

```
In [ ]: # importing all the required libs

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
%matplotlib inline

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

```
In [ ]: # Loading Data
data = pd.read_csv('train.csv')
test_data = pd.read_csv('test.csv')
```

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

```
Out[ ]:
```

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	LandContour	Utilities
0	1	60	RL	65.0	8450	Pave	NaN	Reg	Lvl	AllPu
1	2	20	RL	80.0	9600	Pave	NaN	Reg	Lvl	AllPu
2	3	60	RL	68.0	11250	Pave	NaN	IR1	Lvl	AllPu
3	4	70	RL	60.0	9550	Pave	NaN	IR1	Lvl	AllPu
4	5	60	RL	84.0	14260	Pave	NaN	IR1	Lvl	AllPu

5 rows × 81 columns



```
In [ ]: data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1460 entries, 0 to 1459
Data columns (total 81 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Id                    1460 non-null   int64
1   MSSubClass            1460 non-null   int64
2   MSZoning              1460 non-null   object
3   LotFrontage          1201 non-null   float64
4   LotArea              1460 non-null   int64
5   Street               1460 non-null   object
6   Alley                91 non-null     object
7   LotShape             1460 non-null   object
8   LandContour          1460 non-null   object
9   Utilities            1460 non-null   object
10  LotConfig            1460 non-null   object
11  LandSlope            1460 non-null   object
```

12	Neighborhood	1460	non-null	object
13	Condition1	1460	non-null	object
14	Condition2	1460	non-null	object
15	BldgType	1460	non-null	object
16	HouseStyle	1460	non-null	object
17	OverallQual	1460	non-null	int64
18	OverallCond	1460	non-null	int64
19	YearBuilt	1460	non-null	int64
20	YearRemodAdd	1460	non-null	int64
21	RoofStyle	1460	non-null	object
22	RoofMatl	1460	non-null	object
23	Exterior1st	1460	non-null	object
24	Exterior2nd	1460	non-null	object
25	MasVnrType	1452	non-null	object
26	MasVnrArea	1452	non-null	float64
27	ExterQual	1460	non-null	object
28	ExterCond	1460	non-null	object
29	Foundation	1460	non-null	object
30	BsmtQual	1423	non-null	object
31	BsmtCond	1423	non-null	object
32	BsmtExposure	1422	non-null	object
33	BsmtFinType1	1423	non-null	object
34	BsmtFinSF1	1460	non-null	int64
35	BsmtFinType2	1422	non-null	object
36	BsmtFinSF2	1460	non-null	int64
37	BsmtUnfSF	1460	non-null	int64
38	TotalBsmtSF	1460	non-null	int64
39	Heating	1460	non-null	object
40	HeatingQC	1460	non-null	object
41	CentralAir	1460	non-null	object
42	Electrical	1459	non-null	object
43	1stFlrSF	1460	non-null	int64
44	2ndFlrSF	1460	non-null	int64
45	LowQualFinSF	1460	non-null	int64
46	GrLivArea	1460	non-null	int64
47	BsmtFullBath	1460	non-null	int64
48	BsmtHalfBath	1460	non-null	int64
49	FullBath	1460	non-null	int64
50	HalfBath	1460	non-null	int64
51	BedroomAbvGr	1460	non-null	int64
52	KitchenAbvGr	1460	non-null	int64
53	KitchenQual	1460	non-null	object
54	TotRmsAbvGrd	1460	non-null	int64
55	Functional	1460	non-null	object
56	Fireplaces	1460	non-null	int64
57	FireplaceQu	770	non-null	object
58	GarageType	1379	non-null	object
59	GarageYrBlt	1379	non-null	float64
60	GarageFinish	1379	non-null	object
61	GarageCars	1460	non-null	int64
62	GarageArea	1460	non-null	int64
63	GarageQual	1379	non-null	object
64	GarageCond	1379	non-null	object
65	PavedDrive	1460	non-null	object
66	WoodDeckSF	1460	non-null	int64
67	OpenPorchSF	1460	non-null	int64
68	EnclosedPorch	1460	non-null	int64
69	3SsnPorch	1460	non-null	int64
70	ScreenPorch	1460	non-null	int64
71	PoolArea	1460	non-null	int64
72	PoolQC	7	non-null	object
73	Fence	281	non-null	object
74	MiscFeature	54	non-null	object
75	MiscVal	1460	non-null	int64
76	MoSold	1460	non-null	int64
77	YrSold	1460	non-null	int64
78	SaleType	1460	non-null	object
79	SaleCondition	1460	non-null	object
80	SalePrice	1460	non-null	int64

dtypes: float64(3), int64(35), object(43)
memory usage: 924.0+ KB

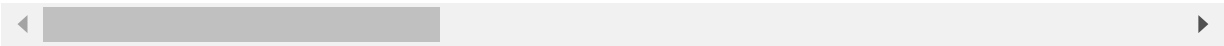
Below is a quick stats overview of the features that have numerical datatypes.

```
In [ ]: data.describe()
```

Out []:

	Id	MSSubClass	LotFrontage	LotArea	OverallQual	OverallCond	YearBuilt
count	1460.000000	1460.000000	1201.000000	1460.000000	1460.000000	1460.000000	1460.000000
mean	730.500000	56.897260	70.049958	10516.828082	6.099315	5.575342	1971.267808
std	421.610009	42.300571	24.284752	9981.264932	1.382997	1.112799	30.202904
min	1.000000	20.000000	21.000000	1300.000000	1.000000	1.000000	1872.000000
25%	365.750000	20.000000	59.000000	7553.500000	5.000000	5.000000	1954.000000
50%	730.500000	50.000000	69.000000	9478.500000	6.000000	5.000000	1973.000000
75%	1095.250000	70.000000	80.000000	11601.500000	7.000000	6.000000	2000.000000
max	1460.000000	190.000000	313.000000	215245.000000	10.000000	9.000000	2010.000000

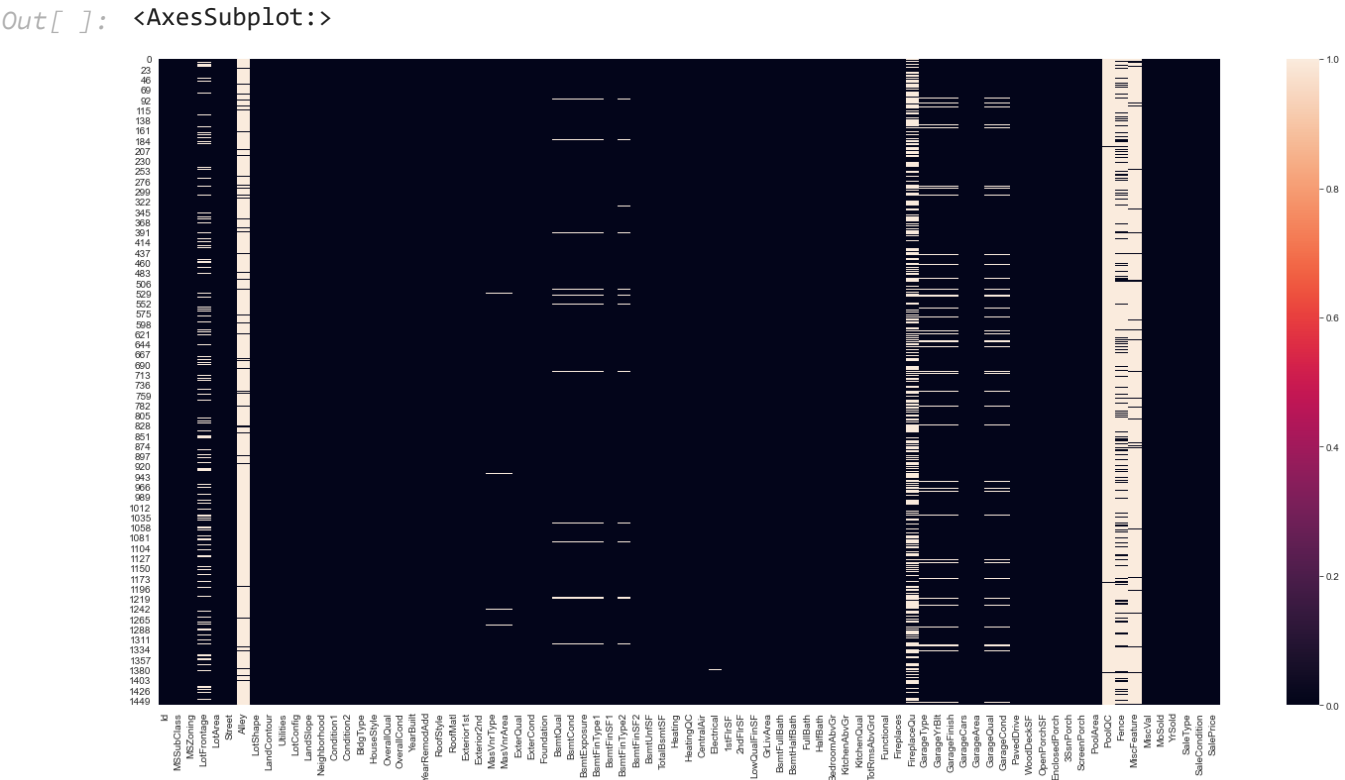
8 rows × 38 columns



Training Dataset

Checking and cleaning null values

```
In [ ]: plt.figure(figsize=(24,12))
sns.heatmap(data.isnull())
```



Assessing each column in the dataframe to classify them as either sparse or non-sparse.



```
In [ ]: columns_to_drop = []
columns_to_model = []
non_sparse_column_percentage = 90 # The percentage of the column that has non-null v

# Loop through columns to assess if the column is a sparse column or not
for col in data.columns:
    if (data[data[col].notnull()][col].count()/(len(data))*100 != 100:
        print(f"{col}: {(data[data[col].notnull()][col].count()/(len(data))*100:.4f}
            if (data[data[col].notnull()][col].count()/(len(data))*100 < non_sparse_col
                columns_to_drop.append(col)
            else:
                columns_to_model.append(col)
        else:
            columns_to_model.append(col)
```

```
LotFrontage: 82.2603%
Alley: 6.2329%
MasVnrType: 99.4521%
MasVnrArea: 99.4521%
BsmtQual: 97.4658%
BsmtCond: 97.4658%
BsmtExposure: 97.3973%
BsmtFinType1: 97.4658%
BsmtFinType2: 97.3973%
Electrical: 99.9315%
FireplaceQu: 52.7397%
GarageType: 94.4521%
GarageYrBlt: 94.4521%
GarageFinish: 94.4521%
GarageQual: 94.4521%
GarageCond: 94.4521%
PoolQC: 0.4795%
Fence: 19.2466%
MiscFeature: 3.6986%
```

Eliminating the sparse columns and null values.

```
In [ ]: data = data[columns_to_model]

for col in columns_to_model:
    data = data[data[col].notnull()]
```

```
In [ ]: data
```

```
Out[ ]:
```

	Id	MSSubClass	MSZoning	LotArea	Street	LotShape	LandContour	Utilities	LotConfig
0	1	60	RL	8450	Pave	Reg	Lvl	AllPub	Inside
1	2	20	RL	9600	Pave	Reg	Lvl	AllPub	FR2
2	3	60	RL	11250	Pave	IR1	Lvl	AllPub	Inside
3	4	70	RL	9550	Pave	IR1	Lvl	AllPub	Corner
4	5	60	RL	14260	Pave	IR1	Lvl	AllPub	FR2
...
1455	1456	60	RL	7917	Pave	Reg	Lvl	AllPub	Inside
1456	1457	20	RL	13175	Pave	Reg	Lvl	AllPub	Inside
1457	1458	70	RL	9042	Pave	Reg	Lvl	AllPub	Inside

	Id	MSSubClass	MSZoning	LotArea	Street	LotShape	LandContour	Utilities	LotConfig
1458	1459	20	RL	9717	Pave	Reg	Lvl	AllPub	Inside
1459	1460	20	RL	9937	Pave	Reg	Lvl	AllPub	Inside

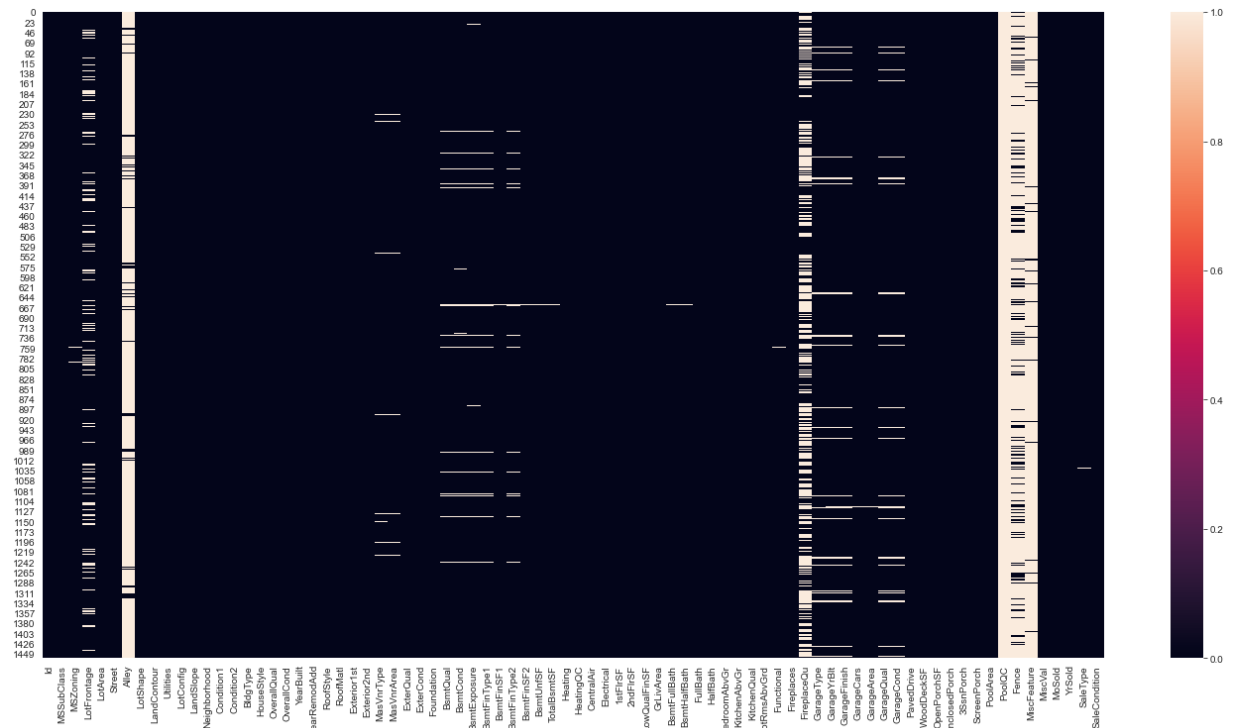
1338 rows × 75 columns



Test Dataset

