296079	-0.401521	0.250409	
4	-2.53396	0.388852	0.833702	0.296079	-0.401521	0.250409	
5	0.31870	0.388852	0.833702	0.296079	1.918553	0.250409	
6	0.31870	-2.072470	0.833702	0.296079	-0.401521	0.250409	
7	0.31870	0.388852	0.833702	0.296079	-0.401521	0.250409	
8	0.31870	0.388852	0.833702	0.296079	0.758516	0.250409	
9	0.31870	0.388852	-0.533007	0.296079	-0.401521	0.250409	
10	0.31870	0.388852	0.833702	0.296079	-1.561558	0.250409	
11	0.31870	0.388852	-0.533007	0.296079	-0.401521	0.250409	
12	0.31870	0.388852	-0.533007	0.296079	-0.401521	0.250409	
13	0.31870	0.388852	-0.533007	0.296079	1.918553	0.250409	
14	0.31870	0.388852	-0.533007	0.296079	-0.401521	0.250409	
15	0.31870	0.388852	0.833702	0.296079	-0.401521	0.250409	
16	0.31870	0.388852	0.833702	0.296079	-0.401521	0.250409	
17	0.31870	0.388852	0.833702	0.296079	-0.401521	0.250409	
18	0.31870	0.388852	0.833702	0.296079	-0.401521	0.250409	
19	-2.53396	0.388852	0.833702	0.296079	-0.401521	0.250409	

20 rows × 42 columns

In [413…
```
df3['Id']=df['Id']
```

In [414…
```
result=df3[['Id','SalePrice']]
```

In [415…
```
result.head(20)
```

Out[415…

	Id	SalePrice
0	1	145686.554170
1	2	234266.949591
2	3	235165.333304
3	4	250925.431932
4	5	207103.111077
5	6	213939.568348
6	7	211409.006583
7	8	209703.004724
8	9	219599.900275
9	10	155497.600280
10	11	245457.879292
11	12	111190.829614
12	13	113202.432824
13	14	164302.317367
14	15	111437.753061
15	16	339168.895424
16	17	262935.784240
17	18	297898.893281
18	19	302393.585006
19	20	470485.058757

In [415…