Quiz Notebook-Finished

January 18, 2022

0.1 Data Analysis Exercise

The objective of this notebook to gain an understanding of what your skill set looks like. You are free to use whichever libraries you need for this exercise. Please be sure to make comments where necessary and use the quickest and cleanest methods you know.

0.1.1 Task:

You will have to download the train.csv dataset onto your local machine from the following link https://www.kaggle.com/c/house-prices-advanced-regression-techniques/data and make an account on kaggle if you do not already. You will be using this dataset to answer all of the following questions. Make sure your graphs are clean and readable with titles.

[1]:
```
import pandas as pd
boston = pd.read_csv('train.csv')
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
from scipy.stats import norm
import statistics
```

0.1.2 Familiarize yourself with the data

- how many rows
- how many columns

[2]:
```
pd.set_option('display.max_columns', None)
boston
```

[2]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	\
0	1	60	RL	65.0	8450	Pave	NaN	Reg	
1	2	20	RL	80.0	9600	Pave	NaN	Reg	
2	3	60	RL	68.0	11250	Pave	NaN	IR1	
3	4	70	RL	60.0	9550	Pave	NaN	IR1	
4	5	60	RL	84.0	14260	Pave	NaN	IR1	
…	…	…	…	…	…	…	…	…	
1455	1456	60	RL	62.0	7917	Pave	NaN	Reg	
1456	1457	20	RL	85.0	13175	Pave	NaN	Reg	

```
1457  1458          70       RL         66.0     9042   Pave   NaN      Reg
1458  1459          20       RL         68.0     9717   Pave   NaN      Reg
1459  1460          20       RL         75.0     9937   Pave   NaN      Reg

     LandContour Utilities LotConfig LandSlope Neighborhood Condition1  \
0            Lvl    AllPub    Inside       Gtl      CollgCr       Norm
1            Lvl    AllPub       FR2       Gtl      Veenker      Feedr
2            Lvl    AllPub    Inside       Gtl      CollgCr       Norm
3            Lvl    AllPub    Corner       Gtl      Crawfor       Norm
4            Lvl    AllPub       FR2       Gtl      NoRidge       Norm
…            …        …         …          …          …           …
1455         Lvl    AllPub    Inside       Gtl      Gilbert       Norm
1456         Lvl    AllPub    Inside       Gtl       NWAmes       Norm
1457         Lvl    AllPub    Inside       Gtl      Crawfor       Norm
1458         Lvl    AllPub    Inside       Gtl        NAmes       Norm
1459         Lvl    AllPub    Inside       Gtl      Edwards       Norm

     Condition2 BldgType HouseStyle  OverallQual  OverallCond  YearBuilt  \
0          Norm     1Fam     2Story            7            5       2003
1          Norm     1Fam     1Story            6            8       1976
2          Norm     1Fam     2Story            7            5       2001
3          Norm     1Fam     2Story            7            5       1915
4          Norm     1Fam     2Story            8            5       2000
…          …        …        …           …            …           …
1455       Norm     1Fam     2Story            6            5       1999
1456       Norm     1Fam     1Story            6            6       1978
1457       Norm     1Fam     2Story            7            9       1941
1458       Norm     1Fam     1Story            5            6       1950
1459       Norm     1Fam     1Story            5            6       1965

      YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType  \
0             2003     Gable  CompShg     VinylSd     VinylSd    BrkFace
1             1976     Gable  CompShg     MetalSd     MetalSd       None
2             2002     Gable  CompShg     VinylSd     VinylSd    BrkFace
3             1970     Gable  CompShg     Wd Sdng     Wd Shng       None
4             2000     Gable  CompShg     VinylSd     VinylSd    BrkFace
…             …        …      …           …           …          …
1455          2000     Gable  CompShg     VinylSd     VinylSd       None
1456          1988     Gable  CompShg     Plywood     Plywood      Stone
1457          2006     Gable  CompShg     CemntBd     CmentBd       None
1458          1996       Hip  CompShg     MetalSd     MetalSd       None
1459          1965     Gable  CompShg     HdBoard     HdBoard       None

      MasVnrArea ExterQual ExterCond Foundation BsmtQual BsmtCond  \
0          196.0        Gd        TA      PConc       Gd       TA
1            0.0        TA        TA     CBlock       Gd       TA
2          162.0        Gd        TA      PConc       Gd       TA
```

```
3            0.0        TA        TA     BrkTil       TA       Gd
4          350.0        Gd        TA      PConc       Gd       TA
…           …       …        …         …      …      …
1455         0.0        TA        TA      PConc       Gd       TA
1456       119.0        TA        TA     CBlock       Gd       TA
1457         0.0        Ex        Gd      Stone       TA       Gd
1458         0.0        TA        TA     CBlock       TA       TA
1459         0.0        Gd        TA     CBlock       TA       TA

     BsmtExposure BsmtFinType1  BsmtFinSF1 BsmtFinType2  BsmtFinSF2  \
0              No          GLQ         706          Unf           0
1              Gd          ALQ         978          Unf           0
2              Mn          GLQ         486          Unf           0
3              No          ALQ         216          Unf           0
4              Av          GLQ         655          Unf           0
…           …           …          …           …         …
1455           No          Unf           0          Unf           0
1456           No          ALQ         790          Rec         163
1457           No          GLQ         275          Unf           0
1458           Mn          GLQ          49          Rec        1029
1459           No          BLQ         830          LwQ         290

      BsmtUnfSF  TotalBsmtSF Heating HeatingQC CentralAir Electrical  \
0           150          856    GasA        Ex          Y      SBrkr
1           284         1262    GasA        Ex          Y      SBrkr
2           434          920    GasA        Ex          Y      SBrkr
3           540          756    GasA        Gd          Y      SBrkr
4           490         1145    GasA        Ex          Y      SBrkr
…         …           …     …       …        …         …
1455        953          953    GasA        Ex          Y      SBrkr
1456        589         1542    GasA        TA          Y      SBrkr
1457        877         1152    GasA        Ex          Y      SBrkr
1458          0         1078    GasA        Gd          Y      FuseA
1459        136         1256    GasA        Gd          Y      SBrkr

      1stFlrSF  2ndFlrSF  LowQualFinSF  GrLivArea  BsmtFullBath  BsmtHalfBath  \
0          856       854             0       1710             1             0
1         1262         0             0       1262             0             1
2          920       866             0       1786             1             0
3          961       756             0       1717             1             0
4         1145      1053             0       2198             1             0
…         …       …            …         …           …            …
1455       953       694             0       1647             0             0
1456      2073         0             0       2073             1             0
1457      1188      1152             0       2340             0             0
1458      1078         0             0       1078             1             0
1459      1256         0             0       1256             1             0
```

```
      FullBath  HalfBath  BedroomAbvGr  KitchenAbvGr KitchenQual  \
0            2         1             3             1          Gd
1            2         0             3             1          TA
2            2         1             3             1          Gd
3            1         0             3             1          Gd
4            2         1             4             1          Gd
…          …         …             …             …          …
1455         2         1             3             1          TA
1456         2         0             3             1          TA
1457         2         0             4             1          Gd
1458         1         0             2             1          Gd
1459         1         1             3             1          TA

      TotRmsAbvGrd Functional  Fireplaces FireplaceQu GarageType  GarageYrBlt  \
0                8        Typ           0         NaN     Attchd       2003.0
1                6        Typ           1          TA     Attchd       1976.0
2                6        Typ           1          TA     Attchd       2001.0
3                7        Typ           1          Gd     Detchd       1998.0
4                9        Typ           1          TA     Attchd       2000.0
…              …          …           …          …         …          …
1455             7        Typ           1          TA     Attchd       1999.0
1456             7       Min1           2          TA     Attchd       1978.0
1457             9        Typ           2          Gd     Attchd       1941.0
1458             5        Typ           0         NaN     Attchd       1950.0
1459             6        Typ           0         NaN     Attchd       1965.0

     GarageFinish  GarageCars  GarageArea GarageQual GarageCond PavedDrive  \
0             RFn           2         548         TA         TA          Y
1             RFn           2         460         TA         TA          Y
2             RFn           2         608         TA         TA          Y
3             Unf           3         642         TA         TA          Y
4             RFn           3         836         TA         TA          Y
…           …           …         …         …         …         …
1455          RFn           2         460         TA         TA          Y
1456          Unf           2         500         TA         TA          Y
1457          RFn           1         252         TA         TA          Y
1458          Unf           1         240         TA         TA          Y
1459          Fin           1         276         TA         TA          Y

      WoodDeckSF  OpenPorchSF  EnclosedPorch  3SsnPorch  ScreenPorch  \
0              0           61              0          0            0
1            298            0              0          0            0
2              0           42              0          0            0
3              0           35            272          0            0
4            192           84              0          0            0
…          …           …             …          …          …
```

```
1455           0           40              0         0            0
1456         349            0              0         0            0
1457           0           60              0         0            0
1458         366            0            112         0            0
1459         736           68              0         0            0

      PoolArea PoolQC  Fence MiscFeature  MiscVal  MoSold  YrSold SaleType  \
0            0    NaN    NaN         NaN        0       2    2008       WD
1            0    NaN    NaN         NaN        0       5    2007       WD
2            0    NaN    NaN         NaN        0       9    2008       WD
3            0    NaN    NaN         NaN        0       2    2006       WD
4            0    NaN    NaN         NaN        0      12    2008       WD
…          …    …    …          …       …     …      …
1455         0    NaN    NaN         NaN        0       8    2007       WD
1456         0    NaN  MnPrv         NaN        0       2    2010       WD
1457         0    NaN  GdPrv        Shed     2500       5    2010       WD
1458         0    NaN    NaN         NaN        0       4    2010       WD
1459         0    NaN    NaN         NaN        0       6    2008       WD

     SaleCondition  SalePrice
0           Normal     208500
1           Normal     181500
2           Normal     223500
3          Abnorml     140000
4           Normal     250000
…             …        …
1455        Normal     175000
1456        Normal     210000
1457        Normal     266500
1458        Normal     142125
1459        Normal     147500

[1460 rows x 81 columns]
```