```
In [ ]: plt.figure(figsize=(24,12))
sns.heatmap(test_data.isnull())
```

Out[]: <AxesSubplot:>



```
In [ ]: for col in test_data.columns:
    if (test_data[test_data[col].notnull()][col].count()/(len(test_data))*100 != 100):
        print(f"{col}: {(test_data[test_data[col].notnull()][col].count()/(len(test_data))*100)}%")
```

```
MSZoning: 99.7258%
LotFrontage: 84.4414%
Alley: 7.3338%
Utilities: 99.8629%
Exterior1st: 99.9315%
Exterior2nd: 99.9315%
MasVnrType: 98.9034%
MasVnrArea: 98.9719%
BsmtQual: 96.9842%
BsmtCond: 96.9157%
BsmtExposure: 96.9842%
BsmtFinType1: 97.1213%
BsmtFinSF1: 99.9315%
BsmtFinType2: 97.1213%
BsmtFinSF2: 99.9315%
BsmtUnfSF: 99.9315%
TotalBsmtSF: 99.9315%
BsmtFullBath: 99.8629%
```

```

BsmtHalfBath: 99.8629%
KitchenQual: 99.9315%
Functional: 99.8629%
FireplaceQu: 49.9657%
GarageType: 94.7910%
GarageYrBlt: 94.6539%
GarageFinish: 94.6539%
GarageCars: 99.9315%
GarageArea: 99.9315%
GarageQual: 94.6539%
GarageCond: 94.6539%
PoolQC: 0.2056%
Fence: 19.8766%
MiscFeature: 3.4955%
SaleType: 99.9315%

```

Categorical and Numerical Features

In []:

```

numerical_features = []
categorical_features = []
for col in data:
    if (data[col].dtype == int) | (data[col].dtype == float):
        numerical_features.append(col)
    else:
        categorical_features.append(col)
print(f"Numerical features: {numerical_features}")
print(f"Categorical features {categorical_features}")

```

```

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

```

Categorical Features

In []:

```

for feature in categorical_features:
    print(f"{feature}: (Unique Count = {len(data[feature].unique())})\n\n{data[feature]}")

```

Id: (Unique Count = 1338)

```
[ 1    2    3 ... 1458 1459 1460]
```

MSSubClass: (Unique Count = 15)

```
[ 60  20  70  50 190  45 120  30  85  90  80 160  75 180  40]
```

MSZoning: (Unique Count = 5)

```
['RL' 'RM' 'C (all)' 'FV' 'RH']
```

LotArea: (Unique Count = 1000)

[	8450	9600	11250	9550	14260	14115	10084	10382	6120	7420
	11200	11924	12968	10652	10920	11241	13695	7560	14215	7449
	9742	4224	8246	14230	7200	11478	16321	6324	8500	8544
	11049	10552	7313	13418	10859	8532	7922	8658	16905	9180
	9200	7945	7658	12822	11096	7742	13869	6240	8472	50271
	7134	10175	2645	11645	13682	13072	6442	10300	9375	9591
	19900	10665	4608	15593	13651	7599	10141	10200	5790	1596
	8475	8635	10440	13000	4500	10206	8892	8530	16059	11911
	3951	13360	9337	9765	10264	10921	10625	10603	9206	10402
	7758	10800	6000	11751	9525	7750	9965	21000	7259	3230
	11616	8536	12376	8461	21453	6060	9464	7892	17043	4928
	7590	8973	14200	12224	7388	6853	10335	10400	10355	11070
	9066	15426	8520	9100	2522	9505	10356	13891	14803	13500
	11340	12003	12552	19378	11120	13688	12182	5400	10708	10562
	8244	16669	12358	31770	5306	10197	12416	12615	10029	13650
	17423	2117	7588	11426	7438	22950	9947	10410	7018	4923
	10570	7472	9017	7180	2280	9416	25419	8546	10125	7000
	4438	3500	11851	13673	12493	14364	8250	10420	8640	13568
	10900	10011	9906	15660	3010	8990	8068	11475	10500	13472
	1680	9950	1869	8521	3182	8760	15138	10650	8773	9453
	12030	8741	9000	5000	10762	8880	9142	11310	11317	159000
	4750	8366	9350	8400	8738	8791	8814	12435	19296	9588
	8471	5500	5232	12090	11207	6900	7917	10728	39104	11764
	8314	7264	9196	19138	14450	10005	11287	5063	9612	8012
	4251	9786	9819	8730	15611	11409	16659	7937	13710	7399
	11700	14000	15750	16226	13704	9800	18386	10386	13474	12342
	12378	7685	8000	7800	215245	7795	13005	9900	16259	12099
	10380	5820	11275	10846	11600	11888	6402	10624	8176	8198
	9042	164660	14157	9135	14145	12400	14191	8849	2592	6435
	12772	17600	2448	20431	7820	5271	9084	11249	9248	6930
	12011	7540	9144	18800	10690	9500	9150	9830	8121	7175
	10634	8200	8846	11143	11394	8123	9245	53107	9382	12474
	8405	12209	10134	9571	8967	8125	14963	8767	10364	9991
	10480	15576	14154	34650	4403	8960	11228	8899	7844	22420
	8160	7060	16635	21750	3378	12800	8593	6762	11457	1920
	10839	10667	4400	4280	12354	15431	3922	8750	9855	16492
	11214	8600	5684	70761	9303	9297	4571	53227	5100	7015
	8004	8281	11988	3072	10628	9480	11428	9291	6820	11952
	3675	14977	5330	8480	13125	13693	10637	5925	16033	11846
	2500	10289	12243	1526	2665	9490	15578	7931	5784	12692
	9120	7535	1890	9803	9170	15602	2308	7596	9554	7862
	14559	6792	9187	10594	12220	10448	10208	9531	10918	40094
	11787	7500	13300	14948	6155	9056	8924	12735	11553	11423
	14601	11000	10140	4058	17104	13837	8737	7244	8235	4043
	11146	6380	14850	11040	21872	3196	11341	10010	21780	13346
	6858	11198	10171	12327	7032	13101	7332	13159	9967	6292
	11777	3604	12150	14585	12704	11443	10267	8740	25095	8320
	13478	6600	4435	7990	11302	3600	12984	1950	10927	10041
	12803	13600	12464	12168	7943	11050	10395	11885	8800	7861
	7227	11694	12244	7064	10000	11606	9020	4590	11900	9250
	6979	3982	12677	7050	13860	10793	10530	10452	7700	10320
	10437	10007	17503	9937	12384	46589	13560	10012	20896	11194
	18450	14175	8633	6629	14442	2289	9022	11844	9945	2887
	11248	16770	5062	10207	5105	8089	7577	4426	21535	26178
	13811	6420	4282	14331	12438	7630	115149	9018	7162	8712
	4671	9873	13517	10542	9920	6563	8120	8172	13286	6960
	21695	7314	5389	9590	11404	8978	10463	9313	6768	12886
	5395	8963	8795	10593	9236	10240	7930	10769	12257	6911
	9430	9549	14587	10421	12508	53504	7252	8877	7819	10150
	14226	11210	13350	7875	7153	16285	9101	9790	10142	12205
	11333	9158	10832	8197	7677	13518	12798	4800	8199	12274
	9750	21384	13400	8100	8248	12137	11425	13265	8816	6371
	7226	12394	11216	8529	28698	2544	3180	9548	10004	11767
	12155	12665	16647	9317	15523	45600	7128	12095	17920	6897
	10970	11029	7642	11625	9672	10656	6970	9938	12144	5720
	25286	8834	11782	7024	13758	9636	6204	7150	5119	8393
	16466	15865	12160	8064	11184	8414	13284	7056	8765	12919
	6993	7340	14859	6173	13501	11500	8885	12589	9286	6270
	3000	2001	17140	8462	10237	11999	11838	13006	8925	11670

8487	27650	5825	9675	24090	12640	8755	25000	14375	8820
8163	14536	9360	11075	7136	1300	2572	12227	11923	11316
7390	2268	11414	2651	9450	12122	12203	10880	5310	10159
12046	9452	17671	9760	12456	4712	10659	11717	11957	8385
2217	12118	21286	10592	11664	11883	5814	10784	3013	7406
9439	15498	9300	9520	9492	15863	14541	6305	12898	9240
1477	9130	5381	11839	16056	8993	11175	8562	11367	11361
7052	29959	11308	4920	18000	7837	3964	10152	7585	7950
8556	15870	8775	8749	13031	9069	1974	10574	3316	2160
9230	5868	3696	11880	9758	8910	2016	12256	10357	23257
8063	11362	7100	8923	12085	9764	13825	8263	8926	9125
10434	3684	14572	11796	7804	9828	6180	8731	7350	10304
12180	12000	5700	8280	17755	5890	13700	10768	5001	11932
14778	8724	12900	16157	9541	10475	10852	13728	35760	9880
4017	16560	10678	6951	3950	7681	11170	5587	15623	35133
9738	10615	12461	8935	32463	9364	8029	14054	8850	11235
9353	14684	8900	7763	10182	11218	12134	9340	10246	10205
7094	10496	10680	15384	10482	14598	8872	8769	7910	18890
7728	13132	2628	12393	9037	8158	9849	11435	12328	11160
3136	9858	17542	6931	14303	9587	24682	13515	4060	3735
10120	13214	14100	11344	23595	9156	13526	11512	5362	11345
12936	17871	9808	8049	9638	36500	5664	11065	14112	8700
63887	8688	3363	13173	6955	8072	17500	9572	14774	8190
10226	4230	14781	10215	10186	9986	10780	2368	9650	9246
13450	9560	8294	7558	11103	20781	15306	16196	11643	9247
14720	10316	10192	9477	12537	16737	9842	16158	12513	8499
9179	10635	11400	10991	10998	1953	8212	12925	25339	9060
5436	16692	14892	8944	7838	4045	57200	6171	7415	15256
3842	8445	7740	20544	12420	10994	13053	3635	16545	9204
16381	19690	9503	10721	10944	10930	12546	21930	10261	17400
12444	7407	11584	11526	11003	8854	26142	9262	13175	9717]

Street: (Unique Count = 2)

['Pave' 'Grv1']

LotShape: (Unique Count = 4)

['Reg' 'IR1' 'IR2' 'IR3']

LandContour: (Unique Count = 4)

['Lv1' 'Bnk' 'Low' 'HLS']

Utilities: (Unique Count = 2)

['AllPub' 'NoSeWa']

LotConfig: (Unique Count = 5)

['Inside' 'FR2' 'Corner' 'CulDSac' 'FR3']

LandSlope: (Unique Count = 3)

['Gtl' 'Mod' 'Sev']

Neighborhood: (Unique Count = 25)

['CollgCr' 'Veenker' 'Crawfor' 'NoRidge' 'Mitchel' 'Somerst' 'NWAmes'
'OldTown' 'BrkSide' 'Sawyer' 'NridgHt' 'NAmes' 'SawyerW' 'IDOTRR'
'MeadowV' 'Timber' 'Gilbert' 'StoneBr' 'ClearCr' 'Edwards' 'NPKvill'
'Blmngtn' 'BrDale' 'SWISU' 'Blueste']


```

*****
Condition1: (Unique Count = 9)

['Norm' 'Feedr' 'PosN' 'Artery' 'RRAe' 'RRNn' 'RRAn' 'PosA' 'RRNe']

*****
Condition2: (Unique Count = 8)

['Norm' 'Artery' 'RRNn' 'Feedr' 'PosN' 'PosA' 'RRAn' 'RRAe']

*****
BldgType: (Unique Count = 5)

['1Fam' '2fmCon' 'TwnhsE' 'Duplex' 'Twnhs']

*****
HouseStyle: (Unique Count = 8)

['2Story' '1Story' '1.5Fin' '1.5Unf' 'SFoyer' 'SLvl' '2.5Unf' '2.5Fin']

*****
OverallQual: (Unique Count = 9)

[ 7  6  8  5  9  4 10  3  2]

*****
OverallCond: (Unique Count = 8)

[5 8 6 7 4 3 9 2]

*****
YearBuilt: (Unique Count = 109)

[2003 1976 2001 1915 2000 1993 2004 1973 1931 1939 1965 2005 1962 2006
 1960 1929 1970 1958 1930 2002 1968 2007 1951 1957 1927 1920 1966 1959
 1994 1954 1953 1983 1975 1997 1934 1963 1981 1955 1964 1999 1972 1921
 1945 1982 1998 1956 1948 1910 1995 1991 2009 1961 1977 1985 1885 1990
 1969 1979 1967 1988 1952 1936 1971 1923 1984 1926 1941 1987 1986 1950
 2008 1908 1892 1916 1932 1918 1924 1947 1925 1900 1980 1940 1989 1992
 1949 1880 1928 1978 1996 2010 1946 1913 1937 1942 1938 1974 1922 1893
 1935 1906 1890 1914 1898 1904 1912 1882 1917 1919 1905]

