NOAA Dataset Cleaning

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
import pandas as pd
import numpy as np
from IPython.display import display
import matplotlib.pyplot as plt
import seaborn as sns
```

```
noaa_weather_raw = pd.read_csv("/content/drive/Shareddrives/Data Science 303 Group Project/csv/noaa_weather/noaa_CA_1992_2016_weather_2781174.csv")
print(noaa_weather_raw.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8761 entries, 0 to 8760
Data columns (total 29 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   STATION    8761 non-null   object 
 1   NAME       8761 non-null   object 
 2   LATITUDE   8761 non-null   float64
 3   LONGITUDE  8761 non-null   float64
 4   ELEVATION  8761 non-null   float64
 5   DATE       8761 non-null   object 
 6   CDSD       7409 non-null   float64
 7   CLDD       8683 non-null   float64
 8   DP01       266 non-null    float64
 9   DP10       266 non-null    float64
 10  DSND       258 non-null    float64
 11  DSNW       247 non-null    float64
 12  DT00       8724 non-null   float64
 13  DT32       8724 non-null   float64
 14  DX32       8738 non-null   float64
 15  DX70       8738 non-null   float64
 16  DX90       8738 non-null   float64
 17  EMNT       8724 non-null   float64
 18  EMSD       258 non-null    float64
 19  EMSN       247 non-null    float64
 20  EMXP       266 non-null    float64
 21  EMXT       8738 non-null   float64
 22  HDSD       7594 non-null   float64
 23  HTDD       8683 non-null   float64
 24  PRCP       266 non-null    float64
 25  SNOW       247 non-null    float64
 26  TAVG       8705 non-null   float64
 27  TMAX       8738 non-null   float64
 28  TMIN       8724 non-null   float64
dtypes: float64(26), object(3)
memory usage: 1.9+ MB
None
```

```
NOAA_DECODE = {
    "CDSD": "NUM_COOLING_DEGREE_DAY_CUMULATIVE",
    "CLDD": "NUM_COOLING_DEGREE_DAY",
    "DP01": "NUM_DAYS_WITH_0_01_INCH_PRECIPITATION",
    "DP10": "NUM_DAYS_WITH_0_1_INCH_PRECIPITATION",
    "DSND": "NUM_DAYS_SNOW_DEPTH_1_INCH",
    "DSNW": "NUM_DAYS_SNOW_FALL_1_INCH",
    "DT00": "NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT",
    "DT32": "NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT",
    "DX70": "NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT",
    "DX90": "NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT",
    "EMNT": "EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH",
    "EMSD": "HIGHEST_DAILY_SNOW_DEPTH",
    "EMSN": "HIGHEST_DAILY_SNOW_FALL",
    "EMXP": "HIGHEST_DAILY_PRECIPITATION",
    "EMXT": "EXTREME_MAXIMUM_TEMPERATURE_MONTH",
    "HDSD": "HEATING_DEGREE_DAYS_TO_DATE",
    "HTDD": "NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT",
    "PRCP": "TOTAL_MONTHLY_RAINFALL",
    "SNOW": "TOTAL_MONTHLY_SNOWFALL",
    "TAVG": "TEMPERATURE_AVERAGE",
    "TMAX": "TEMPERATURE_MAX",
    "TMIN": "TEMPERATURE_MIN"
```

```
}


# DECODE AND ORGANIZE NOAA_DATA
noaa_weather = noaa_weather_raw[["STATION", "LATITUDE", "LONGITUDE", "ELEVATION"]]

# CONVERT NAME OF STATION TO UNDERSCORES
noaa_weather["STATION_NAME"] = noaa_weather_raw.NAME.map(lambda raw_name: raw_name[: (raw_name.index(" CALI"))].replace(" ", "_"))

# CONVERT DATE STRING TO DATE TIME YEAR AND MONTH
dates = pd.to_datetime(noaa_weather_raw["DATE"])
year = dates.dt.year
month = dates.dt.month

noaa_weather["YEAR"] = year
noaa_weather["MONTH"] = month


# CONVERT COLUMN NAMES TO ENGLISH
for (k, v) in NOAA_DECODE.items():
  length = len(noaa_weather_raw[k])
  num_missing = noaa_weather_raw[k].isnull().sum()
  print(f"Feature '{v}' is missing {(num_missing / length)*100:1.1f}%")