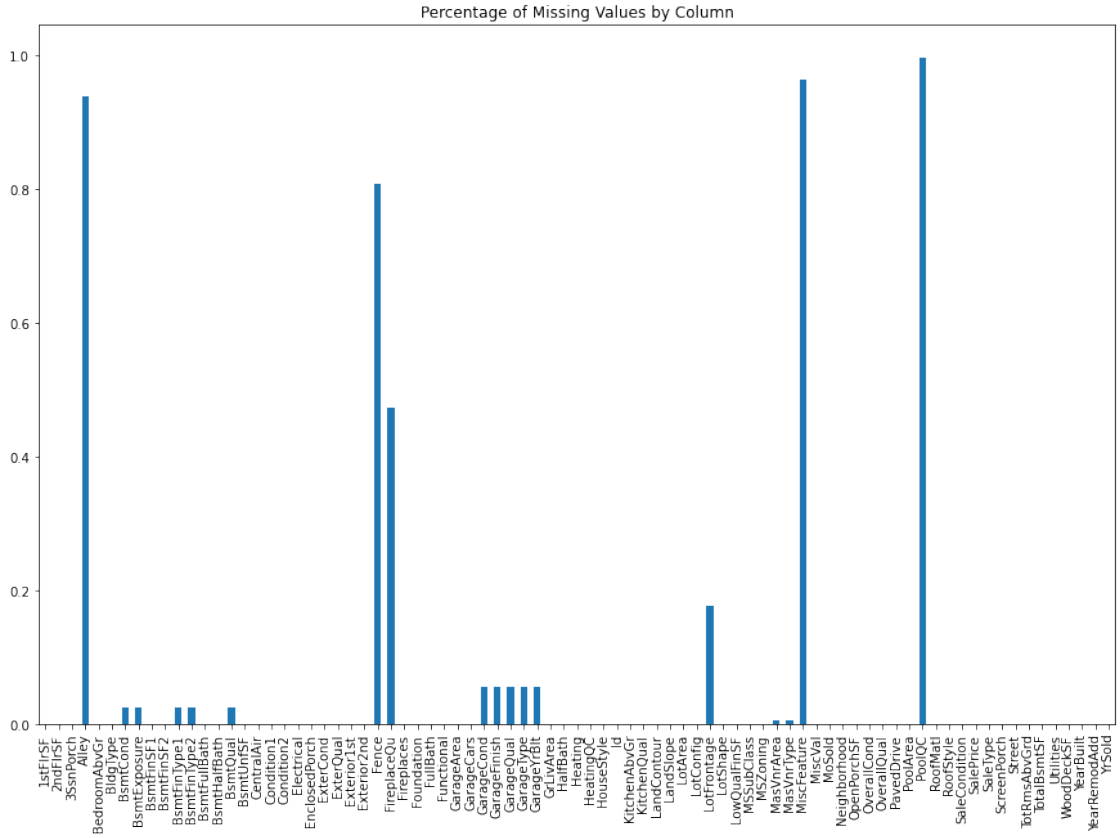
[3]:
```
# The data set contains 1460 rows and 81 columns.
```

0.1.3 Inspect missing values and deal with missing values

- Graph the percentage of missing values
- Come up with 2 reasons why data might be missing for MiscFeature: Miscellaneous feature
- For every field with missing values, create a duplicate boolean field and graph the mean and
- Drop columns with greater than 30% of missing values

[4]:
```
boston_missing_percentage = boston.isnull().sum()/boston.isnull().count().
↪sort_values(ascending = False)
boston_missing_percentage.plot(kind = 'bar', figsize = (15,10), title =␣
↪'Percentage of Missing Values by Column')
```

[4]: <AxesSubplot:title={'center':'Percentage of Missing Values by Column'}>



[5]:
```
# There could simply be no homes with any Miscellaneous Features.
# Miscellaneous Features may be a combination of unique values in which no␣
 ↪homes fall under.
```

[6]:
```
boston['Alley_2'] = boston['Alley'].isnull()
boston['BsmtCond_2'] = boston['BsmtCond'].isnull()
boston['BsmtExposure_2'] = boston['BsmtExposure'].isnull()
boston['BsmtFinType1_2'] = boston['BsmtFinType1'].isnull()
boston['BsmtFintype2_2'] = boston['BsmtFinType2'].isnull()
boston['BsmtQual_2'] = boston['BsmtQual'].isnull()
boston['FireplaceQU_2'] = boston['FireplaceQu'].isnull()
boston['Fence_2'] = boston['Fence'].isnull()
boston['GarageCond_2'] = boston['GarageCond'].isnull()
boston['GarageFinish_2'] = boston['GarageFinish'].isnull()
boston['GarageQual_2'] = boston['GarageQual'].isnull()
boston['GarageType_2'] = boston['GarageType'].isnull()
boston['GargeYrBlt_2'] = boston['GarageYrBlt'].isnull()
boston['LotFrontage_2'] = boston['LotFrontage'].isnull()
```

```
boston['MasVnrArea_2'] = boston['MasVnrArea'].isnull()
boston['MasVnrType_2'] = boston['MasVnrType'].isnull()
boston['MiscFeature_2'] = boston['MiscFeature'].isnull()
boston['PoolQC_2'] = boston['PoolQC'].isnull()
boston
```

[6]:

```
         Id  MSSubClass MSZoning  LotFrontage  LotArea Street Alley LotShape  \
0         1          60       RL         65.0     8450   Pave   NaN      Reg
1         2          20       RL         80.0     9600   Pave   NaN      Reg
2         3          60       RL         68.0    11250   Pave   NaN      IR1
3         4          70       RL         60.0     9550   Pave   NaN      IR1
4         5          60       RL         84.0    14260   Pave   NaN      IR1
…       …          …       …           …       …    …      …       …
1455   1456          60       RL         62.0     7917   Pave   NaN      Reg
1456   1457          20       RL         85.0    13175   Pave   NaN      Reg
1457   1458          70       RL         66.0     9042   Pave   NaN      Reg
1458   1459          20       RL         68.0     9717   Pave   NaN      Reg
1459   1460          20       RL         75.0     9937   Pave   NaN      Reg

     LandContour Utilities LotConfig LandSlope Neighborhood Condition1  \
0            Lvl    AllPub    Inside       Gtl      CollgCr       Norm
1            Lvl    AllPub       FR2       Gtl      Veenker      Feedr
2            Lvl    AllPub    Inside       Gtl      CollgCr       Norm
3            Lvl    AllPub    Corner       Gtl      Crawfor       Norm
4            Lvl    AllPub       FR2       Gtl      NoRidge       Norm
…          …       …       …          …          …       …
1455         Lvl    AllPub    Inside       Gtl      Gilbert       Norm
1456         Lvl    AllPub    Inside       Gtl       NWAmes       Norm
1457         Lvl    AllPub    Inside       Gtl      Crawfor       Norm
1458         Lvl    AllPub    Inside       Gtl        NAmes       Norm
1459         Lvl    AllPub    Inside       Gtl      Edwards       Norm

     Condition2 BldgType HouseStyle  OverallQual  OverallCond  YearBuilt  \
0          Norm     1Fam     2Story            7            5       2003
1          Norm     1Fam     1Story            6            8       1976
2          Norm     1Fam     2Story            7            5       2001
3          Norm     1Fam     2Story            7            5       1915
4          Norm     1Fam     2Story            8            5       2000
…         …       …         …           …            …       …
1455       Norm     1Fam     2Story            6            5       1999
1456       Norm     1Fam     1Story            6            6       1978
1457       Norm     1Fam     2Story            7            9       1941
1458       Norm     1Fam     1Story            5            6       1950
1459       Norm     1Fam     1Story            5            6       1965

      YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType  \
0             2003     Gable  CompShg     VinylSd     VinylSd    BrkFace
```

```
1             1976     Gable  CompShg     MetalSd     MetalSd       None
2             2002     Gable  CompShg     VinylSd     VinylSd    BrkFace
3             1970     Gable  CompShg     Wd Sdng     Wd Shng       None
4             2000     Gable  CompShg     VinylSd     VinylSd    BrkFace
…              …        …       …          …           …          …
1455          2000     Gable  CompShg     VinylSd     VinylSd       None
1456          1988     Gable  CompShg     Plywood     Plywood      Stone
1457          2006     Gable  CompShg     CemntBd     CmentBd       None
1458          1996       Hip  CompShg     MetalSd     MetalSd       None
1459          1965     Gable  CompShg     HdBoard     HdBoard       None

      MasVnrArea ExterQual ExterCond Foundation BsmtQual BsmtCond  \
0          196.0        Gd        TA      PConc       Gd       TA
1            0.0        TA        TA     CBlock       Gd       TA
2          162.0        Gd        TA      PConc       Gd       TA
3            0.0        TA        TA     BrkTil       TA       Gd
4          350.0        Gd        TA      PConc       Gd       TA
…           …         …         …         …        …       …
1455         0.0        TA        TA      PConc       Gd       TA
1456       119.0        TA        TA     CBlock       Gd       TA
1457         0.0        Ex        Gd      Stone       TA       Gd
1458         0.0        TA        TA     CBlock       TA       TA
1459         0.0        Gd        TA     CBlock       TA       TA

     BsmtExposure BsmtFinType1  BsmtFinSF1 BsmtFinType2  BsmtFinSF2  \
0              No          GLQ         706          Unf           0
1              Gd          ALQ         978          Unf           0
2              Mn          GLQ         486          Unf           0
3              No          ALQ         216          Unf           0
4              Av          GLQ         655          Unf           0
…             …           …          …           …          …
1455           No          Unf           0          Unf           0
1456           No          ALQ         790          Rec         163
1457           No          GLQ         275          Unf           0
1458           Mn          GLQ          49          Rec        1029
1459           No          BLQ         830          LwQ         290

      BsmtUnfSF  TotalBsmtSF Heating HeatingQC CentralAir Electrical  \
0           150          856    GasA        Ex          Y      SBrkr
1           284         1262    GasA        Ex          Y      SBrkr
2           434          920    GasA        Ex          Y      SBrkr
3           540          756    GasA        Gd          Y      SBrkr
4           490         1145    GasA        Ex          Y      SBrkr
…          …           …      …          …           …         …
1455        953          953    GasA        Ex          Y      SBrkr
1456        589         1542    GasA        TA          Y      SBrkr
1457        877         1152    GasA        Ex          Y      SBrkr
```