*****
YearRemodAdd: (Unique Count = 61)

[2003 1976 2002 1970 2000 1995 2005 1973 1950 1965 2006 1962 2007 1960
 2001 2004 2008 1997 1959 1990 1983 1980 1966 1963 1987 1955 1964 1972
 1996 1998 1989 1953 1956 1981 1968 1992 2009 1961 1993 1999 1985 1977
 1969 1958 1991 1967 1952 1975 1971 2010 1984 1986 1979 1994 1988 1954
 1957 1982 1951 1978 1974]

*****
RoofStyle: (Unique Count = 6)

['Gable' 'Hip' 'Gambrel' 'Mansard' 'Flat' 'Shed']

*****
RoofMat1: (Unique Count = 8)

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

*****
Exterior1st: (Unique Count = 14)

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

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*****
Exterior2nd: (Unique Count = 16)

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

*****
MasVnrType: (Unique Count = 4)

['BrkFace' 'None' 'Stone' 'BrkCmn']

*****
ExterQual: (Unique Count = 4)

['Gd' 'TA' 'Ex' 'Fa']

*****
ExterCond: (Unique Count = 4)

['TA' 'Gd' 'Fa' 'Ex']

*****
Foundation: (Unique Count = 5)

['PConc' 'CBlock' 'BrkTil' 'Wood' 'Stone']

*****
BsmtQual: (Unique Count = 4)

['Gd' 'TA' 'Ex' 'Fa']

*****
BsmtCond: (Unique Count = 4)

['TA' 'Gd' 'Fa' 'Po']

*****
BsmtExposure: (Unique Count = 4)

['No' 'Gd' 'Mn' 'Av']

*****
BsmtFinType1: (Unique Count = 6)

['GLQ' 'ALQ' 'Unf' 'Rec' 'BLQ' 'LwQ']

*****
BsmtFinSF1: (Unique Count = 621)

[ 706  978  486  216  655  732 1369  859    0  851  906  998  737  733
 578  646  504  840  188  234 1218 1277 1018 1153 1213  731  643  967
 747  280  179  456 1351   24  763  182  104 1810  384  490  649  632
 941  739  912 1013  603 1880  565  320  462  228  336  448 1201   33
 600  713 1046  648  310 1162  520  108 1200  224  705  444  250  984
  35  774  419  170 1470  938  570  300  120  512  567  445  695  405
1005  668  821 1300  507  679 1332  209  716 1400  416  429  222   57
 660 1016  370  379 1288  360  639  495  288 1398  477  831 1904  436
 352  611 1086  297  626  560  390  566 1126 1036 1088  641  617  662
 312 1065  787   36  822  378  946  341   16  550  524   56  321  842
 689  358  402   94 1078  929  697 1573  270  922  503 1334  361  672
 506  588  714  403  751  226  620  546  392  421  905  904  430  450
 292  795 1285  819  420  841  281  894 1464  700  262 1274  518  680
1236  425  692  987  970   28  256  116 1619   40  846  720  828 1249
 810  213  585  129  498 1270  573 1410 1082  236  388  334  874  956
 773  399  162  712  609  371  540   72  623  428  298 1445  218  985
 631 1280  241  690  777  812  786 1116  789 1056   50 1128  775 1309
1246  986  616 1518  664  387  471  385  365 1767  642  247  331  742
1606  916  185  544  350  553  326  778  386  426  368  459 1350 1196

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630	994	168	1261	1567	299	897	607	836	515	374	1231	329	111
356	400	698	1247	257	380	27	141	991	650	521	1436	2260	719
377	1330	783	673	1358	1260	144	584	554	1002	619	180	559	308
866	895	637	604	1302	1071	728	2	1441	943	231	414	349	442
328	594	1460	210	1324	1338	816	685	1422	1283	81	454	903	605
990	457	48	871	674	624	480	1154	738	493	1121	282	500	1696
806	1361	920	1721	187	1138	988	193	551	767	1186	892	311	827
543	1003	1059	239	945	20	1455	965	980	1219	863	533	1084	1173
523	1148	191	1234	375	808	724	152	1180	252	832	575	919	439
381	438	549	612	1163	437	394	1416	422	762	975	1097	251	686
656	568	539	862	569	197	516	663	608	1636	249	1040	483	196
572	338	330	156	1390	513	460	659	364	564	306	505	932	750
64	633	1170	899	902	432	1238	528	351	1024	1064	285	2188	465
322	860	599	354	63	223	301	443	489	284	294	814	165	625
552	464	936	772	748	982	398	562	484	417	699	896	556	651
867	854	1646	1074	536	1172	915	595	1237	273	684	324	1165	138
1513	317	1012	1022	509	900	1085	1104	240	383	644	397	740	837
220	586	535	410	75	824	592	1039	510	423	661	248	704	290
412	1032	219	708	415	1004	353	702	369	622	645	852	1150	348
1258	275	176	296	538	1157	492	1198	1387	522	658	468	1216	1480
2096	1159	440	1456	883	547	788	485	340	1220	427	344	784	756
1540	666	803	1000	885	319	534	125	1314	602	266	192	593	1053
532	1158	1014	194	167	776	5644	694	1572	746	1406	925	482	189
765	80	1443	735	734	1447	548	315	1282	408	309	203	865	204
790	1320	769	1070	264	759	1373	976	781	25	1110	404	580	678
958	1336	1079	49	830]									

BsmtFinType2: (Unique Count = 6)

['Unf' 'BLQ' 'ALQ' 'Rec' 'LwQ' 'GLQ']

BsmtFinSF2: (Unique Count = 141)

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

BsmtUnfSF: (Unique Count = 764)

[	150	284	434	540	490	64	317	216	952	140	134	177	175	1494
	520	832	426	468	525	1158	637	1777	200	204	1566	180	486	207
	649	1228	1234	380	408	1117	1097	84	326	445	383	0	167	465
	1296	83	1632	192	612	816	32	935	321	860	1410	148	217	530
	1346	576	318	1143	1035	440	747	701	343	280	404	840	724	295
	448	36	1530	1065	384	1288	684	635	163	168	176	370	350	410
	741	1226	1053	641	516	1139	550	905	104	310	252	1125	203	728
	732	510	899	1362	958	413	479	297	658	262	891	1304	519	1907
	336	107	403	811	396	970	506	884	896	253	409	93	1200	774
	769	1335	572	556	340	779	470	294	1686	360	441	354	700	725
	320	554	312	968	504	1107	577	660	99	871	474	289	600	625
	1121	276	186	1424	1140	375	92	305	1176	78	274	311	710	686
	457	1232	1498	1010	160	2336	630	638	162	70	1357	1194	773	483
	125	1390	594	1694	488	626	916	1020	1367	798	452	392	975	361
	270	602	1482	680	606	88	342	212	1095	96	628	1560	744	2121
	768	386	357	1468	1145	432	698	1079	476	131	184	143	1092	324
	1541	1470	536	599	622	179	292	286	80	712	291	153	1088	1249
	166	906	604	100	818	844	596	210	115	103	673	726	995	967
	721	1656	972	460	208	191	438	1869	371	624	552	322	598	268

130	484	785	733	953	847	1580	411	982	808	1293	939	784	595
402	229	114	735	405	117	961	1286	672	1141	806	165	1064	1063
245	1276	892	1008	499	1316	463	242	444	281	35	356	988	580
651	619	544	387	926	648	75	788	1078	1258	273	1436	557	930
780	813	878	122	248	588	524	288	389	1375	1626	406	298	2153
417	739	225	611	319	237	290	264	238	363	190	1969	697	414
522	316	466	420	254	960	397	1191	548	50	178	1368	169	748
570	689	1264	467	605	1257	551	678	707	880	378	223	578	969
379	765	149	912	620	1709	132	993	197	1374	90	195	1163	367
1122	1515	55	1497	450	846	23	390	861	285	1050	331	2042	1237
113	742	924	512	119	314	308	293	537	126	427	309	173	1774
485	1116	978	636	564	108	366	300	542	645	664	756	755	247
776	849	793	1392	38	1406	111	545	121	244	2046	161	261	567
1195	874	1342	151	989	1073	927	219	224	526	1164	761	424	461
876	859	171	718	138	941	464	250	72	508	1584	415	82	901
948	893	864	1349	76	487	652	1240	801	279	1030	348	234	1198
740	89	586	323	1836	480	456	1935	338	1594	102	374	1413	491
1129	255	1496	650	1926	154	999	1734	124	1417	15	834	1649	936
778	1489	442	1434	352	458	1221	1099	416	227	907	528	189	1273
563	372	381	702	1090	435	198	1372	174	1638	894	299	105	676
1120	431	218	110	795	1098	1043	481	666	142	447	783	1670	277
412	794	239	662	1072	717	546	430	422	266	1181	1753	964	1450
1905	1480	772	1032	220	187	29	495	640	1800	193	196	918	77
1266	1128	692	770	750	135	1442	1007	501	691	1550	1680	1330	1710
720	746	814	515	571	359	355	301	668	920	1055	1420	1752	304
1302	833	133	549	705	722	706	799	462	429	810	155	170	230
1459	1082	758	1290	1074	251	172	868	797	400	365	418	730	533
671	1012	1528	1005	1373	500	752	399	1042	40	26	932	278	459
568	1502	543	574	449	983	731	120	538	831	994	341	879	815
1212	866	1630	328	141	364	1380	81	303	188	764	1048	334	1689
792	585	473	246	1045	1405	201	14	841	1104	241	925	2002	74
661	708	1152	256	804	812	1085	344	425	1616	976	496	349	971
1393	1622	1352	1795	1017	1588	428	803	858	1284	1203	1652	39	539
1217	257	715	616	240	315	1351	1026	1571	156	61	95	482	1094
60	862	221	112	791	736	398	777	503	734	709	1252	333	762
656	1319	1422	560	1573	589	877	136]						

TotalBsmtSF: (Unique Count = 700)

[	856	1262	920	756	1145	796	1686	1107	952	991	1040	1175	912	1494
1253	832	1004	1114	1029	1158	637	1777	1060	1566	900	1704	1484	520	
649	1228	1234	1398	1561	1117	1097	1297	1057	1088	1350	840	938	1150	
1752	1434	1656	955	794	816	1842	384	1425	970	860	1410	780	530	
1370	576	1143	1947	1453	747	1304	2223	845	1086	462	672	440	896	
1237	1563	1065	1288	684	612	1235	876	1214	824	680	1588	960	458	
1610	741	1226	1053	641	789	1844	994	1264	1809	1028	729	1092	1125	
1673	728	732	1080	1199	1362	1078	660	1008	924	992	1063	1267	1461	
1907	928	1734	910	1490	1728	715	884	969	1710	825	1602	1200	774	
1392	1232	1572	1541	1149	1617	1582	720	1064	1606	1202	1151	1052	2216	
968	793	504	1188	1593	853	725	1431	864	855	1726	1360	1713	1121	
1196	617	848	1424	1140	1100	1157	1212	990	689	1070	1436	686	798	
1248	1498	1010	713	2392	630	1203	483	1373	1194	1462	894	1414	996	
1694	735	540	626	948	1845	1020	1367	1444	1573	1302	1314	975	1604	
963	1482	506	926	1422	802	740	1095	1385	1152	1240	1560	2121	1160	
807	1468	1575	625	882	698	1079	768	795	1416	1003	702	1165	1470	
2000	700	861	1896	697	972	2136	716	1347	1372	1249	1136	1502	1162	
710	1719	1383	844	596	1056	1358	943	1499	1922	1536	1208	1215	967	
721	1684	536	958	1478	764	1848	1869	616	624	940	1142	1062	888	
883	1394	1099	1268	953	744	608	847	870	1580	1856	982	1026	1293	
939	784	1256	1041	1682	804	1144	961	1260	1310	1141	806	1281	1034	
1276	1340	1344	988	651	1518	907	765	799	648	3094	1258	915	1517	
930	813	1533	872	1242	1364	588	709	560	1375	1277	1626	1488	808	
547	1976	2153	1705	1833	1792	1216	999	1113	1073	954	264	1269	190	
3200	866	1501	777	1218	1368	1084	2006	1244	3138	1379	1257	1452	611	
707	880	1051	1581	1838	1650	723	654	1204	1069	1709	998	993	1374	
1389	1163	1122	1496	846	372	1164	1050	2042	1868	1437	742	770	1722	
1814	1430	1058	908	600	965	1440	1032	1299	936	783	1822	1522	980	
1116	978	1156	636	1554	1386	811	1520	1952	1766	981	1094	755	2109	

525 776 1486 1629 1138 2077 1406 1021 1408 738 1477 2046 923 1291
1195 1190 874 551 1419 2444 1210 927 1112 1391 1800 360 1473 1643
1324 859 718 1176 1311 971 1742 941 1698 1584 1595 868 1153 893
1349 1337 1720 1479 1030 1318 1252 983 1860 858 836 1935 1614 761
1413 956 901 712 650 773 1926 731 1417 1024 849 1442 1649 1568
778 1489 2078 1454 1013 1516 1067 1559 1127 1390 528 1273 918 1763
1090 1054 1039 1148 1002 1638 105 676 1184 1109 892 2217 1505 1059
951 2330 1670 1623 1017 1105 1001 546 480 1134 1104 1316 1126 1181
1753 964 1466 925 1905 1500 585 1632 819 1616 1161 828 979 561
696 1330 817 1098 673 944 1225 1266 1128 485 1930 1396 916 822
750 1700 1007 1187 691 1574 1680 1346 985 1657 602 1022 1082 810
1504 1220 1132 1565 1338 1654 1620 1055 800 1306 1475 2524 1992 1193
973 854 662 1103 1154 942 1048 727 690 1096 1459 1251 1247 1074
1271 290 950 655 1463 1836 803 833 408 533 1012 1552 1005 1530
1567 1042 1298 704 572 932 1219 1296 1198 959 1261 1683 818 1600
2396 1120 1624 831 1224 663 879 815 1630 2158 931 1660 559 1300
788 1702 1075 1361 1106 1476 1689 792 2110 1405 1192 746 1986 841
2002 1332 935 1019 661 1309 1328 1085 6110 1246 771 976 1652 1278
1902 1274 1393 1622 1352 1795 1510 911 1284 1732 2033 570 1980 814
873 757 1108 2633 1571 984 1205 714 1746 1525 482 1356 862 839
1286 1485 1594 622 791 708 1223 913 656 1319 1932 539 1221 1542]