  # Exclude features that have > 90% of values missing
  if not (num_missing / length >= .9):
    noaa_weather[v] = noaa_weather_raw[k]

display(noaa_weather)
noaa_weather.info()
```

```
Feature 'NUM_COOLING_DEGREE_DAY_CUMULATIVE' is missing 15.4%
Feature 'NUM_COOLING_DEGREE_DAY' is missing 0.9%
Feature 'NUM_DAYS_WITH_0_01_INCH_PRECIPITATION' is missing 97.0%
Feature 'NUM_DAYS_WITH_0_1_INCH_PRECIPITATION' is missing 97.0%
Feature 'NUM_DAYS_SNOW_DEPTH_1_INCH' is missing 97.1%
Feature 'NUM_DAYS_SNOW_FALL_1_INCH' is missing 97.2%
Feature 'NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT' is missing 0.4%
Feature 'NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT' is missing 0.4%
Feature 'NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT' is missing 0.3%
Feature 'NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT' is missing 0.3%
Feature 'EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH' is missing 0.4%
Feature 'HIGHEST_DAILY_SNOW_DEPTH' is missing 97.1%
Feature 'HIGHEST_DAILY_SNOW_FALL' is missing 97.2%
Feature 'HIGHEST_DAILY_PRECIPITATION' is missing 97.0%
Feature 'EXTREME_MAXIMUM_TEMPERATURE_MONTH' is missing 0.3%
Feature 'HEATING_DEGREE_DAYS_TO_DATE' is missing 13.3%
Feature 'NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT' is missing 0.9%
Feature 'TOTAL_MONTHLY_RAINFALL' is missing 97.0%
Feature 'TOTAL_MONTHLY_SNOWFALL' is missing 97.2%
Feature 'TEMPERATURE_AVERAGE' is missing 0.6%
Feature 'TEMPERATURE_MAX' is missing 0.3%
Feature 'TEMPERATURE_MIN' is missing 0.4%
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:31: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:38: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:39: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:50: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

	STATION	LATITUDE	LONGITUDE	ELEVATION	STATION_NAME	YEAR	MONTH	NUM_COOLING_DEGREE_DAY_CUMULATIVE	NUM_COOLING_DEGREE_DAY	NUM_DAYS_WITH_MIN_TEMP_BELOW_0
0	USR0000CCOH	39.8717	-121.7689	528.2	COHASSET	1992	1	0.0	0.0	
2	USR0000CCOH	39.8717	-121.7689	528.2	COHASSET	1992	3	5.0	0.0	

Impute Values

```
# First, we want to drop stations that don't have enough data over the given time period
max_year = 2016
min_year = noaa_weather['YEAR'].min()
station_name_list = list(noaa_weather["STATION_NAME"].unique())
total_station_month_year_pairs_expected = (max_year - min_year + 1) * 12

# Print out the percentage of missing station, month, year pairs:
station_drop_list = []
for station in station_name_list:
  num_present = (noaa_weather["STATION_NAME"] == station).sum()
  # print(f"station: {station}, { num_present / total_station_month_year_pairs_expected}")
  if num_present / total_station_month_year_pairs_expected < .75:
    station_drop_list.append(station)

# For any station with less than 75 percent of month-date pairs missing, drop them
for station in station_drop_list:
  print(station)
  noaa_weather.drop(noaa_weather[noaa_weather['STATION_NAME'] == station].index, inplace = True)
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/frame.py:4174: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  errors=errors,
MALLORY_RIDGE
BRADLEY
CASHMAN
BIG_ROCK
MAD_RIVER
EEL_RIVER_CAMP
JOHNSONDALE
MODOC_NWR
AMMO_DUMP
TEMESCAL_LPF
LYTLE_CREEK
MAPLE_CREEK
```

```
FAWNSKIN
CLEAR_CREEK
BEVERLY_HILLS
MILO
KERNVILLE
TRIMMER
CARPENTER_RIDGE
OJAI
CRANSTON
```

```
def count_missing_data(df):
 # Count the number of missing values by feature:
 df_na = df.isna().sum()
 df_na = df_na.drop(df_na[df_na == 0].index).sort_values(ascending=False)
 df_na = (df_na / len(df)) * 100
 missing_data = pd.DataFrame({"Missing Ratio" : df_na})
 display(missing_data)

count_missing_data(noaa_weather)
```