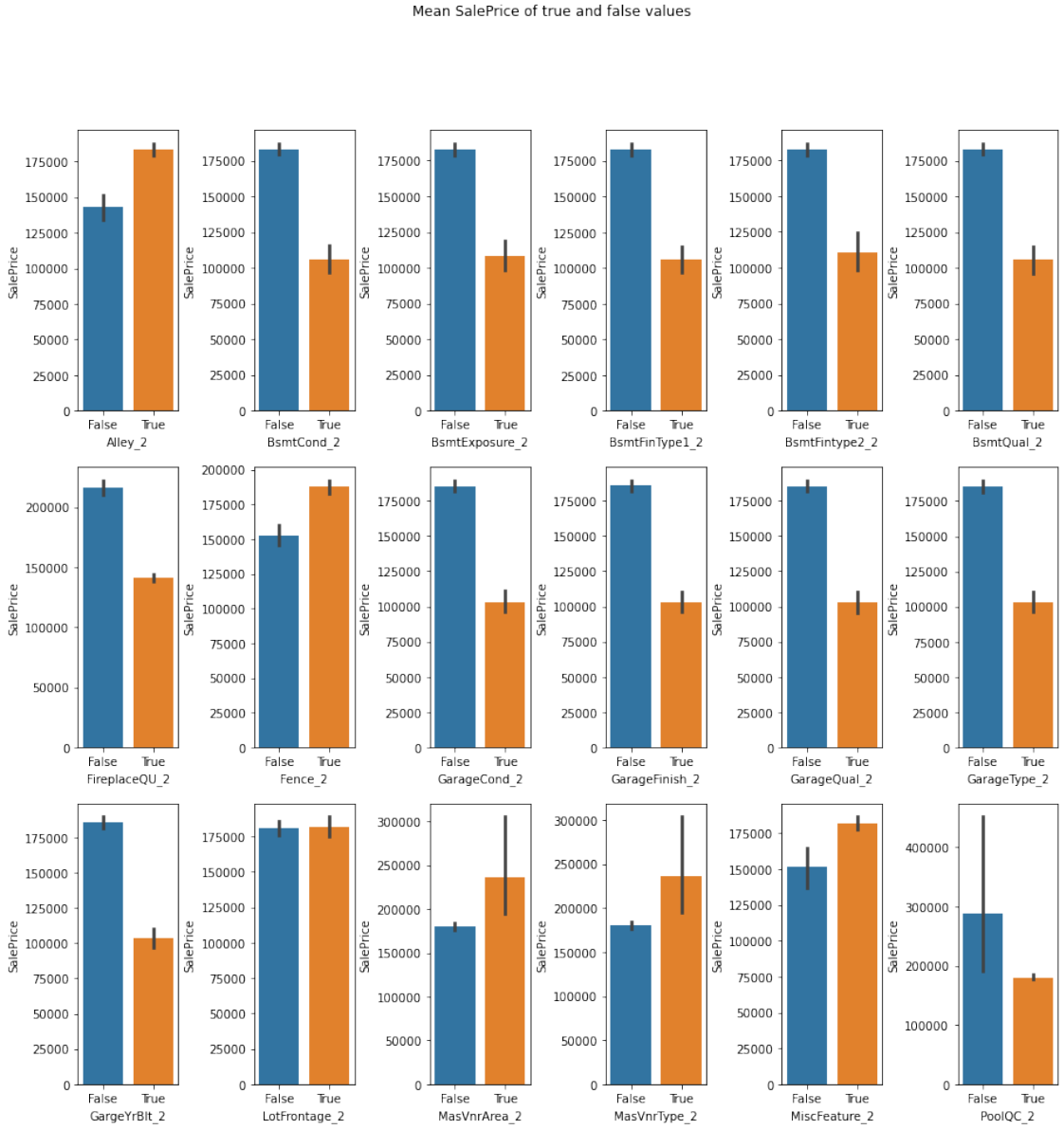
```
1458          0         1078    GasA        Gd          Y      FuseA
1459        136         1256    GasA        Gd          Y      SBrkr

      1stFlrSF  2ndFlrSF  LowQualFinSF  GrLivArea  BsmtFullBath  BsmtHalfBath  \
0          856       854             0       1710             1             0
1         1262         0             0       1262             0             1
2          920       866             0       1786             1             0
3          961       756             0       1717             1             0
4         1145      1053             0       2198             1             0
…          …         …             …         …              …             …
1455       953       694             0       1647             0             0
1456      2073         0             0       2073             1             0
1457      1188      1152             0       2340             0             0
1458      1078         0             0       1078             1             0
1459      1256         0             0       1256             1             0

      FullBath  HalfBath  BedroomAbvGr  KitchenAbvGr KitchenQual  \
0            2         1             3             1          Gd
1            2         0             3             1          TA
2            2         1             3             1          Gd
3            1         0             3             1          Gd
4            2         1             4             1          Gd
…          …         …             …             …          …
1455         2         1             3             1          TA
1456         2         0             3             1          TA
1457         2         0             4             1          Gd
1458         1         0             2             1          Gd
1459         1         1             3             1          TA

      TotRmsAbvGrd Functional  Fireplaces FireplaceQu GarageType  GarageYrBlt  \
0                8        Typ           0         NaN     Attchd       2003.0
1                6        Typ           1          TA     Attchd       1976.0
2                6        Typ           1          TA     Attchd       2001.0
3                7        Typ           1          Gd     Detchd       1998.0
4                9        Typ           1          TA     Attchd       2000.0
…              …        …             …          …        …            …
1455             7        Typ           1          TA     Attchd       1999.0
1456             7       Min1           2          TA     Attchd       1978.0
1457             9        Typ           2          Gd     Attchd       1941.0
1458             5        Typ           0         NaN     Attchd       1950.0
1459             6        Typ           0         NaN     Attchd       1965.0

     GarageFinish  GarageCars  GarageArea GarageQual GarageCond PavedDrive  \
0             RFn           2         548         TA         TA          Y
1             RFn           2         460         TA         TA          Y
2             RFn           2         608         TA         TA          Y
3             Unf           3         642         TA         TA          Y
```

```
4             RFn           3         836         TA         TA          Y
…             …             …         …           …          …
1455          RFn           2         460         TA         TA          Y
1456          Unf           2         500         TA         TA          Y
1457          RFn           1         252         TA         TA          Y
1458          Unf           1         240         TA         TA          Y
1459          Fin           1         276         TA         TA          Y

      WoodDeckSF  OpenPorchSF  EnclosedPorch  3SsnPorch  ScreenPorch  \
0              0           61              0          0            0
1            298            0              0          0            0
2              0           42              0          0            0
3              0           35            272          0            0
4            192           84              0          0            0
…            …             …             …          …
1455           0           40              0          0            0
1456         349            0              0          0            0
1457           0           60              0          0            0
1458         366            0            112          0            0
1459         736           68              0          0            0

      PoolArea PoolQC  Fence MiscFeature  MiscVal  MoSold  YrSold SaleType  \
0            0    NaN    NaN         NaN        0       2    2008       WD
1            0    NaN    NaN         NaN        0       5    2007       WD
2            0    NaN    NaN         NaN        0       9    2008       WD
3            0    NaN    NaN         NaN        0       2    2006       WD
4            0    NaN    NaN         NaN        0      12    2008       WD
…        …    …    …           …       …     …      …
1455         0    NaN    NaN         NaN        0       8    2007       WD
1456         0    NaN  MnPrv         NaN        0       2    2010       WD
1457         0    NaN  GdPrv        Shed     2500       5    2010       WD
1458         0    NaN    NaN         NaN        0       4    2010       WD
1459         0    NaN    NaN         NaN        0       6    2008       WD

     SaleCondition  SalePrice  Alley_2  BsmtCond_2  BsmtExposure_2  \
0           Normal     208500     True       False           False
1           Normal     181500     True       False           False
2           Normal     223500     True       False           False
3          Abnorml     140000     True       False           False
4           Normal     250000     True       False           False
…             …        …      …          …               …
1455        Normal     175000     True       False           False
1456        Normal     210000     True       False           False
1457        Normal     266500     True       False           False
1458        Normal     142125     True       False           False
1459        Normal     147500     True       False           False
```

```
      BsmtFinType1_2  BsmtFintype2_2  BsmtQual_2  FireplaceQU_2  Fence_2  \
0              False           False       False           True     True
1              False           False       False          False     True
2              False           False       False          False     True
3              False           False       False          False     True
4              False           False       False          False     True
…                …               …           …              …        …
1455           False           False       False          False     True
1456           False           False       False          False    False
1457           False           False       False          False    False
1458           False           False       False           True     True
1459           False           False       False           True     True

      GarageCond_2  GarageFinish_2  GarageQual_2  GarageType_2  GargeYrBlt_2  \
0            False           False         False         False         False
1            False           False         False         False         False
2            False           False         False         False         False
3            False           False         False         False         False
4            False           False         False         False         False
…              …               …             …             …             …
1455         False           False         False         False         False
1456         False           False         False         False         False
1457         False           False         False         False         False
1458         False           False         False         False         False
1459         False           False         False         False         False

      LotFrontage_2  MasVnrArea_2  MasVnrType_2  MiscFeature_2  PoolQC_2
0             False         False         False           True      True
1             False         False         False           True      True
2             False         False         False           True      True
3             False         False         False           True      True
4             False         False         False           True      True
…               …             …             …              …         …
1455          False         False         False           True      True
1456          False         False         False           True      True
1457          False         False         False          False      True
1458          False         False         False           True      True
1459          False         False         False           True      True

[1460 rows x 99 columns]
```