Heating: (Unique Count = 4)

['GasA' 'GasW' 'Grav' 'OthW']

HeatingQC: (Unique Count = 5)

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

CentralAir: (Unique Count = 2)

['Y' 'N']

Electrical: (Unique Count = 5)

['SBrkr' 'FuseF' 'FuseA' 'FuseP' 'Mix']

1stFlrSF: (Unique Count = 727)

[856 1262 920 961 1145 796 1694 1107 1022 1077 1040 1182 912 1494
1253 854 1004 1114 1339 1158 1108 1795 1060 1600 900 1704 520 649
1228 1234 1700 1561 1132 1097 1297 1057 1324 1328 884 938 1150 1752
1518 1656 955 794 816 1842 1360 1425 983 860 1426 780 581 1370
902 1143 2207 1479 747 1304 2223 845 885 1086 840 526 952 1072
682 1337 1563 1065 804 1301 684 612 1235 964 1260 905 680 1588
960 835 1610 977 1226 1053 1047 789 1844 1216 774 1282 2259 1436
729 1092 1125 1699 728 988 772 1080 1199 1586 958 660 1327 1296
1721 1682 1214 1959 928 1734 910 1501 1728 970 875 896 969 1710
1252 1200 991 1392 1232 1572 1541 1149 1867 1707 1064 1362 1651 2158
1164 2234 968 769 901 936 1217 808 1224 1593 1549 725 1431 864
855 1726 1713 1121 1279 865 848 720 1442 1696 1100 1180 1212 932
990 689 1236 810 1137 1248 1498 1010 811 2392 630 483 1555 1194
1490 894 1414 1014 798 1566 889 626 1222 1872 908 1375 1444 1625
1302 1314 1005 1604 963 1382 1482 926 764 1422 802 1052 778 1113
1095 1363 1632 1560 2121 1156 1175 1468 1575 625 1085 698 1079 1148
1644 1003 975 1041 1152 1336 1210 1675 2000 1122 861 1944 697 972
793 2036 832 716 1153 1088 1372 1472 1249 1136 1553 1163 1898 803
1719 1383 1445 596 1056 1358 943 1619 1922 1536 1621 1215 993 841
1684 536 1478 1848 1869 1453 616 1192 1167 1142 1352 790 672 1394
1268 1287 953 752 1319 847 914 1580 1856 1007 1026 939 784 1269
1742 735 1144 876 1112 1288 1310 1165 806 1620 1166 1071 1050 1276
1028 1340 756 1344 1602 1470 1196 707 907 1208 1412 765 827 734
904 694 2402 1128 1258 933 1689 1888 956 679 813 1533 888 786

1242	624	1663	833	979	575	849	1277	1634	1502	1161	1976	1652	1493
2069	1718	1131	1850	1792	916	999	1073	1484	1766	886	3228	1133	899
866	1801	1218	1368	2020	1378	882	1244	3138	1266	1476	1509	751	880
1159	1601	1838	997	1680	767	664	1377	915	768	825	1069	1717	1006
1048	897	1557	1389	1134	1535	1496	846	576	877	1320	703	1429	2042
1521	989	2028	838	1473	779	770	924	1826	1402	1647	1058	927	600
1186	1940	1029	1032	1299	1054	807	1828	1548	980	1012	1116	1520	1350
1089	1554	1411	1567	981	1094	1051	755	909	2113	525	851	1486	1686
1181	2097	1454	1465	1679	1437	738	1839	792	2046	923	1291	1668	1195
1190	874	551	1419	2444	1238	1067	1391	1800	1264	1824	859	1576	1178
1325	971	1698	1776	1616	1146	948	1349	1464	1720	1038	742	757	1506
1836	1690	858	1220	1117	1973	1204	1614	1430	1110	1342	966	976	1062
1127	1285	773	1966	1428	1075	1309	1044	686	1661	1008	944	1489	2084
1434	1160	941	1516	1559	1099	1701	1307	1456	918	1779	702	1512	1039
1002	1646	1120	1036	676	1184	1462	1155	1090	1187	954	892	1709	1712
872	2217	1505	1068	951	2364	1306	1670	1063	1636	1020	1105	1015	1001
546	480	1229	1316	1617	1126	1098	1788	1466	925	1905	1500	1207	1188
1629	1381	965	1168	561	696	1542	824	783	673	1118	1407	750	691
1574	1504	985	1657	1082	2898	1687	1654	1055	1803	800	1532	2524	1992
1526	1091	1523	1364	1130	1096	1338	1103	1154	799	893	829	1240	1459
1251	996	1247	1390	438	950	887	1021	1552	812	1530	986	1042	1298
572	1811	1265	1640	1432	959	1831	1261	1170	2129	818	820	2411	949
1624	831	1622	842	663	879	815	1630	1074	2196	1283	1660	1211	2136
788	1138	1702	1507	1361	1141	1173	1140	1034	2110	1405	760	1987	1104
713	2018	1968	1332	935	1357	661	1724	1573	1582	1659	4692	1246	753
1203	1294	1902	1274	1787	1061	1584	1334	1284	1172	2156	2053	992	1078
1980	1281	814	2633	1571	984	2117	998	1416	1664	1746	869	1525	1221
741	1569	708	1223	1440	962	1537	1932	1423	913	1578	2073	1256]	

2ndFlrSF: (Unique Count = 394)

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

LowQualFinSF: (Unique Count = 16)

[0 360 528 572 144 392 390 420 473 156 80 232 481 120 397 384]

GrLivArea: (Unique Count = 822)

[1710 1262 1786 1717 2198 1362 1694 2090 1774 1077 1040 2324 912 1494
1253 854 1004 1114 1339 2376 1108 1795 1060 1600 900 1704 520 1317
1228 1234 1700 1561 2452 1097 1297 1057 1324 1328 884 938 1150 1752
2149 1656 955 1470 1176 816 1842 1360 1425 1739 1720 2945 780 1158
1111 1370 2034 2473 2207 1479 747 2287 2223 845 1718 1086 1605 988
952 1285 1230 2142 1337 1563 1065 1474 2417 1560 1224 1235 964 2291
1588 960 835 1610 1732 1226 1818 1992 1047 789 1844 1855 1430 2696
2259 2320 1458 1092 1125 3222 1456 1123 1080 1199 1586 958 1348 1053
2157 2054 1327 1296 1721 1682 1214 1959 1852 1764 1734 1385 1501 1728
1709 875 2035 1344 969 1993 1252 1200 1968 1947 2462 1232 2668 1541
1616 1867 2161 1707 1382 1767 1651 2158 2060 1920 2234 968 1525 1802
2082 3608 1217 1593 2727 1431 864 1726 3112 1713 1121 1279 1310 848
1284 1442 1696 1100 2062 1212 990 1392 1236 1436 1954 1248 1498 2267
1552 2392 1302 2520 987 1555 1194 2794 894 1414 1744 1487 1566 1440
2110 1872 1928 1375 1668 2144 1625 1640 1314 1604 1792 2574 1316 764
1422 1511 2192 778 1113 1939 1363 2270 1632 1548 2121 2022 1982 1468
1575 1250 1396 1919 1716 2263 1644 1003 1558 1950 1743 1152 1336 3493
2000 2243 861 1944 972 1118 2036 1641 1432 2353 2646 1472 2596 2468
2730 1163 2978 803 1719 1383 2134 1192 1056 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 914 2466 1856
1800 1691 1301 1797 784 1953 1269 2332 1367 1961 1034 1144 1812 1550
1288 672 1572 1620 1639 1680 2172 2078 1276 1028 2097 1340 1400 2624
1134 1602 2630 1196 1389 907 1208 1412 1365 1661 904 694 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 630 1304 1578 886 3228 1820 899
1218 1768 1801 1322 1960 1911 1378 1041 1368 2020 2119 2344 1796 2080
1244 4676 2398 1266 928 2713 1509 1724 1159 1601 1838 2285 767 1496
2183 1635 768 825 2094 1069 2046 1048 1446 1557 1674 2295 1647 2504
1535 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
1054 832 1828 2262 2614 980 1512 1790 1116 1520 1350 1750 1554 1411
1387 1567 1518 1929 2704 1766 981 1094 1839 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 1178 2554
2418 971 1742 1698 1776 1146 2031 948 1349 1464 2715 2256 2640 2098
1026 1471 1386 2531 1547 2365 1506 1714 1836 3279 858 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 1120 1949 910 2610 2224
1155 1090 2230 892 1712 1393 2217 1683 1068 951 2364 1306 1670 902
1063 1636 2057 2274 1015 2002 480 1229 2127 1617 1686 1126 2374 1978
1788 2236 1466 925 1905 1500 2069 1971 1962 2403 1629 1381 965 1958
2872 1894 1308 1098 1095 918 2019 2612 2290 1940 2030 1851 1050 691
1504 985 1657 1271 1022 1082 1665 1132 2898 882 1264 3082 1654 954
1803 2329 2524 2868 1977 1526 1989 1523 1364 2184 1991 1338 2337 1103
1154 2260 1571 1611 2521 893 1240 1740 1096 1459 1251 996 1247 1088
438 950 2622 2021 1690 1658 1964 833 1012 1005 1530 1981 2210 986
1868 2828 1298 932 1811 1265 1580 1876 1671 2108 3627 1261 2345 1343
2514 4476 1130 1221 1699 1624 1804 1622 1863 1630 1074 2196 1283 1845
1211 1846 2136 1490 1138 1933 1702 1507 2620 1190 1188 1784 1948 1141
1173 1517 1553 2058 1405 874 2167 1987 1166 1675 1452 1889 2018 3447
1524 1357 1395 2447 1659 1970 2372 5642 1246 1983 2526 1708 1122 1294
1902 1274 2810 2599 2112 1787 1923 2792 1334 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]

BsmtFullBath: (Unique Count = 3)

[1 0 2]

BsmtHalfBath: (Unique Count = 3)

```

[0 1 2]

*****
FullBath: (Unique Count = 4)

[2 1 3 0]

*****
HalfBath: (Unique Count = 3)

[1 0 2]

*****
BedroomAbvGr: (Unique Count = 7)

[3 4 1 2 0 5 6]

*****
KitchenAbvGr: (Unique Count = 3)

[1 2 3]

*****
KitchenQual: (Unique Count = 4)

['Gd' 'TA' 'Ex' 'Fa']

*****
TotRmsAbvGrd: (Unique Count = 10)

[ 8  6  7  9  5 11  4 10 12  3]

*****
Functional: (Unique Count = 7)

['Typ' 'Min1' 'Maj1' 'Min2' 'Mod' 'Maj2' 'Sev']

*****
Fireplaces: (Unique Count = 4)

[0 1 2 3]

*****
GarageType: (Unique Count = 6)

['Attchd' 'Detchd' 'BuiltIn' 'CarPort' 'Basment' '2Types']

*****
GarageFinish: (Unique Count = 3)

['RFn' 'Unf' 'Fin']

*****
GarageCars: (Unique Count = 4)

[2 3 1 4]

*****
GarageArea: (Unique Count = 435)

[ 548  460  608  642  836  480  636  484  468  205  384  736  352  840
  576  294  853  280  534  572  270  890  772  319  240  250  271  447
  556  691  672  498  246  440  308  504  300  670  826  386  388  528
  516  894  565  641  288  645  852  558  220  667  360  427  490  379
  297  283  509  405  758  461  400  462  432  506  684  420  472  366
  476  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  680  678  726  532  216  303  789  511  616
  521  451 1166  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
282 375 683 843 552 870 888 746 708 410 513 1025 656 872
292 441 189 676 301 474 706 617 445 200 592 566 514 296
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
499 508 694 874 164 402 515 286 603 900 583 889 252 858
502 403 527 765 367 426 615 871 570 406 590 612 650 1390
880 275 452 842 816 621 544 486 230 261 531 393 774 749
364 627 260 256 478 442 512 839 330 711 1134 416 779 702
567 832 326 551 606 739 408 475 704 983 768 632 541 320
800 831 554 878 752 614 481 496 423 841 895 412 865 605
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
414 738 354 483 327 756 690 284 833 601 533 522 788 689
796 808 510 255 424 305 368 824 328 160 437 665 912 905
542 716 586 467 582 1248 1043 254 712 719 862 928 782 392
630 466 714 1052 225 234 324 306 830 807 358 625 186 693
482 813 995 757 1356 459 701 322 315 668 404 543 954 477
276 518 1014 753 1418 213 844 860 748 248 825 647 342 770
663 377 804 936 722 208 662 754 622 620 370 1069 372 923
192]

GarageQual: (Unique Count = 5)

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

GarageCond: (Unique Count = 5)

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

PavedDrive: (Unique Count = 3)

['Y' 'N' 'P']

WoodDeckSF: (Unique Count = 266)

[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
232 158 182 180 166 224 80 367 188 105 24 98 276 200 409 239 400 476
178 574 237 210 441 280 104 87 132 238 149 355 60 139 108 351 209 216
248 143 365 370 197 123 138 333 250 292 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 89 96 414 519 206 141 260 324 156
220 38 261 126 466 270 78 169 320 268 72 349 42 35 326 382 161 179
103 253 148 335 176 390 312 185 269 195 57 236 517 304 198 426 28 316
322 307 257 219 416 344 380 68 114 327 165 187 181 228 245 503 315 241
303 133 403 36 52 265 207 150 290 486 278 70 418 234 26 342 97 272
121 243 511 164 173 384 202 56 86 194 421 305 550 509 153 394 371 63
252 136 170 474 214 116 199 328 728 436 55 186 431 448 361 362 162 229
439 379 356 84 635 325 88 33 212 314 242 294 30 45 177 227 218 309
404 500 668 402 283 183 154 175 128 58 586 295 366 736]

OpenPorchSF: (Unique Count = 197)

[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 40 114 136 132 62 228
60 238 260 27 74 16 26 83 34 55 22 98 172 119 208 105 140 168
28 39 148 12 51 150 117 250 10 81 44 175 195 128 76 17 214 121
53 231 134 192 123 78 144 187 85 133 176 113 137 125 100 285 88 406
155 73 182 502 274 158 142 243 235 312 124 267 265 87 288 23 152 341