	Missing Ratio
NUM_COOLING_DEGREE_DAY_CUMULATIVE	15.925234
HEATING_DEGREE_DAYS_TO_DATE	14.074766
NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT	0.934579
NUM_COOLING_DEGREE_DAY	0.934579
TEMPERATURE_AVERAGE	0.598131
TEMPERATURE_MAX	0.392523
EXTREME_MAXIMUM_TEMPERATURE_MONTH	0.392523
NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT	0.392523
NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT	0.392523
TEMPERATURE_MIN	0.280374
EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH	0.280374
NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT	0.280374

```
# We will next impute values. We want to impute only from other samples from the same weather station. We will group by station AND month.
# We can expect that year to year, a value should be about the same for each month
stations = noaa_weather.STATION_NAME.unique()
features_by_station_and_month = noaa_weather.groupby([noaa_weather.STATION_NAME, noaa_weather.MONTH])
for feature in noaa_weather.select_dtypes(include="number").columns:
  # Skip imputing the year, month, latitude, or longitude:
  if not feature == "YEAR" and not feature == "MONTH" and not feature == "LATITUDE" and not feature == "LONGITUDE":
    print(f"Imputing feature by station and month { feature }")
    noaa_weather[feature] = features_by_station_and_month[feature].transform(lambda group: group.fillna(group.mean()))

count_missing_data(noaa_weather)
```

```
Imputing feature by station and month ELEVATION
Imputing feature by station and month NUM_COOLING_DEGREE_DAY_CUMULATIVE
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:9: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  if __name__ == '__main__':
Imputing feature by station and month NUM_COOLING_DEGREE_DAY
Imputing feature by station and month NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT
Imputing feature by station and month NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT
Imputing feature by station and month NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT
Imputing feature by station and month NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT
Imputing feature by station and month EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH
Imputing feature by station and month EXTREME_MAXIMUM_TEMPERATURE_MONTH
Imputing feature by station and month HEATING_DEGREE_DAYS_TO_DATE
Imputing feature by station and month NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT
Imputing feature by station and month TEMPERATURE_AVERAGE
Imputing feature by station and month TEMPERATURE_MAX
Imputing feature by station and month TEMPERATURE_MIN
```