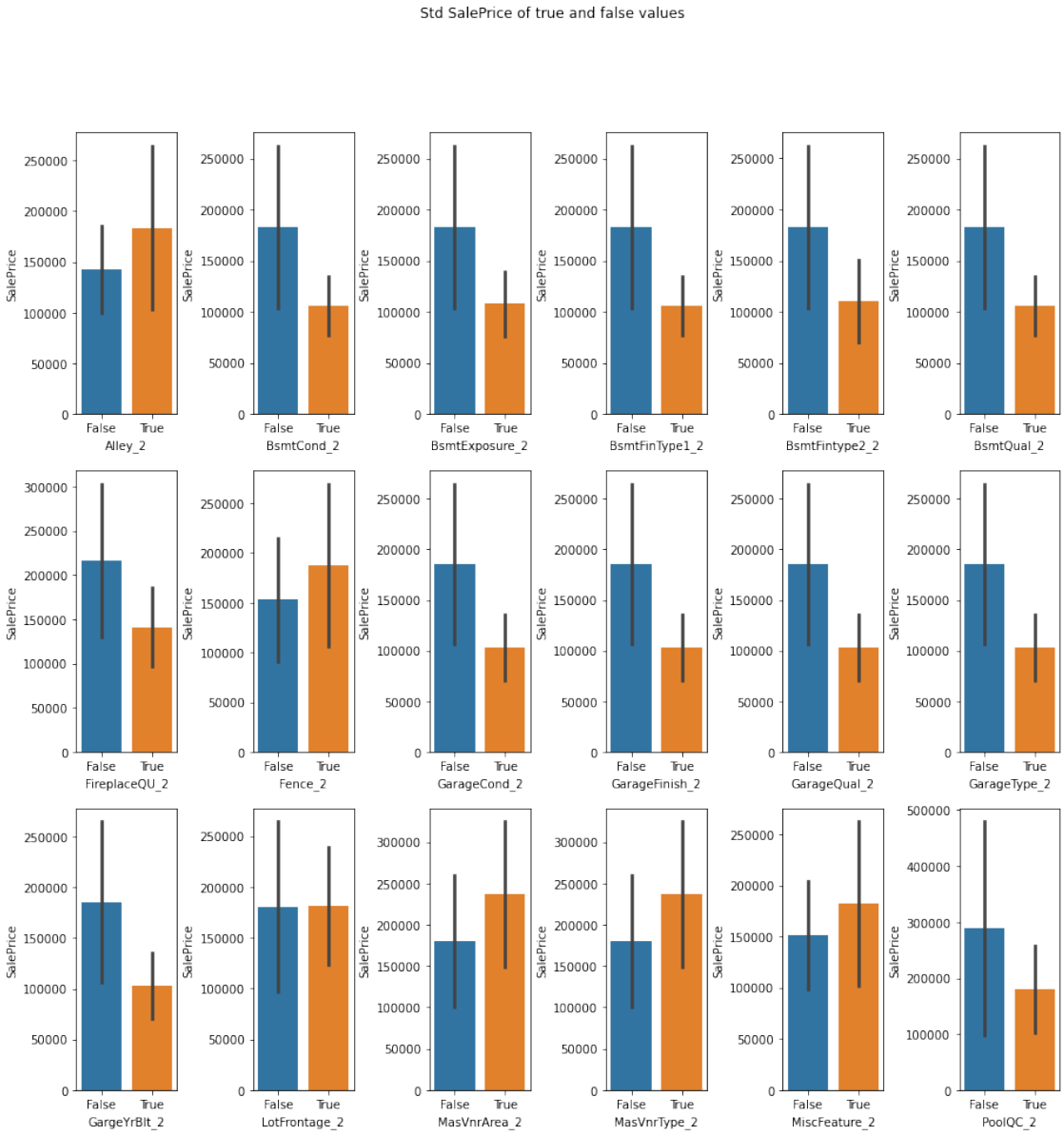
[7]:
```
fig, axes = plt.subplots(3, 6, figsize=(15, 15))
fig.suptitle('Mean SalePrice of true and false values')

sns.barplot(x =boston['Alley_2'], y = boston['SalePrice'], ax=axes[0,0])
sns.barplot(x =boston['BsmtCond_2'], y = boston['SalePrice'], ax=axes[0,1])
sns.barplot(x =boston['BsmtExposure_2'], y = boston['SalePrice'], ax=axes[0,2])
```

```
sns.barplot(x =boston['BsmtFinType1_2'], y = boston['SalePrice'], ax=axes[0,3])
sns.barplot(x =boston['BsmtFintype2_2'], y = boston['SalePrice'], ax=axes[0,4])
sns.barplot(x =boston['BsmtQual_2'], y = boston['SalePrice'], ax=axes[0,5])
sns.barplot(x =boston['FireplaceQU_2'], y = boston['SalePrice'], ax=axes[1,0])
sns.barplot(x =boston['Fence_2'], y = boston['SalePrice'], ax=axes[1,1])
sns.barplot(x =boston['GarageCond_2'], y = boston['SalePrice'], ax=axes[1,2])
sns.barplot(x =boston['GarageFinish_2'], y = boston['SalePrice'], ax=axes[1,3])
sns.barplot(x =boston['GarageQual_2'], y = boston['SalePrice'], ax=axes[1,4])
sns.barplot(x =boston['GarageType_2'], y = boston['SalePrice'], ax=axes[1,5])
sns.barplot(x =boston['GargeYrBlt_2'], y = boston['SalePrice'], ax=axes[2,0])
sns.barplot(x =boston['LotFrontage_2'], y = boston['SalePrice'], ax=axes[2,1])
sns.barplot(x =boston['MasVnrArea_2'], y = boston['SalePrice'], ax=axes[2,2])
sns.barplot(x =boston['MasVnrType_2'], y = boston['SalePrice'], ax=axes[2,3])
sns.barplot(x =boston['MiscFeature_2'], y = boston['SalePrice'], ax=axes[2,4])
sns.barplot(x =boston['PoolQC_2'], y = boston['SalePrice'], ax=axes[2,5])

fig.subplots_adjust(wspace=0.75)
```