```
116 174 247 59 18 170 156 166 129 418 240 77 364 188 207 67 69 131
191 118 252 189 282 135 95 224 169 319 58 93 244 185 92 180 263 304
103 198 287 292 241 547 211 91 86 262 210 141 15 160 126 236 41]
```

```
*****
EnclosedPorch: (Unique Count = 109)
```

```
[ 0 272 228 205 176 87 172 37 144 64 114 202 128 44 77 192 140 180
183 39 184 40 552 126 60 150 120 112 252 52 224 234 244 268 137 24
108 294 218 242 91 160 130 169 105 34 96 248 236 32 80 291 116 158
36 156 84 136 102 240 54 189 293 216 239 67 90 56 129 98 143 70
386 154 196 264 185 275 230 254 68 194 164 318 48 94 226 174 19 170
220 214 280 330 208 145 259 81 42 123 162 190 168 301 198 221 212 50
99]
```

```
*****
3SsnPorch: (Unique Count = 20)
```

```
[ 0 320 407 130 180 168 140 508 238 245 196 144 182 162 23 216 96 153
290 304]
```

```
*****
ScreenPorch: (Unique Count = 76)
```

```
[ 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]
```

```
*****
PoolArea: (Unique Count = 8)
```

```
[ 0 512 648 576 555 480 519 738]
```

```
*****
MiscVal: (Unique Count = 20)
```

```
[ 0 700 350 400 480 450 500 15500 800 2000 600 1300
1200 54 620 560 1400 8300 1150 2500]
```

```
*****
MoSold: (Unique Count = 12)
```

```
[ 2 5 9 12 10 8 11 4 1 7 3 6]
```

```
*****
YrSold: (Unique Count = 5)
```

```
[2008 2007 2006 2009 2010]
```

```
*****
SaleType: (Unique Count = 9)
```

```
['WD' 'New' 'COD' 'ConLI' 'CWD' 'ConLw' 'Con' 'ConLD' 'Oth']
```

```
*****
SaleCondition: (Unique Count = 6)
```

```
['Normal' 'Abnorml' 'Partial' 'Family' 'Alloca' 'AdjLand']
```

```
*****
SalePrice: (Unique Count = 620)
```

```
[208500 181500 223500 140000 250000 143000 307000 200000 129900 118000
129500 345000 144000 279500 157000 132000 149000 159000 139000 325300
139400 230000 154000 256300 134800 306000 207500 68500 40000 149350
179900 165500 277500 309000 145000 153000 109000 160000 170000 130250
141000 319900 239686 249700 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
193500 153500 245000 126500 168500 260000 174000 164500 98600 163500
133900 204750 214000 94750 83000 205000 178000 198900 169500 100000
115000 190000 136900 383970 217000 259500 176000 155000 320000 163990
136000 153900 181000 128000 150000 150750 220000 171000 231500 166000
204000 125000 105000 222500 122000 372402 235000 269500 254900 162500
412500 152000 325624 183500 228000 128500 215000 239000 163000 184000
243000 211000 501837 200100 475000 173000 135000 153337 286000 315000
192000 148500 311872 274900 171500 112000 143900 277000 186000 252678
156000 161750 134450 210000 107000 311500 167240 204900 97000 386250
290000 106000 192500 148000 403000 94500 128200 89500 185500 194500
318000 113000 262500 79000 120000 241500 137000 276000 151000 73000
175500 179500 120500 266000 124500 201000 415298 228500 244600 179200
164700 153575 233230 131000 167000 142500 175000 158500 267000 149900
295000 305900 82500 360000 165600 119900 375000 188500 270000 187500
342643 354000 301000 126175 242000 87000 324000 145250 214500 78000
119000 207000 228950 377426 202900 82000 85000 140200 151500 157500
437154 318061 95000 105900 177500 134000 280000 147000 165000 162000
172400 123000 340000 394432 179000 187750 213500 76000 240000 191000
426000 129000 67000 241000 245500 164990 108000 258000 168000 339750
60000 222000 181134 149500 126000 142000 206300 275000 109008 195400
85400 122500 212000 116000 90350 555000 162900 127500 199900 119500
188000 98000 256000 161000 263435 62383 188700 178740 146500 187000
440000 251000 132500 208900 380000 297000 89471 326000 374000 164000
86000 133000 172785 91300 430000 226700 289000 208300 164900 202665
96500 402861 265000 234000 184750 315750 446261 111250 272000 248000
213250 179665 229000 263000 112500 255500 284000 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 137500 183200 105500 314813 305000 165150 139900 124000
209500 93000 264561 274000 370878 143250 350000 88000 145500 97500
197900 402000 423000 230500 173500 103600 257500 109500 232500 159434
285000 227875 148800 392000 194700 755000 335000 108480 141500 89000
123500 138500 196000 312500 361919 213000 302000 254000 179540 109900
102776 189000 130500 159500 341000 103000 236500 131400 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 200500 66500 303477 132250
136500 328900 122900 154500 106500 611657 125500 255000 154300 173733
75000 35311 238000 176500 169990 193000 117500 79900 253000 239799
244400 150900 197500 172000 214900 178900 99500 167500 178400 336000
159895 255900 117000 395192 195000 197000 348000 173900 337500 121600
206000 232000 136905 119200 227000 203000 213490 194000 287000 293077
310000 119750 315500 262280 278000 556581 176485 200141 185850 81000
90000 110500 328000 167900 151400 91500 138800 155900 83500 252000
176432 274725 134500 184100 133700 118400 212900 163900 259000 239500
169000 424870 174500 116900 201800 218000 235128 108959 233170 245350
625000 171900 154900 392500 745000 186700 104900 262000 219210 116050
271900 229456 137900 367294 138887 265900 248328 186500 169900 171750
294000 165400 301500 128900 183900 378500 381000 185750 68400 150500
281000 107500 333168 206900 295493 111000 156500 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 287090 266500 142125 147500]

```

Numerical Features that are Categorical

```

In [ ]: categorical_numerical_features = []
for feature in categorical_numerical_features:
    numerical_features.remove(feature)
    categorical_features.append(feature)

```

```
print(f"Numerical features:\n {numerical_features}\n")
print(f"Categorical features:\n {categorical_features}")
```

Numerical features:
['MasVnrArea', 'GarageYrBlt']

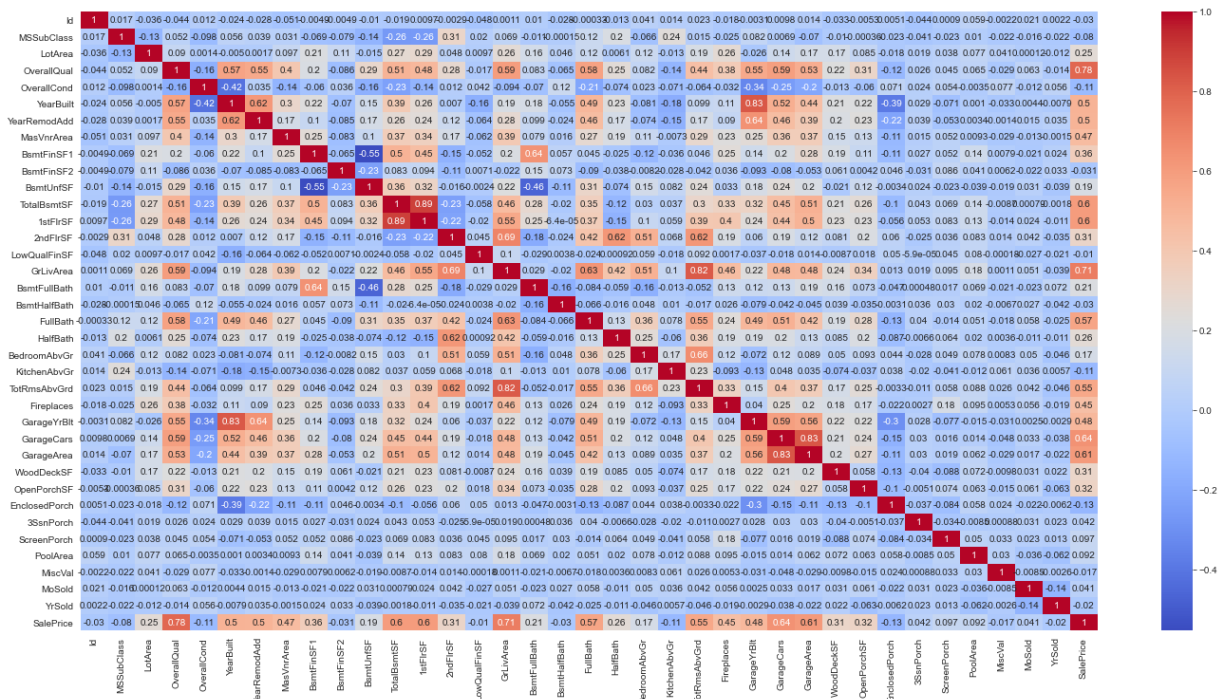
Categorical features

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

Exploratory Data Analysis (EDA)

```
In [ ]: plt.figure(figsize=(24,12))
sns.heatmap(data.corr(), cmap='coolwarm', annot=True)
```

Out[]: <AxesSubplot:>



checking correlation with sales price

```
In [ ]: data.corr()[data.corr()['SalePrice']>0][['SalePrice']].sort_values(by='SalePrice', as
```

Out[]:

	SalePrice
SalePrice	1.000000
OverallQual	0.783546
GrLivArea	0.711706

	SalePrice
GarageCars	0.640154
GarageArea	0.607535
1stFlrSF	0.604714
TotalBsmtSF	0.602042
FullBath	0.569313
TotRmsAbvGrd	0.551821
YearBuilt	0.504297
YearRemodAdd	0.501435
GarageYrBlt	0.481730
MasVnrArea	0.465811
Fireplaces	0.445434
BsmtFinSF1	0.359677
OpenPorchSF	0.322786
2ndFlrSF	0.311354
WoodDeckSF	0.305983
HalfBath	0.258175
LotArea	0.254757
BsmtFullBath	0.209695
BsmtUnfSF	0.191689
BedroomAbvGr	0.169266
ScreenPorch	0.096624
PoolArea	0.091881
3SsnPorch	0.042159
MoSold	0.041310

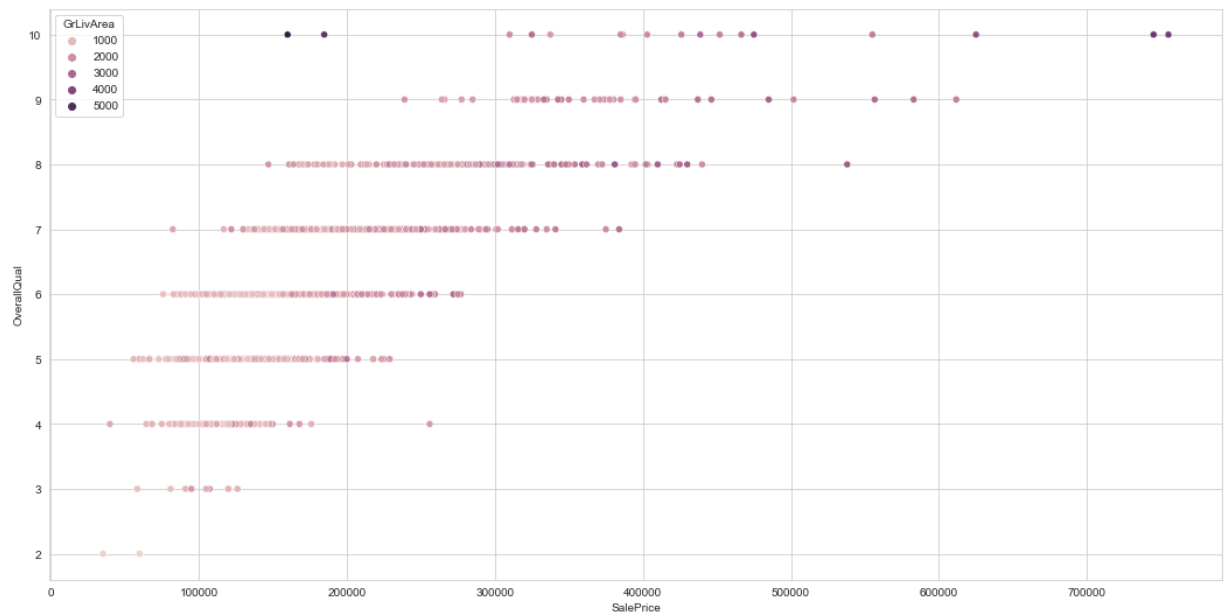
Plotting Relationships between sales price and different features

In []:

```
plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='OverallQual',hue='GrLivArea')
```

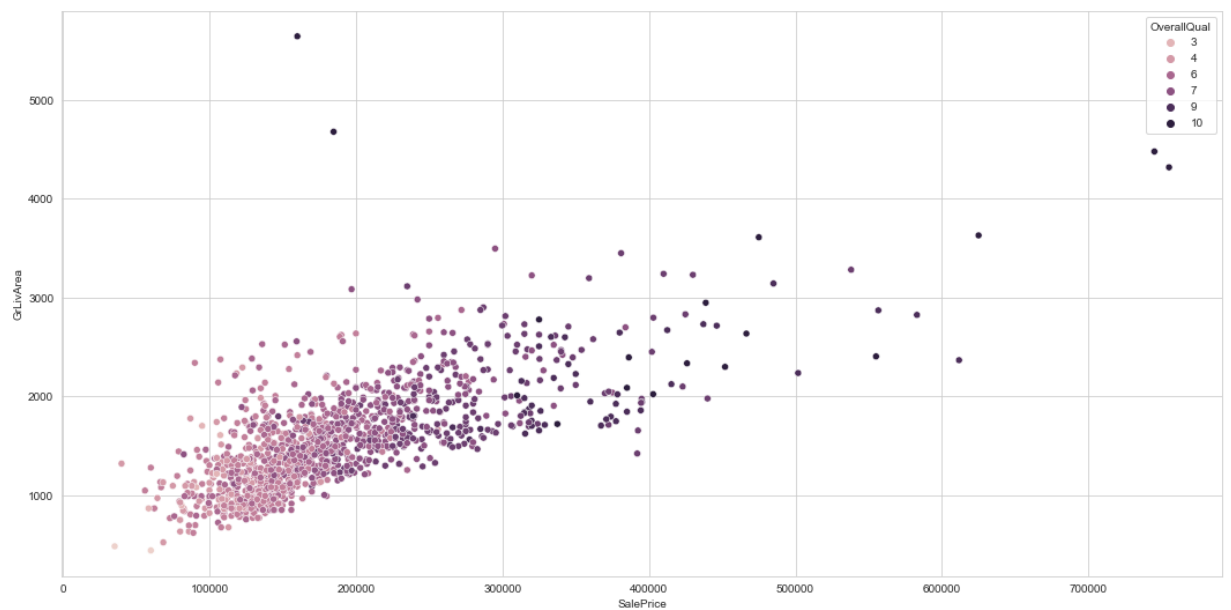
Out[]:

```
<AxesSubplot:xlabel='SalePrice', ylabel='OverallQual'>
```



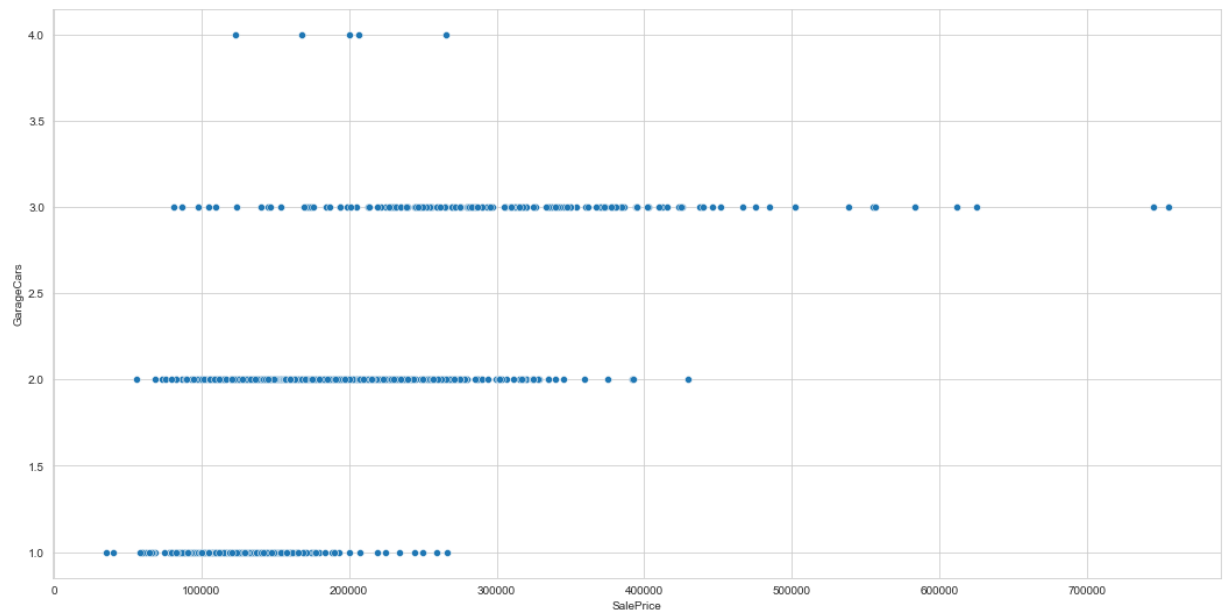
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='GrLivArea',hue='OverallQual')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='GrLivArea'>
```



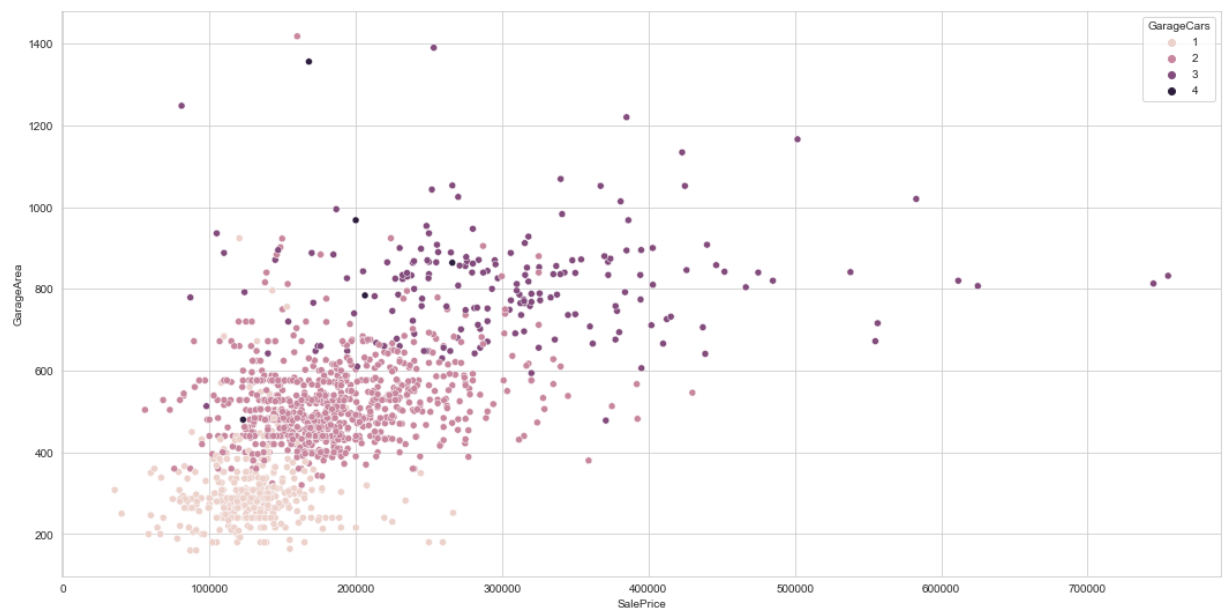
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='GarageCars'>
```



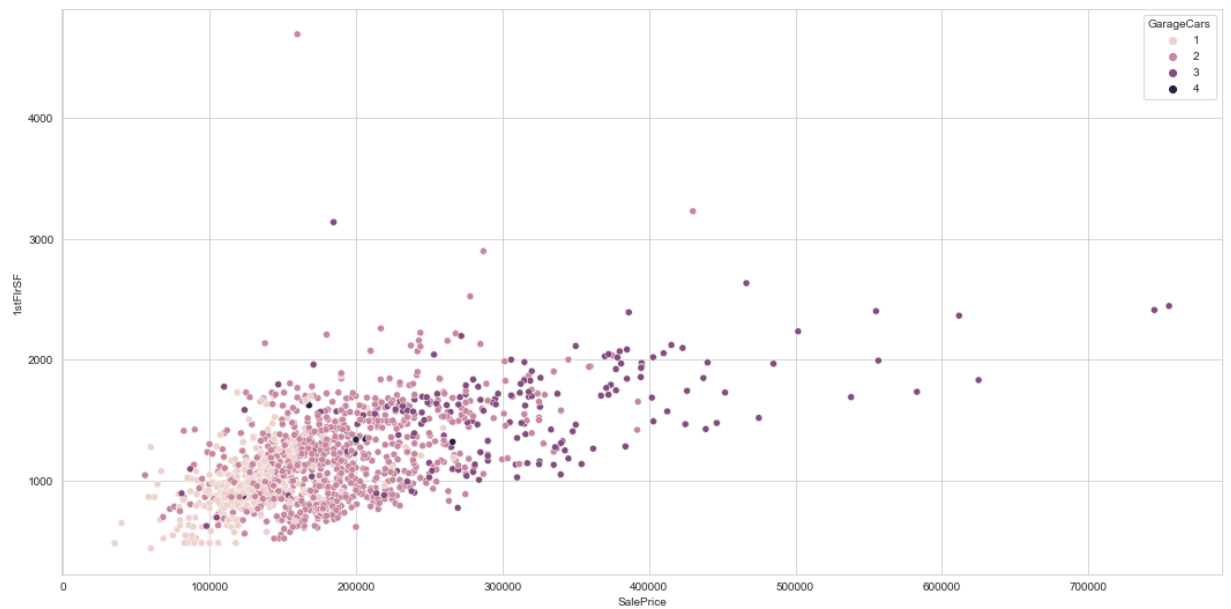
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='GarageArea',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='GarageArea'>
```



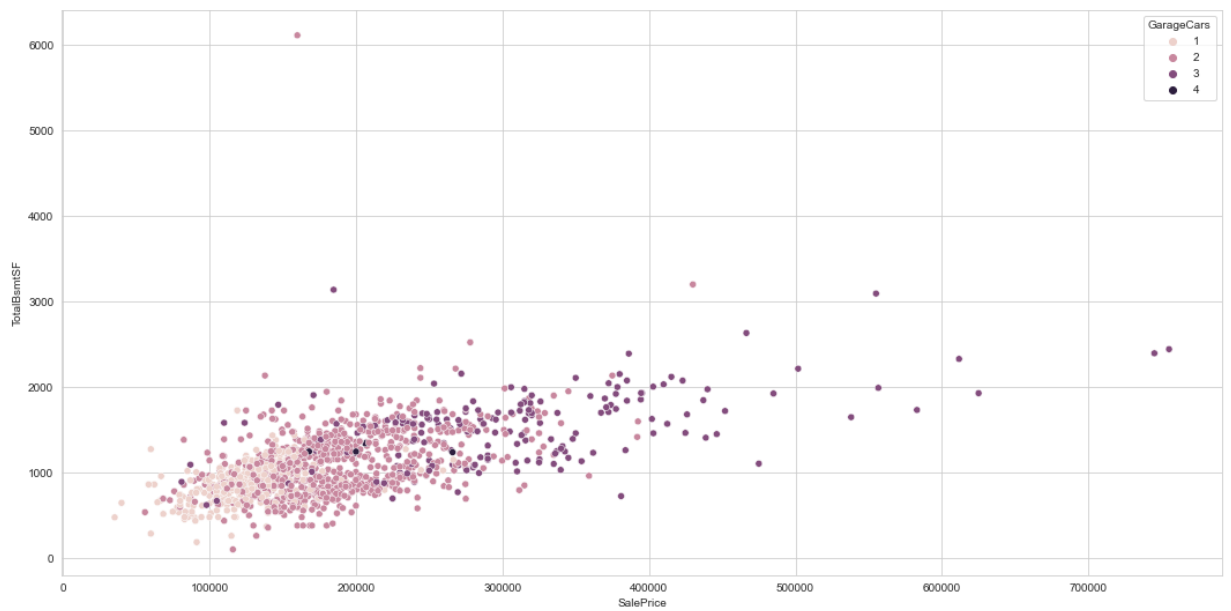
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='1stFlrSF',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='1stFlrSF'>
```



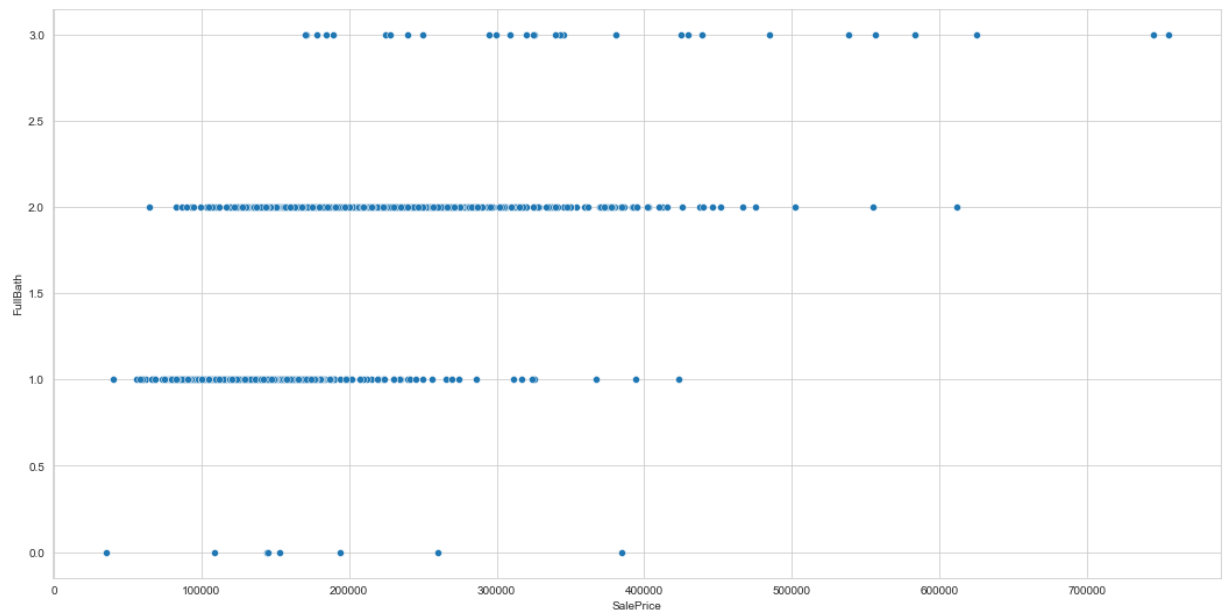
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='TotalBsmtSF',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='TotalBsmtSF'>
```