	Missing Ratio

```
# Check to make sure all columns have correct type.... Looks good
noaa_weather.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5350 entries, 0 to 8448
Data columns (total 20 columns):
 #   Column                                      Non-Null Count  Dtype
---  ------                                      --------------  -----
 0   STATION                                     5350 non-null   object
 1   LATITUDE                                    5350 non-null   float64
 2   LONGITUDE                                   5350 non-null   float64
 3   ELEVATION                                   5350 non-null   float64
 4   STATION_NAME                                5350 non-null   object
 5   YEAR                                        5350 non-null   int64
 6   MONTH                                       5350 non-null   int64
 7   NUM_COOLING_DEGREE_DAY_CUMULATIVE           5350 non-null   float64
 8   NUM_COOLING_DEGREE_DAY                      5350 non-null   float64
 9   NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT   5350 non-null   float64
 10  NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT  5350 non-null   float64
 11  NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT  5350 non-null   float64
 12  NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT  5350 non-null   float64
 13  EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH       5350 non-null   float64
 14  EXTREME_MAXIMUM_TEMPERATURE_MONTH           5350 non-null   float64
 15  HEATING_DEGREE_DAYS_TO_DATE                 5350 non-null   float64
 16  NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT 5350 non-null   float64
 17  TEMPERATURE_AVERAGE                         5350 non-null   float64
 18  TEMPERATURE_MAX                             5350 non-null   float64
 19  TEMPERATURE_MIN                             5350 non-null   float64
dtypes: float64(16), int64(2), object(2)
memory usage: 877.7+ KB
```

```
# TODO: CHECK IF THIS GIVES GOOD RESULTS. HAVING TO IMPUTE A LOT!!


# Check which station, month, year pairs are missing
import itertools

noaa_stations = list(noaa_weather["STATION_NAME"].unique())
years = [i for i in range(1992, 2016)]
months = [i for i in range(1, 13)]

station_month_year_pairs = list(itertools.product(noaa_stations, months, years))
# print(station_month_year_pairs)
pairs_missing = 0
pairs_not_missing = 0

all_missing_triplets = []
for triple in station_month_year_pairs:
  if not ((noaa_weather["STATION_NAME"] == triple[0]) & (noaa_weather["YEAR"] == triple[2]) & (noaa_weather["MONTH"] == triple[1])).any():
    # print(f"Missing: {triple[0]}:{triple[1]}:{triple[2]}")
    all_missing_triplets.append((triple))
    pairs_missing += 1
  else:
    pairs_not_missing += 1

print(f"Total Station_Month_Year triplets missing: {pairs_missing}, or {pairs_missing / (pairs_missing + pairs_not_missing) * 100}%")
```

```
Total Station_Month_Year triplets missing: 429, or 7.447916666666667%
```