[8]:
```
fig, axes = plt.subplots(3, 6, figsize=(15, 15))
fig.suptitle('Std SalePrice of true and false values')

sns.barplot(x =boston['Alley_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[0,0])
sns.barplot(x =boston['BsmtCond_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[0,1])
sns.barplot(x =boston['BsmtExposure_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[0,2])
```

```
sns.barplot(x =boston['BsmtFinType1_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[0,3])
sns.barplot(x =boston['BsmtFintype2_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[0,4])
sns.barplot(x =boston['BsmtQual_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[0,5])
sns.barplot(x =boston['FireplaceQU_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[1,0])
sns.barplot(x =boston['Fence_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[1,1])
sns.barplot(x =boston['GarageCond_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[1,2])
sns.barplot(x =boston['GarageFinish_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[1,3])
sns.barplot(x =boston['GarageQual_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[1,4])
sns.barplot(x =boston['GarageType_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[1,5])
sns.barplot(x =boston['GargeYrBlt_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[2,0])
sns.barplot(x =boston['LotFrontage_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[2,1])
sns.barplot(x =boston['MasVnrArea_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[2,2])
sns.barplot(x =boston['MasVnrType_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[2,3])
sns.barplot(x =boston['MiscFeature_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[2,4])
sns.barplot(x =boston['PoolQC_2'], y = boston['SalePrice'], ci='sd',␣
 ↪ax=axes[2,5])

fig.subplots_adjust(wspace=0.75)
```



[9]:
```
# Dropping columns with more than 30% of missing Vales
Dropped_na_boston = pd.read_csv('train.csv')
Dropped_na_boston = Dropped_na_boston.drop(columns=['Alley', 'Fence',␣
 ↪'FireplaceQu', 'MiscFeature', 'PoolQC'])
Dropped_na_boston
```

[9]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	LotShape	\
0	1	60	RL	65.0	8450	Pave	Reg	
1	2	20	RL	80.0	9600	Pave	Reg	
2	3	60	RL	68.0	11250	Pave	IR1	
3	4	70	RL	60.0	9550	Pave	IR1	

```
4        5          60       RL         84.0    14260   Pave      IR1
…    …          …       …          …       …    …       …
1455  1456          60       RL         62.0     7917   Pave      Reg
1456  1457          20       RL         85.0    13175   Pave      Reg
1457  1458          70       RL         66.0     9042   Pave      Reg
1458  1459          20       RL         68.0     9717   Pave      Reg
1459  1460          20       RL         75.0     9937   Pave      Reg

     LandContour Utilities LotConfig LandSlope Neighborhood Condition1  \
0            Lvl    AllPub    Inside       Gtl      CollgCr       Norm
1            Lvl    AllPub       FR2       Gtl      Veenker      Feedr
2            Lvl    AllPub    Inside       Gtl      CollgCr       Norm
3            Lvl    AllPub    Corner       Gtl      Crawfor       Norm
4            Lvl    AllPub       FR2       Gtl      NoRidge       Norm
…          …       …       …       …          …       …
1455         Lvl    AllPub    Inside       Gtl      Gilbert       Norm
1456         Lvl    AllPub    Inside       Gtl       NWAmes       Norm
1457         Lvl    AllPub    Inside       Gtl      Crawfor       Norm
1458         Lvl    AllPub    Inside       Gtl        NAmes       Norm
1459         Lvl    AllPub    Inside       Gtl      Edwards       Norm

     Condition2 BldgType HouseStyle  OverallQual  OverallCond  YearBuilt  \
0          Norm     1Fam     2Story            7            5       2003
1          Norm     1Fam     1Story            6            8       1976
2          Norm     1Fam     2Story            7            5       2001
3          Norm     1Fam     2Story            7            5       1915
4          Norm     1Fam     2Story            8            5       2000
…         …       …       …          …          …       …
1455       Norm     1Fam     2Story            6            5       1999
1456       Norm     1Fam     1Story            6            6       1978
1457       Norm     1Fam     2Story            7            9       1941
1458       Norm     1Fam     1Story            5            6       1950
1459       Norm     1Fam     1Story            5            6       1965

      YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType  \
0             2003     Gable  CompShg     VinylSd     VinylSd    BrkFace
1             1976     Gable  CompShg     MetalSd     MetalSd       None
2             2002     Gable  CompShg     VinylSd     VinylSd    BrkFace
3             1970     Gable  CompShg     Wd Sdng     Wd Shng       None
4             2000     Gable  CompShg     VinylSd     VinylSd    BrkFace
…           …       …      …          …          …       …
1455          2000     Gable  CompShg     VinylSd     VinylSd       None
1456          1988     Gable  CompShg     Plywood     Plywood      Stone
1457          2006     Gable  CompShg     CemntBd     CmentBd       None
1458          1996       Hip  CompShg     MetalSd     MetalSd       None
1459          1965     Gable  CompShg     HdBoard     HdBoard       None
```

```
      MasVnrArea ExterQual ExterCond Foundation BsmtQual BsmtCond  \
0          196.0        Gd        TA      PConc       Gd       TA
1            0.0        TA        TA     CBlock       Gd       TA
2          162.0        Gd        TA      PConc       Gd       TA
3            0.0        TA        TA     BrkTil       TA       Gd
4          350.0        Gd        TA      PConc       Gd       TA
…            …       …        …         …      …      …
1455         0.0        TA        TA      PConc       Gd       TA
1456       119.0        TA        TA     CBlock       Gd       TA
1457         0.0        Ex        Gd      Stone       TA       Gd
1458         0.0        TA        TA     CBlock       TA       TA
1459         0.0        Gd        TA     CBlock       TA       TA

     BsmtExposure BsmtFinType1  BsmtFinSF1 BsmtFinType2  BsmtFinSF2  \
0              No          GLQ         706          Unf           0
1              Gd          ALQ         978          Unf           0
2              Mn          GLQ         486          Unf           0
3              No          ALQ         216          Unf           0
4              Av          GLQ         655          Unf           0
…           …           …          …           …         …
1455           No          Unf           0          Unf           0
1456           No          ALQ         790          Rec         163
1457           No          GLQ         275          Unf           0
1458           Mn          GLQ          49          Rec        1029
1459           No          BLQ         830          LwQ         290

      BsmtUnfSF  TotalBsmtSF Heating HeatingQC CentralAir Electrical  \
0           150          856    GasA        Ex          Y      SBrkr
1           284         1262    GasA        Ex          Y      SBrkr
2           434          920    GasA        Ex          Y      SBrkr
3           540          756    GasA        Gd          Y      SBrkr
4           490         1145    GasA        Ex          Y      SBrkr
…         …           …     …       …        …         …
1455        953          953    GasA        Ex          Y      SBrkr
1456        589         1542    GasA        TA          Y      SBrkr
1457        877         1152    GasA        Ex          Y      SBrkr
1458          0         1078    GasA        Gd          Y      FuseA
1459        136         1256    GasA        Gd          Y      SBrkr

      1stFlrSF  2ndFlrSF  LowQualFinSF  GrLivArea  BsmtFullBath  BsmtHalfBath  \
0          856       854             0       1710             1             0
1         1262         0             0       1262             0             1
2          920       866             0       1786             1             0
3          961       756             0       1717             1             0
4         1145      1053             0       2198             1             0
…        …       …           …        …           …        …
1455       953       694             0       1647             0             0
```

```
1456      2073         0             0       2073             1             0
1457      1188      1152             0       2340             0             0
1458      1078         0             0       1078             1             0
1459      1256         0             0       1256             1             0

      FullBath  HalfBath  BedroomAbvGr  KitchenAbvGr KitchenQual  \
0            2         1             3             1          Gd
1            2         0             3             1          TA
2            2         1             3             1          Gd
3            1         0             3             1          Gd
4            2         1             4             1          Gd
…          …         …             …             …          …
1455         2         1             3             1          TA
1456         2         0             3             1          TA
1457         2         0             4             1          Gd
1458         1         0             2             1          Gd
1459         1         1             3             1          TA

      TotRmsAbvGrd Functional  Fireplaces GarageType  GarageYrBlt  \
0                8        Typ           0     Attchd       2003.0
1                6        Typ           1     Attchd       1976.0
2                6        Typ           1     Attchd       2001.0
3                7        Typ           1     Detchd       1998.0
4                9        Typ           1     Attchd       2000.0
…              …        …           …         …          …
1455             7        Typ           1     Attchd       1999.0
1456             7       Min1           2     Attchd       1978.0
1457             9        Typ           2     Attchd       1941.0
1458             5        Typ           0     Attchd       1950.0
1459             6        Typ           0     Attchd       1965.0

     GarageFinish  GarageCars  GarageArea GarageQual GarageCond PavedDrive  \
0             RFn           2         548         TA         TA          Y
1             RFn           2         460         TA         TA          Y
2             RFn           2         608         TA         TA          Y
3             Unf           3         642         TA         TA          Y
4             RFn           3         836         TA         TA          Y
…           …           …         …         …         …          …
1455          RFn           2         460         TA         TA          Y
1456          Unf           2         500         TA         TA          Y
1457          RFn           1         252         TA         TA          Y
1458          Unf           1         240         TA         TA          Y
1459          Fin           1         276         TA         TA          Y

      WoodDeckSF  OpenPorchSF  EnclosedPorch  3SsnPorch  ScreenPorch  \
0              0           61              0          0            0
1            298            0              0          0            0
```

```
2              0           42              0          0            0
3              0           35            272          0            0
4            192           84              0          0            0
…            …             …               …          …            …
1455           0           40              0          0            0
1456         349            0              0          0            0
1457           0           60              0          0            0
1458         366            0            112          0            0
1459         736           68              0          0            0

      PoolArea  MiscVal  MoSold  YrSold SaleType SaleCondition  SalePrice
0            0        0       2    2008       WD        Normal     208500
1            0        0       5    2007       WD        Normal     181500
2            0        0       9    2008       WD        Normal     223500
3            0        0       2    2006       WD       Abnorml     140000
4            0        0      12    2008       WD        Normal     250000
…        …       …      …       …      …          …          …
1455         0        0       8    2007       WD        Normal     175000
1456         0        0       2    2010       WD        Normal     210000
1457         0     2500       5    2010       WD        Normal     266500
1458         0        0       4    2010       WD        Normal     142125
1459         0        0       6    2008       WD        Normal     147500

[1460 rows x 76 columns]
```