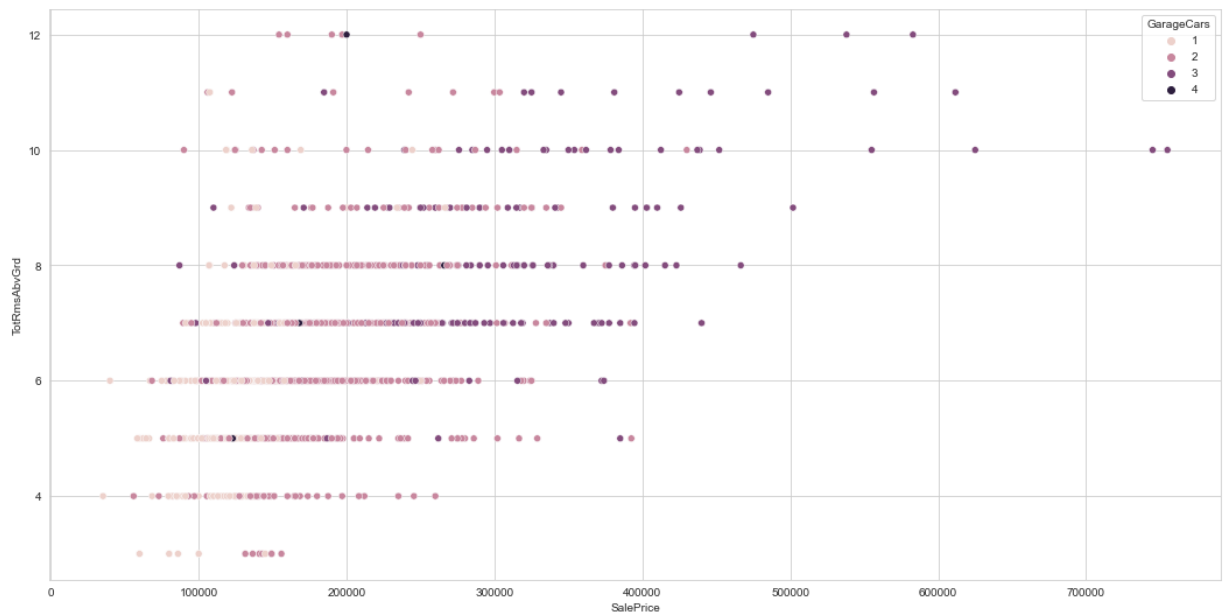
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='FullBath')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='FullBath'>
```

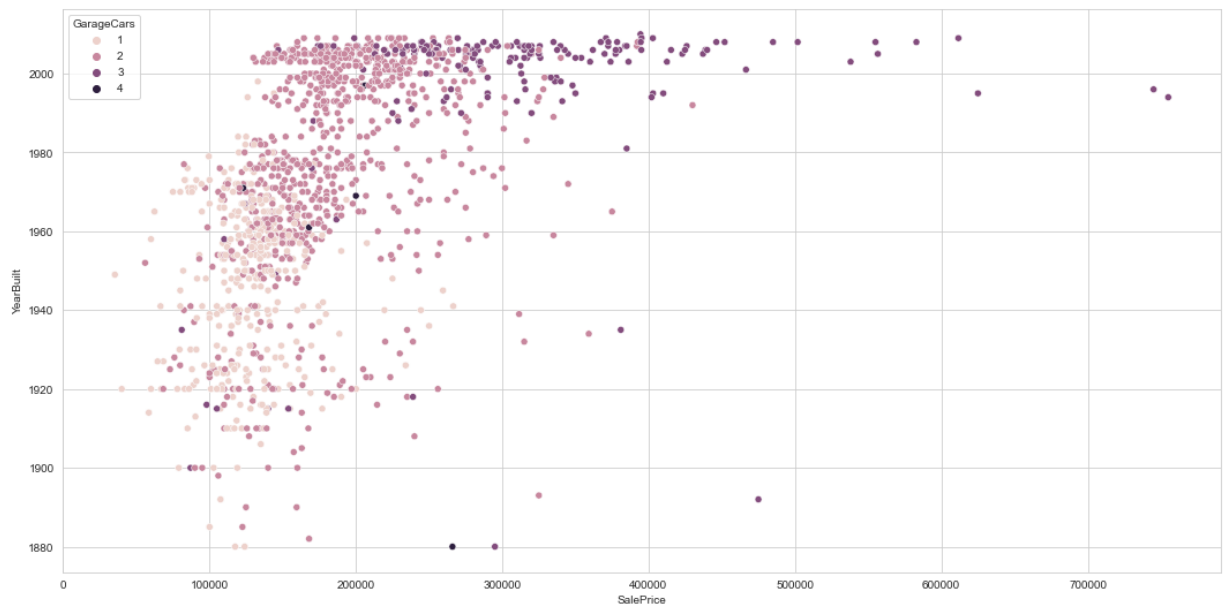
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='TotRmsAbvGrd',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='TotRmsAbvGrd'>
```



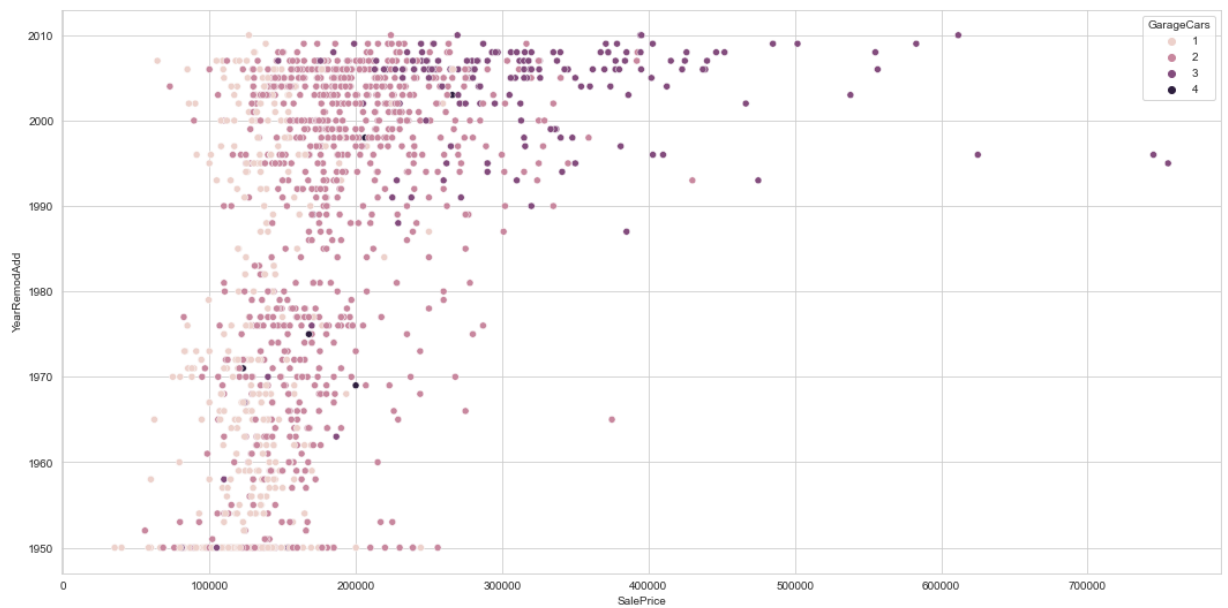
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='YearBuilt',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='YearBuilt'>
```



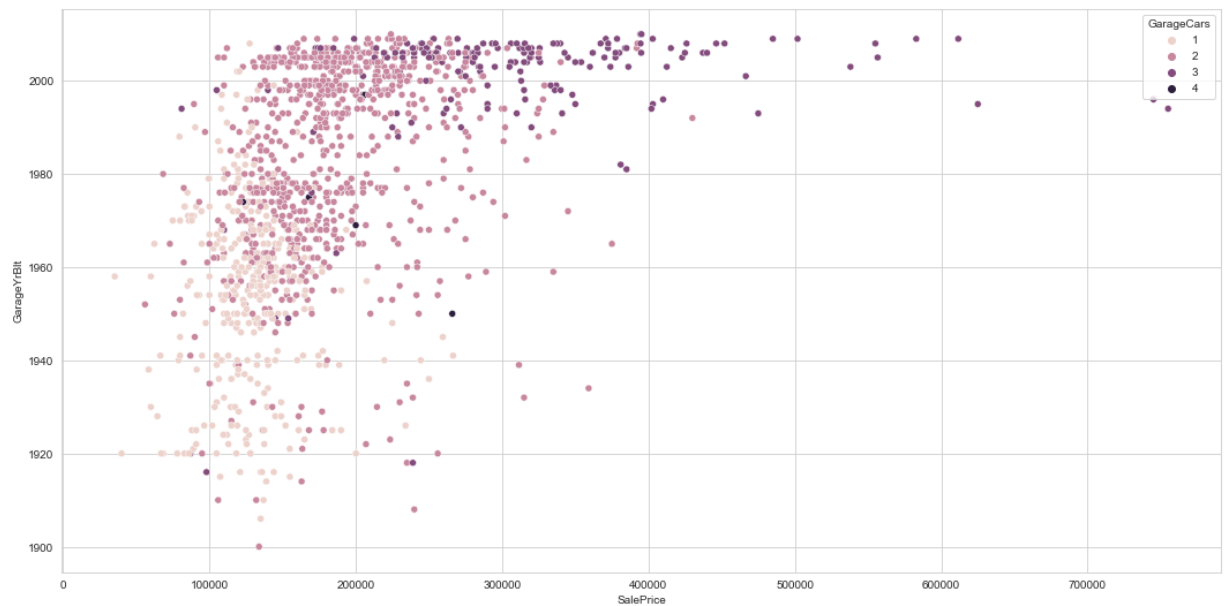
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='YearRemodAdd',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='YearRemodAdd'>
```



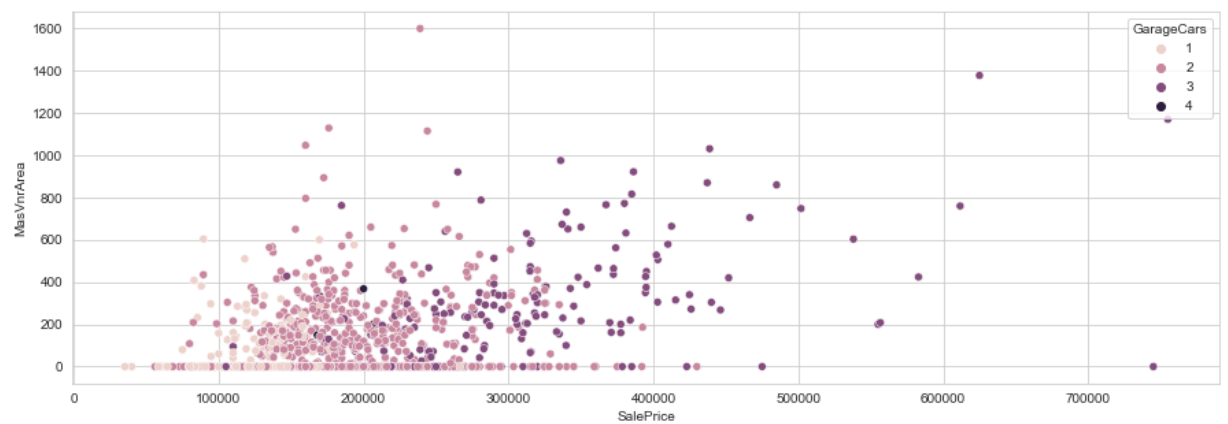
```
In [ ]: plt.figure(figsize=(18,9))
sns.scatterplot(data=data,x='SalePrice',y='GarageYrBlt',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='GarageYrBlt'>
```



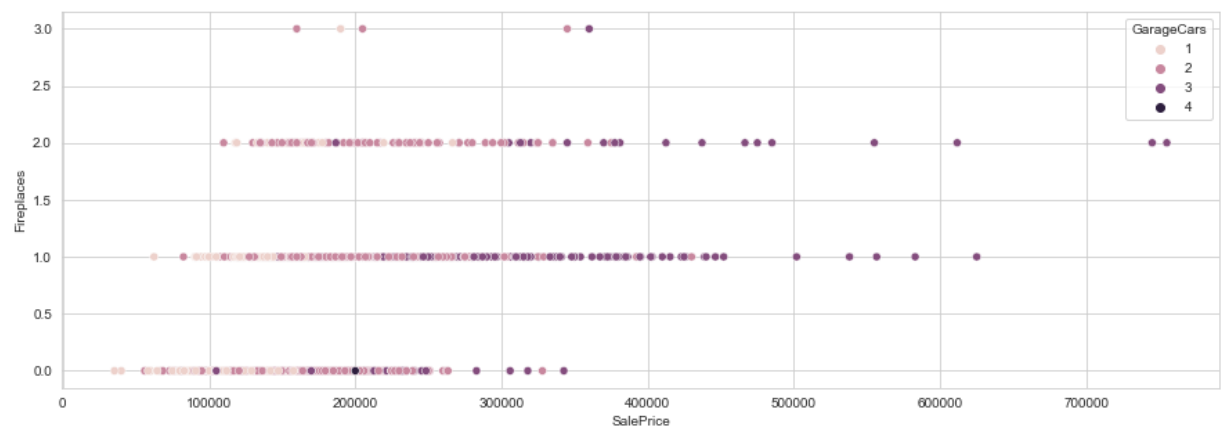
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='MasVnrArea',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='MasVnrArea'>
```



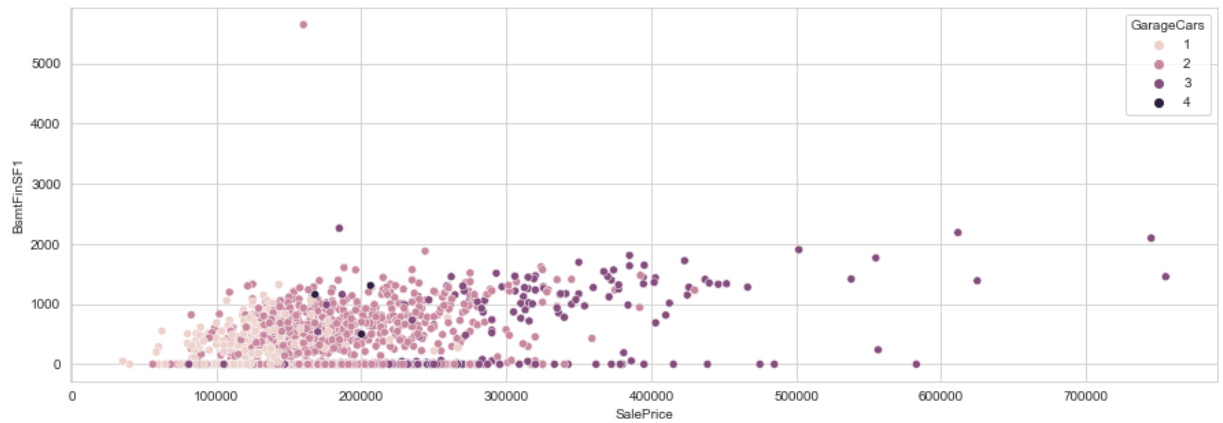
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='Fireplaces',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='Fireplaces'>
```