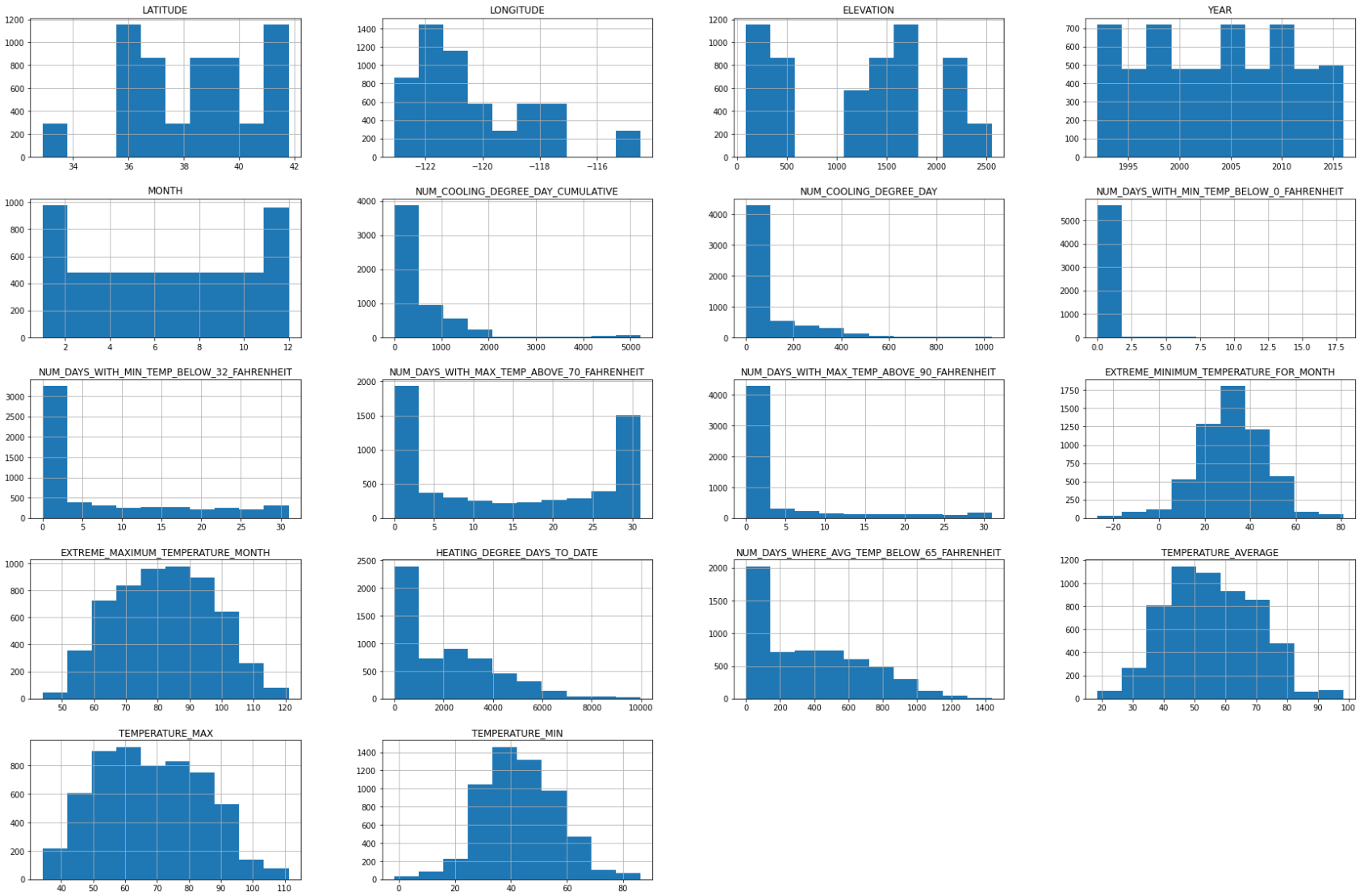
```
# With the given list of missing station, month, year pairs, impute the values.
print("Will now impute the prior values")
def impute_missing_month_row_year_pairs(true_records, imputed_records, station, month, year):
  """
  Given an incomplete dataset, and a missing (station, year, month) triplet,
  impute a row using the available data.

  Hierarchy to generate / impute a value:
  1. Reuse last recorded station month year pair. For example, if ("A", 2000, 7) is missing, fill it in with ("A", 1999, 7)
  2. If no years prior to the missing year exist, use the least recent recording from the same station
  """
  matching = true_records[((true_records["STATION_NAME"] == station) & (true_records["MONTH"] == month))]
  months_prior_to_year = matching[matching["YEAR"] < year]

  if months_prior_to_year.shape[0]:
    idx = months_prior_to_year["YEAR"].argmax()
    best_match = months_prior_to_year.iloc[idx].copy()
    print(f"PAST MATCH: { station }, { month }, { year } -> {best_match.STATION_NAME}, {best_match.MONTH}, {best_match.YEAR}" )
  else:
    # Get the least recent year if no prior years exist
    months_after_year = matching[matching["YEAR"] > year]
```

```
    idx = months_after_year["YEAR"].argmin()
    best_match = months_after_year.iloc[idx].copy()
    print(f"FUTURE MATCH: { station }, { month }, { year } -> {best_match.STATION_NAME}, {best_match.MONTH}, {best_match.YEAR}" )

  best_match["YEAR"] = year
  best_match["MONTH"] = month

  imputed_records.append(best_match)

imputed_records = []
for missing_record in all_missing_triplets:
  impute_missing_month_row_year_pairs(noaa_weather, imputed_records, missing_record[0], missing_record[1], missing_record[2])

noaa_weather = noaa_weather.append(imputed_records)
# get_matching_station(noaa_weather, "HUNTER_MOUNTAIN", 12, 2012)
```