Work with Numerical variables

Discrete

- Determine how many discrete variables and how many temporal variables are in the dataset
- Graph the median SalePrice grouped by year sold (year sold x-axis, SalePrice y-axis)

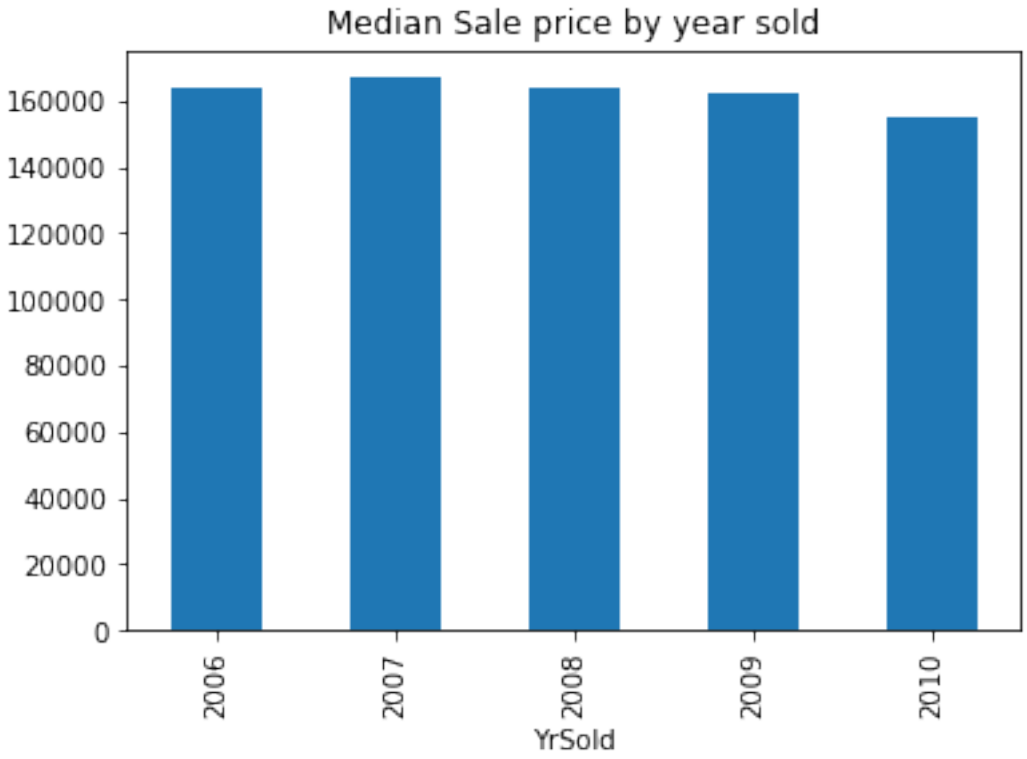
[10]:
```
Dropped_na_boston.dtypes
```

[10]:
```
Id                int64
MSSubClass        int64
MSZoning         object
LotFrontage     float64
LotArea           int64
                 …
MoSold            int64
YrSold            int64
SaleType         object
SaleCondition    object
SalePrice         int64
Length: 76, dtype: object
```

[11]:
```
# There are 35 discrete variables in the dataset.
# There are 4 temporal variables in the data set. (YrSold, GarageYrBlt,␣
 ↪YearRemodAdd, YearBuilt)
```

[12]:
```
Median_Saleprice_by_YrSold = Dropped_na_boston.groupby('YrSold')['SalePrice'].
 ↪median()
Median_Saleprice_by_YrSold.plot(kind = 'bar', title = 'Median Sale price by␣
 ↪year sold')
```

[12]:
```
<AxesSubplot:title={'center':'Median Sale price by year sold'}, xlabel='YrSold'>
```



Continuous

- Determine the number of continuous variables
- Plot a histogram of each
- Use one normalization method on one column to create a normal-like distribution (does not ne

[13]:
```
Dropped_na_boston.dtypes
```

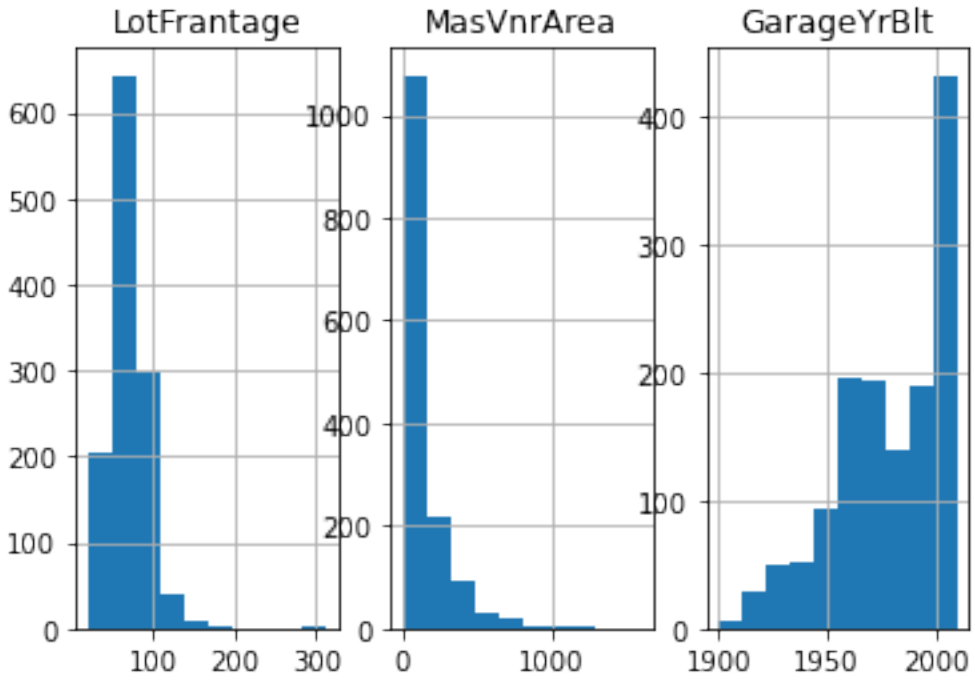
[13]:
```
Id                int64
MSSubClass        int64
MSZoning         object
LotFrontage     float64
```

```
LotArea            int64
                   …
MoSold             int64
YrSold             int64
SaleType          object
SaleCondition     object
SalePrice          int64
Length: 76, dtype: object
```

[14]:
```
# There are 3 continuous variables in the dataset (LotFrontage, MasVnrArea,␣
↪GarageYrBlt)
```

[15]:
```
plt.subplot(1,3,1)
plt.title('LotFrantage')
Dropped_na_boston['LotFrontage'].hist()

plt.subplot(1, 3, 2)
plt.title('MasVnrArea')
Dropped_na_boston['MasVnrArea'].hist()

plt.subplot(1, 3, 3)
plt.title('GarageYrBlt')
Dropped_na_boston['GarageYrBlt'].hist()
```