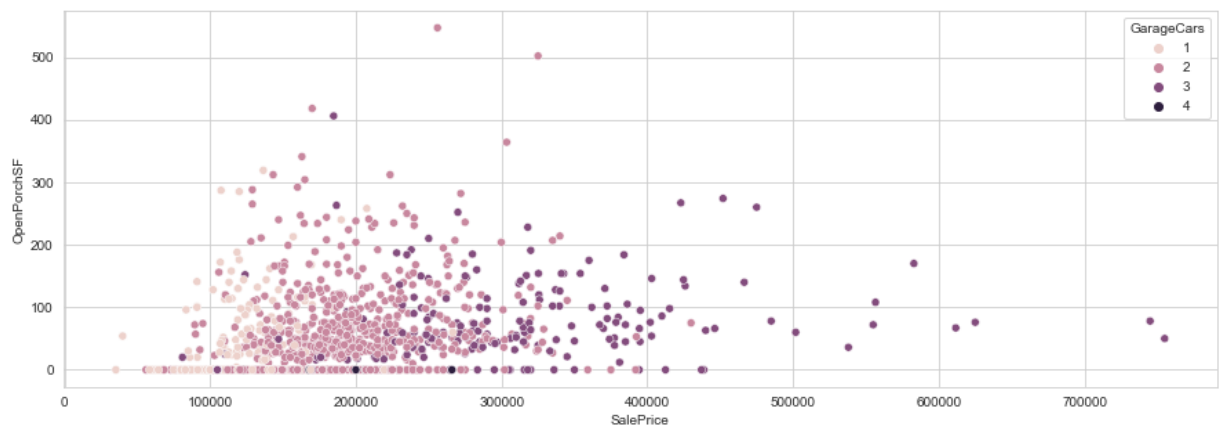
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='BsmtFinSF1',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='BsmtFinSF1'>
```



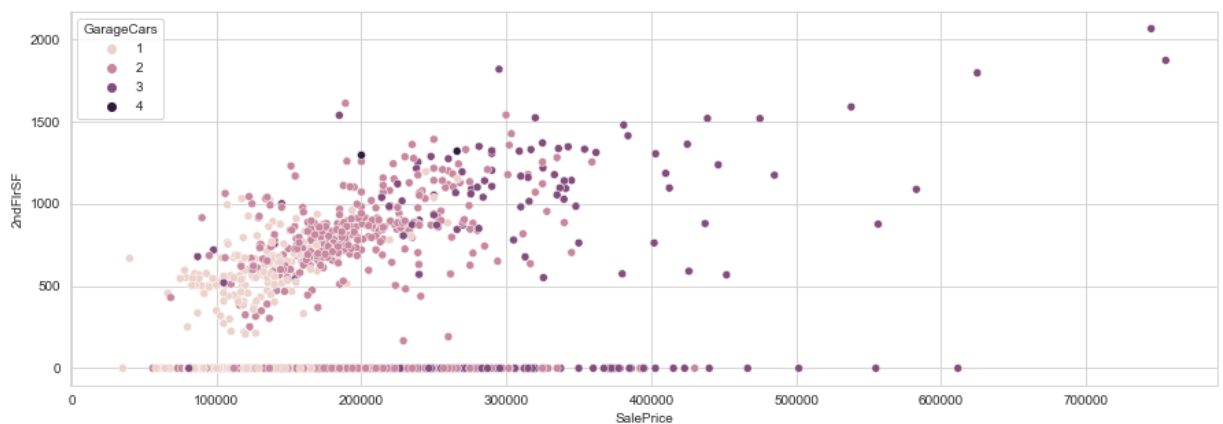
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='OpenPorchSF',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='OpenPorchSF'>
```



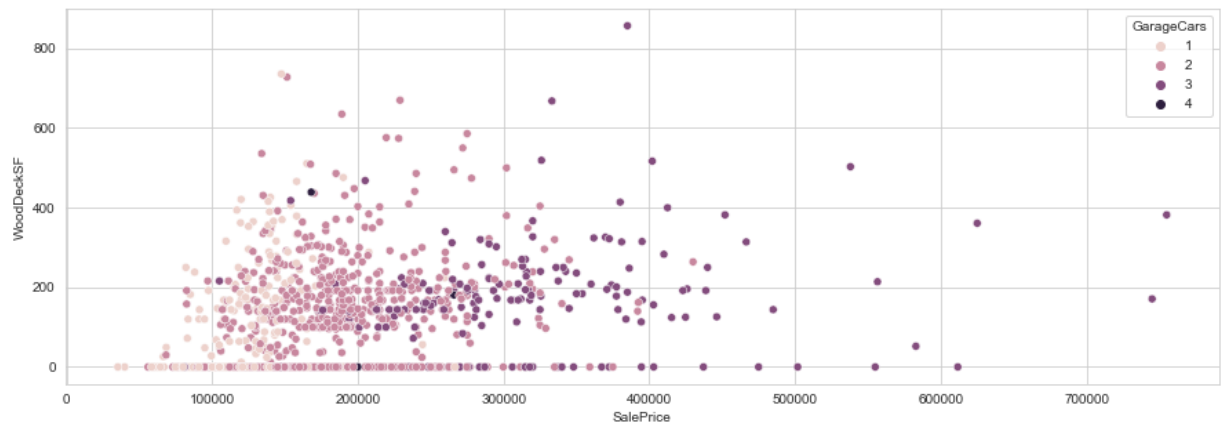
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='2ndFlrSF',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='2ndFlrSF'>
```



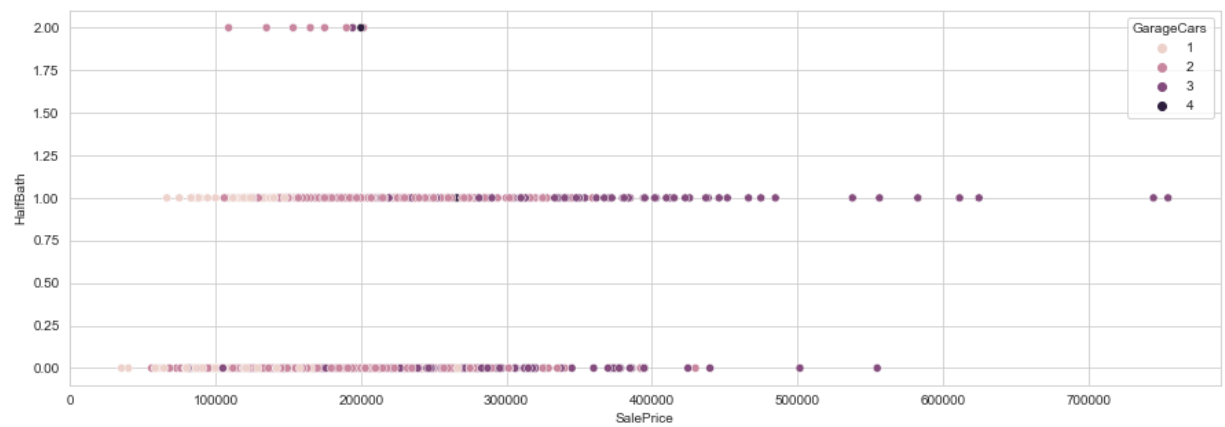
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='WoodDeckSF',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='WoodDeckSF'>
```



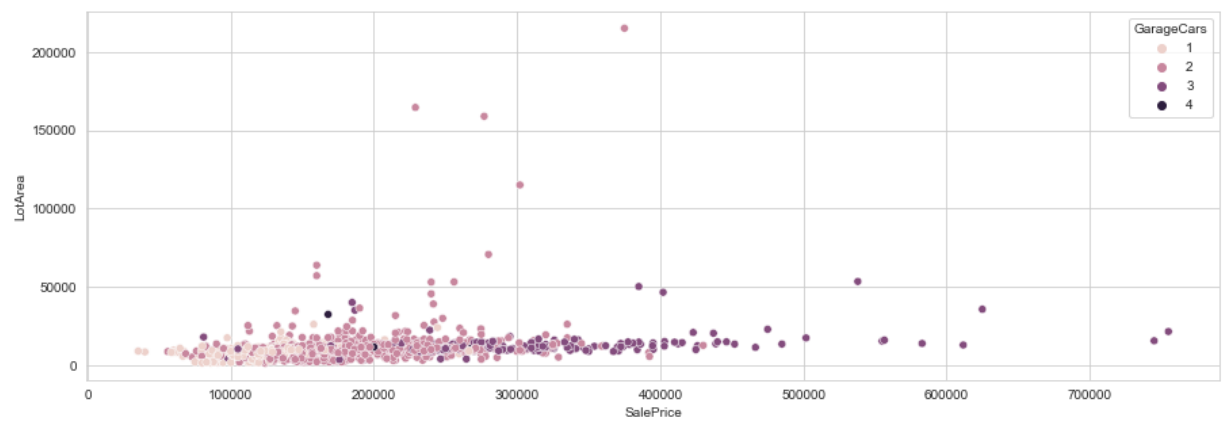
```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='HalfBath',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='HalfBath'>
```



```
In [ ]: plt.figure(figsize=(15,5))
sns.scatterplot(data=data,x='SalePrice',y='LotArea',hue='GarageCars')
```

```
Out[ ]: <AxesSubplot:xlabel='SalePrice', ylabel='LotArea'>
```



Modeling

```
In [ ]: data = data[numerical_features]
```

Splitting Training & Test Data

```
In [ ]: X = data.drop(['Id', 'SalePrice'], axis=1)
        y = data['SalePrice']
        X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_stat
```

Generating the Linear Regression Model

```
In [ ]: lm = LinearRegression()
```

```
In [ ]: lm.fit(X_train, y_train)
```

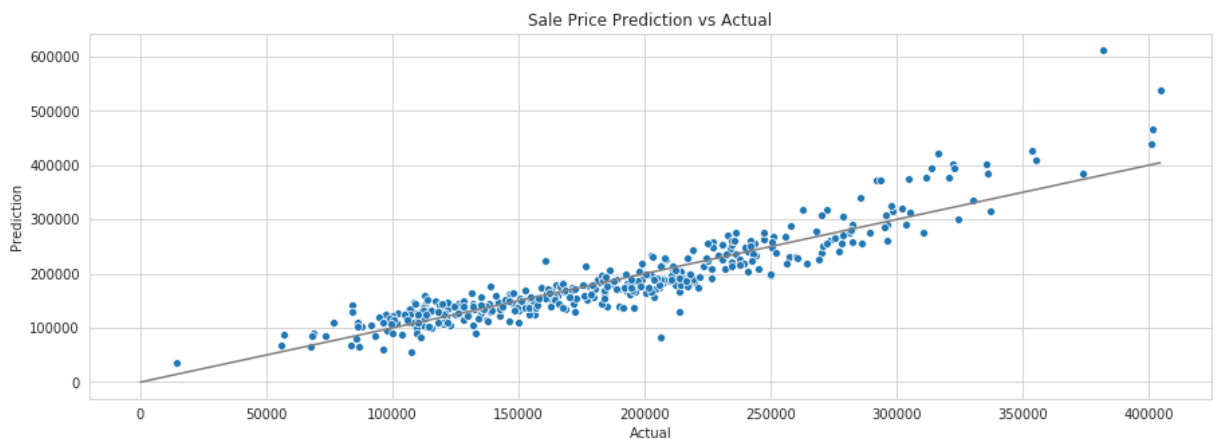
```
Out[ ]: LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

Model Evaluation

```
In [ ]: prediction = lm.predict(X_test)
```

```
In [ ]: plt.figure(figsize=(15,5))
        sns.scatterplot(prediction, y_test)
        sns.lineplot(x=np.linspace(0, max(prediction), 100), y=np.linspace(0, max(prediction), 100))
        plt.title('Sale Price Prediction vs Actual')
        plt.ylabel('Prediction')
        plt.xlabel('Actual')
```

```
Out[ ]: Text(0.5, 0, 'Actual')
```



```
In [ ]: print(f"MAE: {metrics.mean_absolute_error(y_test, prediction):.4f}")
        print(f"MSE: {metrics.mean_squared_error(y_test, prediction):.4f}")
        print(f"RMSE: {np.sqrt(metrics.mean_squared_error(y_test, prediction)):.4f}")
        print(f"Explained Variance Score: {metrics.explained_variance_score(y_test, predictio
```

```
MAE: 20931.1787
MSE: 873688275.8611
RMSE: 29558.2184
Explained Variance Score: 0.8493
```