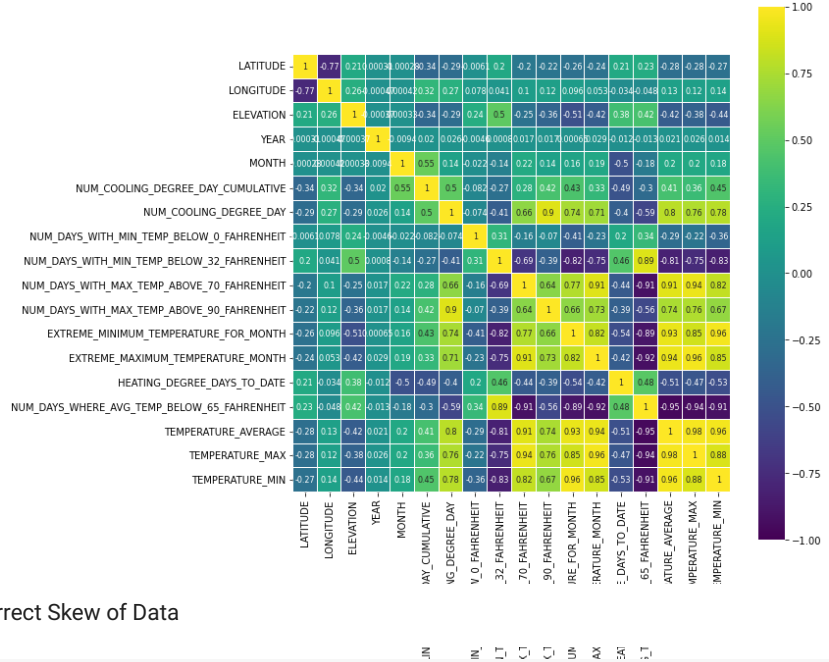
```
Will now impute the prior values
PAST MATCH: COHASSET, 1, 1995 -> COHASSET, 1, 1994
PAST MATCH: COHASSET, 2, 1995 -> COHASSET, 2, 1994
PAST MATCH: COHASSET, 5, 2012 -> COHASSET, 5, 2011
PAST MATCH: COHASSET, 6, 2012 -> COHASSET, 6, 2011
PAST MATCH: COHASSET, 12, 1994 -> COHASSET, 12, 1993
PAST MATCH: LADDER_BUTTE, 1, 1993 -> LADDER_BUTTE, 1, 1992
PAST MATCH: LADDER_BUTTE, 1, 1995 -> LADDER_BUTTE, 1, 1994
PAST MATCH: LADDER_BUTTE, 1, 2000 -> LADDER_BUTTE, 1, 1999
PAST MATCH: LADDER_BUTTE, 2, 1993 -> LADDER_BUTTE, 2, 1992
PAST MATCH: LADDER_BUTTE, 2, 1995 -> LADDER_BUTTE, 2, 1994
PAST MATCH: LADDER_BUTTE, 3, 1993 -> LADDER_BUTTE, 3, 1992
PAST MATCH: LADDER_BUTTE, 3, 1995 -> LADDER_BUTTE, 3, 1994
PAST MATCH: LADDER_BUTTE, 4, 1993 -> LADDER_BUTTE, 4, 1992
PAST MATCH: LADDER_BUTTE, 4, 1995 -> LADDER_BUTTE, 4, 1994
PAST MATCH: LADDER_BUTTE, 11, 1995 -> LADDER_BUTTE, 11, 1994
PAST MATCH: LADDER_BUTTE, 11, 2000 -> LADDER_BUTTE, 11, 1999
FUTURE MATCH: LADDER_BUTTE, 12, 1992 -> LADDER_BUTTE, 12, 1993
PAST MATCH: JUANITA_LAKE, 1, 1994 -> JUANITA_LAKE, 1, 1993
PAST MATCH: JUANITA_LAKE, 1, 2000 -> JUANITA_LAKE, 1, 1999
PAST MATCH: JUANITA_LAKE, 1, 2001 -> JUANITA_LAKE, 1, 1999
PAST MATCH: JUANITA_LAKE, 1, 2002 -> JUANITA_LAKE, 1, 1999
PAST MATCH: JUANITA_LAKE, 1, 2003 -> JUANITA_LAKE, 1, 1999
PAST MATCH: JUANITA_LAKE, 1, 2006 -> JUANITA_LAKE, 1, 2005
PAST MATCH: JUANITA_LAKE, 2, 2001 -> JUANITA_LAKE, 2, 2000
PAST MATCH: JUANITA_LAKE, 2, 2002 -> JUANITA_LAKE, 2, 2000
PAST MATCH: JUANITA_LAKE, 2, 2006 -> JUANITA_LAKE, 2, 2005
PAST MATCH: JUANITA_LAKE, 3, 1993 -> JUANITA_LAKE, 3, 1992
PAST MATCH: JUANITA_LAKE, 3, 2001 -> JUANITA_LAKE, 3, 2000
PAST MATCH: JUANITA_LAKE, 3, 2002 -> JUANITA_LAKE, 3, 2000
PAST MATCH: JUANITA_LAKE, 3, 2006 -> JUANITA_LAKE, 3, 2005
PAST MATCH: JUANITA_LAKE, 4, 2001 -> JUANITA_LAKE, 4, 2000
PAST MATCH: JUANITA_LAKE, 4, 2002 -> JUANITA_LAKE, 4, 2000