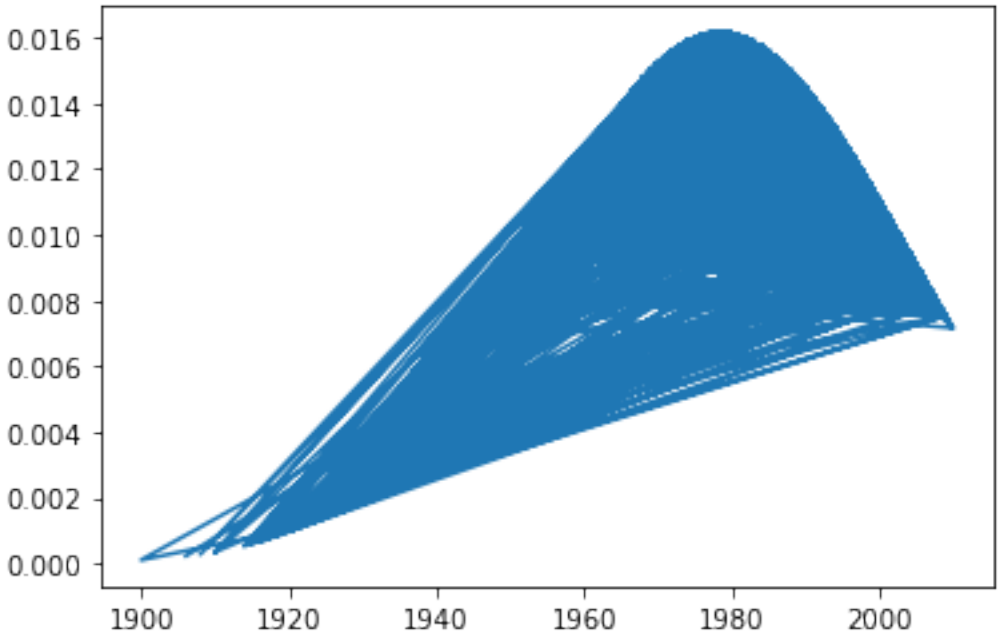
[15]:
```
<AxesSubplot:title={'center':'GarageYrBlt'}>
```



[16]:
```
Dropped = Dropped_na_boston['GarageYrBlt']
```

[17]:
```
Dropped = Dropped.dropna()
```

[18]:
```
x_axis = Dropped
mean = statistics.mean(x_axis)
sd = statistics.stdev(x_axis)

plt.plot(x_axis, norm.pdf(x_axis, mean, sd))
plt.show()
```



0.1.4 Work with categorical variables

- Graph the number of unique variables per column
- Map the following on columns that apply:
  qual_mappings = {'Po': 1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0}
- Create a box and whisker plot on SalePrice for 3 columns that utilize this mapped metric

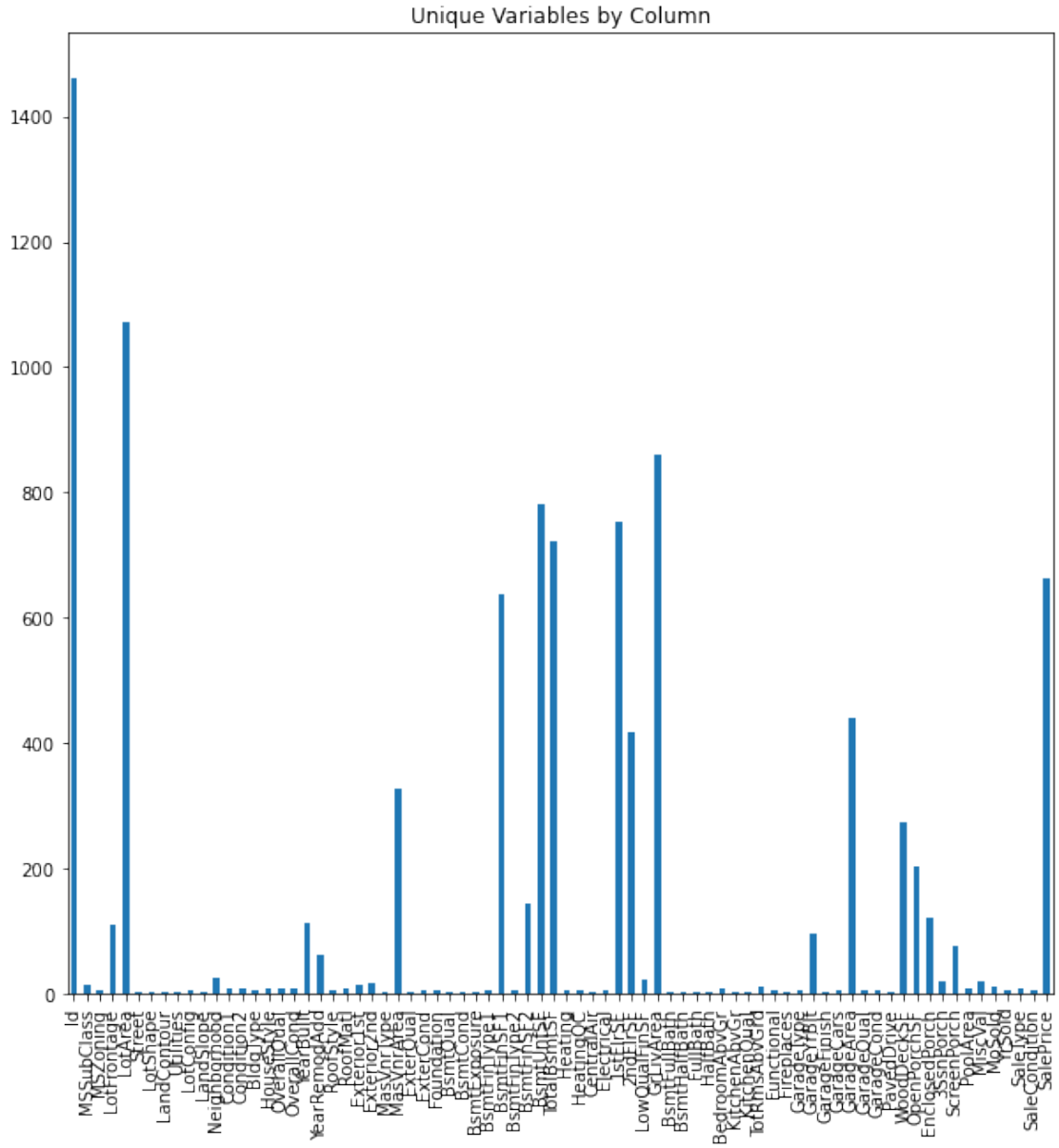
[19]:
```
Unique_Variables_per_column = Dropped_na_boston.nunique()
Unique_Variables_per_column
```

[19]:
```
Id              1460
MSSubClass        15
MSZoning           5
LotFrontage      110
LotArea         1073
```

```
                ...
MoSold           12
YrSold            5
SaleType          9
SaleCondition     6
SalePrice       663
Length: 76, dtype: int64
```

[20]:
```
Unique_Variables_per_column.plot(kind='bar', figsize=(10,10), title='Unique
↪Variables by Column')
```

[20]: <AxesSubplot:title={'center':'Unique Variables by Column'}>



[21]:
```
Dropped_na_boston['ExterQual_map'] = Dropped_na_boston['ExterQual'].map({'Po':␣
↪1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['ExterCond_map'] = Dropped_na_boston['ExterCond'].map({'Po':␣
↪1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['BsmtQual_map'] = Dropped_na_boston['BsmtQual'].map({'Po': 1,␣
↪'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['BsmtCond_map'] = Dropped_na_boston['BsmtCond'].map({'Po': 1,␣
↪'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['BsmtExposure_map'] = Dropped_na_boston['BsmtExposure'].
↪map({'Po': 1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['HeatingQC_map'] = Dropped_na_boston['HeatingQC'].map({'Po':␣
↪1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['KitchenQual_map'] = Dropped_na_boston['KitchenQual'].
↪map({'Po': 1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['GarageQual_map'] = Dropped_na_boston['GarageQual'].map({'Po':
↪ 1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston['GarageCond_map'] = Dropped_na_boston['GarageCond'].map({'Po':
↪ 1, 'Fa': 2, 'TA': 3, 'Gd': 4, 'Ex': 5, 'Missing': 0, 'NA': 0})
Dropped_na_boston
```

[21]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	LotShape	\
0	1	60	RL	65.0	8450	Pave	Reg	
1	2	20	RL	80.0	9600	Pave	Reg	
2	3	60	RL	68.0	11250	Pave	IR1	
3	4	70	RL	60.0	9550	Pave	IR1	
4	5	60	RL	84.0	14260	Pave	IR1	
…	…	…	…	…	…	…	…	
1455	1456	60	RL	62.0	7917	Pave	Reg	
1456	1457	20	RL	85.0	13175	Pave	Reg	
1457	1458	70	RL	66.0	9042	Pave	Reg	
1458	1459	20	RL	68.0	9717	Pave	Reg	
1459	1460	20	RL	75.0	9937	Pave	Reg	

	LandContour	Utilities	LotConfig	LandSlope	Neighborhood	Condition1	\
0	Lvl	AllPub	Inside	Gtl	CollgCr	Norm	
1	Lvl	AllPub	FR2	Gtl	Veenker	Feedr	
2	Lvl	AllPub	Inside	Gtl	CollgCr	Norm	
3	Lvl	AllPub	Corner	Gtl	Crawfor	Norm	
4	Lvl	AllPub	FR2	Gtl	NoRidge	Norm	
…	…	…	…	…	…	…	
1455	Lvl	AllPub	Inside	Gtl	Gilbert	Norm	
1456	Lvl	AllPub	Inside	Gtl	NWAmes	Norm	
1457	Lvl	AllPub	Inside	Gtl	Crawfor	Norm	
1458	Lvl	AllPub	Inside	Gtl	NAmes	Norm	

```
1459         Lvl    AllPub    Inside       Gtl      Edwards       Norm

     Condition2 BldgType HouseStyle  OverallQual  OverallCond  YearBuilt  \
0          Norm     1Fam     2Story            7            5       2003
1          Norm     1Fam     1Story            6            8       1976
2          Norm     1Fam     2Story            7            5       2001
3          Norm     1Fam     2Story            7            5       1915
4          Norm     1Fam     2Story            8            5       2000
…           …       …         …           …           …         …
1455       Norm     1Fam     2Story            6            5       1999
1456       Norm     1Fam     1Story            6            6       1978
1457       Norm     1Fam     2Story            7            9       1941
1458       Norm     1Fam     1Story            5            6       1950
1459       Norm     1Fam     1Story            5            6       1965

      YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType  \
0             2003     Gable  CompShg     VinylSd     VinylSd    BrkFace
1             1976     Gable  CompShg     MetalSd     MetalSd       None
2             2002     Gable  CompShg     VinylSd     VinylSd    BrkFace
3             1970     Gable  CompShg     Wd Sdng     Wd Shng       None
4             2000     Gable  CompShg     VinylSd     VinylSd    BrkFace
…              …       …       …          …           …         …
1455          2000     Gable  CompShg     VinylSd     VinylSd       None
1456          1988     Gable  CompShg     Plywood     Plywood      Stone
1457          2006     Gable  CompShg     CemntBd     CmentBd       None
1458          1996       Hip  CompShg     MetalSd     MetalSd       None
1459          1965     Gable  CompShg     HdBoard     HdBoard       None

      MasVnrArea ExterQual ExterCond Foundation BsmtQual BsmtCond  \
0          196.0        Gd        TA      PConc       Gd       TA
1            0.0        TA        TA     CBlock       Gd       TA
2          162.0        Gd        TA      PConc       Gd       TA
3            0.0        TA        TA     BrkTil       TA       Gd
4          350.0        Gd        TA      PConc       Gd       TA
…           …       …        …         …       …      …
1455         0.0        TA        TA      PConc       Gd       TA
1456       119.0        TA        TA     CBlock       Gd       TA
1457         0.0        Ex        Gd      Stone       TA       Gd
1458         0.0        TA        TA     CBlock       TA       TA
1459         0.0        Gd        TA     CBlock       TA       TA

     BsmtExposure BsmtFinType1  BsmtFinSF1 BsmtFinType2  BsmtFinSF2  \
0              No          GLQ         706          Unf           0
1              Gd          ALQ         978          Unf           0
2              Mn          GLQ         486          Unf           0
3              No          ALQ         216          Unf           0
4              Av          GLQ         655          Unf           0
```

```
…           …           …          …           …          …
1455          No          Unf          0          Unf          0
1456          No          ALQ        790          Rec        163
1457          No          GLQ        275          Unf          0
1458          Mn          GLQ         49          Rec       1029
1459          No          BLQ        830          LwQ        290

      BsmtUnfSF  TotalBsmtSF Heating HeatingQC CentralAir Electrical  \
0           150          856    GasA        Ex          Y      SBrkr
1           284         1262    GasA        Ex          Y      SBrkr
2           434          920    GasA        Ex          Y      SBrkr
3           540          756    GasA        Gd          Y      SBrkr
4           490         1145    GasA        Ex          Y      SBrkr
…         …           …     …       …        …         …
1455        953          953    GasA        Ex          Y      SBrkr
1456        589         1542    GasA        TA          Y      SBrkr
1457        877         1152    GasA        Ex          Y      SBrkr
1458          0         1078    GasA        Gd          Y      FuseA
1459        136         1256    GasA        Gd          Y      SBrkr

      1stFlrSF  2ndFlrSF  LowQualFinSF  GrLivArea  BsmtFullBath  BsmtHalfBath  \
0          856       854             0       1710             1             0
1         1262         0             0       1262             0             1
2          920       866             0       1786             1             0
3          961       756             0       1717             1             0
4         1145      1053             0       2198             1             0
…        …       …            …         …           …          …
1455       953       694             0       1647             0             0
1456      2073         0             0       2073             1             0
1457      1188      1152             0       2340             0             0
1458      1078         0             0       1078             1             0
1459      1256         0             0       1256             1             0

      FullBath  HalfBath  BedroomAbvGr  KitchenAbvGr KitchenQual  \
0            2         1             3             1          Gd
1            2         0             3             1          TA
2            2         1             3             1          Gd
3            1         0             3             1          Gd
4            2         1             4             1          Gd
…          …       …           …            …          …
1455         2         1             3             1          TA
1456         2         0             3             1          TA
1457         2         0             4             1          Gd
1458         1         0             2             1          Gd
1459         1         1             3             1          TA

      TotRmsAbvGrd Functional  Fireplaces GarageType  GarageYrBlt  \
```

```
0                8        Typ           0     Attchd       2003.0
1                6        Typ           1     Attchd       1976.0
2                6        Typ           1     Attchd       2001.0
3                7        Typ           1     Detchd       1998.0
4                9        Typ           1     Attchd       2000.0
…              …        …          …         …          …
1455             7        Typ           1     Attchd       1999.0
1456             7       Min1           2     Attchd       1978.0
1457             9        Typ           2     Attchd       1941.0
1458             5        Typ           0     Attchd       1950.0
1459             6        Typ           0     Attchd       1965.0

     GarageFinish  GarageCars  GarageArea GarageQual GarageCond PavedDrive  \
0             RFn           2         548         TA         TA          Y
1             RFn           2         460         TA         TA          Y
2             RFn           2         608         TA         TA          Y
3             Unf           3         642         TA         TA          Y
4             RFn           3         836         TA         TA          Y
…           …           …         …         …         …          …
1455          RFn           2         460         TA         TA          Y
1456          Unf           2         500         TA         TA          Y
1457          RFn           1         252         TA         TA          Y
1458          Unf           1         240         TA         TA          Y
1459          Fin           1         276         TA         TA          Y

      WoodDeckSF  OpenPorchSF  EnclosedPorch  3SsnPorch  ScreenPorch  \
0              0           61              0          0            0
1            298            0              0          0            0
2              0           42              0          0            0
3              0           35            272          0            0
4            192           84              0          0            0
…          …           …           …         …          …
1455           0           40              0          0            0
1456         349            0              0          0            0
1457           0           60              0          0            0
1458         366            0            112          0            0
1459         736           68              0          0            0

      PoolArea  MiscVal  MoSold  YrSold SaleType SaleCondition  SalePrice  \
0            0        0       2    2008       WD        Normal     208500
1            0        0       5    2007       WD        Normal     181500
2            0        0       9    2008       WD        Normal     223500
3            0        0       2    2006       WD       Abnorml     140000
4            0        0      12    2008       WD        Normal     250000
…        …       …     …     …       …          …        …
1455         0        0       8    2007       WD        Normal     175000
1456         0        0       2    2010       WD        Normal     210000
```

```
1457         0     2500       5    2010       WD        Normal     266500
1458         0        0       4    2010       WD        Normal     142125
1459         0        0       6    2008       WD        Normal     147500

      ExterQual_map  ExterCond_map  BsmtQual_map  BsmtCond_map  \
0                 4              3           4.0           3.0
1                 3              3           4.0           3.0
2                 4              3           4.0           3.0
3                 3              3           3.0           4.0
4                 4              3           4.0           3.0
…               …              …           …             …
1455              3              3           4.0           3.0
1456              3              3           4.0           3.0
1457              5              4           3.0           4.0
1458              3              3           3.0           3.0
1459              4              3           3.0           3.0

      BsmtExposure_map  HeatingQC_map  KitchenQual_map  GarageQual_map  \
0                  NaN              5                4             3.0
1                  4.0              5                3             3.0
2                  NaN              5                4             3.0
3                  NaN              4                4             3.0
4                  NaN              5                4             3.0
…                …              …                …             …
1455               NaN              5                3             3.0
1456               NaN              3                3             3.0
1457               NaN              5                4             3.0
1458               NaN              4                4             3.0
1459               NaN              4                3             3.0

      GarageCond_map
0                3.0
1                3.0
2                3.0
3                3.0
4                3.0
…              …
1455             3.0
1456             3.0
1457             3.0
1458             3.0
1459             3.0

[1460 rows x 85 columns]
```

[22]:
```
plt.subplot(1,3,1)
plt.title('ExternalQual_map')
```

```
plt.boxplot(Dropped_na_boston['ExterQual_map'])

plt.subplot(1, 3, 2)
plt.title('HeatingQC_map')
plt.boxplot(Dropped_na_boston['HeatingQC_map'])

plt.subplot(1, 3, 3)
plt.title('KitchenQual_map')
plt.boxplot(Dropped_na_boston['KitchenQual_map'])

plt.subplots_adjust(wspace=0.5)
```