PAST MATCH: JUANITA_LAKE, 4, 2006 -> JUANITA_LAKE, 4, 2005
PAST MATCH: JUANITA_LAKE, 5, 1999 -> JUANITA_LAKE, 5, 1998
PAST MATCH: JUANITA_LAKE, 5, 2001 -> JUANITA_LAKE, 5, 2000
PAST MATCH: JUANITA_LAKE, 5, 2002 -> JUANITA_LAKE, 5, 2000
PAST MATCH: JUANITA_LAKE, 5, 2005 -> JUANITA_LAKE, 5, 2004
PAST MATCH: JUANITA_LAKE, 5, 2006 -> JUANITA_LAKE, 5, 2004
PAST MATCH: JUANITA_LAKE, 6, 1999 -> JUANITA_LAKE, 6, 1998
PAST MATCH: JUANITA_LAKE, 6, 2001 -> JUANITA_LAKE, 6, 2000
PAST MATCH: JUANITA_LAKE, 6, 2006 -> JUANITA_LAKE, 6, 2005
PAST MATCH: JUANITA_LAKE, 7, 2006 -> JUANITA_LAKE, 7, 2005
PAST MATCH: JUANITA_LAKE, 8, 1999 -> JUANITA_LAKE, 8, 1998
PAST MATCH: JUANITA_LAKE, 9, 1999 -> JUANITA_LAKE, 9, 1998
FUTURE MATCH: JUANITA_LAKE, 11, 1992 -> JUANITA_LAKE, 11, 1993
PAST MATCH: JUANITA_LAKE, 11, 1994 -> JUANITA_LAKE, 11, 1993
PAST MATCH: JUANITA_LAKE, 12, 1993 -> JUANITA_LAKE, 12, 1992
PAST MATCH: JUANITA_LAKE, 12, 1994 -> JUANITA_LAKE, 12, 1992
PAST MATCH: JUANITA_LAKE, 12, 1999 -> JUANITA_LAKE, 12, 1998
PAST MATCH: JUANITA_LAKE, 12, 2000 -> JUANITA_LAKE, 12, 1998
PAST MATCH: JUANITA_LAKE, 12, 2001 -> JUANITA_LAKE, 12, 1998
PAST MATCH: JUANITA_LAKE, 12, 2005 -> JUANITA_LAKE, 12, 2004
FUTURE MATCH: EEL_RIVER, 1, 1992 -> EEL_RIVER, 1, 1993
PAST MATCH: EEL_RIVER, 1, 1995 -> EEL_RIVER, 1, 1994
PAST MATCH: EEL_RIVER, 1, 1997 -> EEL_RIVER, 1, 1996
FUTURE MATCH: EEL_RIVER, 2, 1992 -> EEL_RIVER, 2, 1993
PAST MATCH: EEL_RIVER, 2, 1999 -> EEL_RIVER, 2, 1998
```

Plotting each of the numerical features

```
def plot_numerical_features(df):
  df.select_dtypes(include = "number").hist(figsize=(30, 20))

plot_numerical_features(noaa_weather)
```




```
# Correlation Analysis
noaa_corr = noaa_weather.select_dtypes(include = "number").corr()

plt.figure(figsize=(10, 10))
sns.heatmap(noaa_corr,
cmap='viridis', vmax=1.0, vmin=-1.0, linewidths=0.1,
annot=True, annot_kws={"size": 8}, square=True);
```



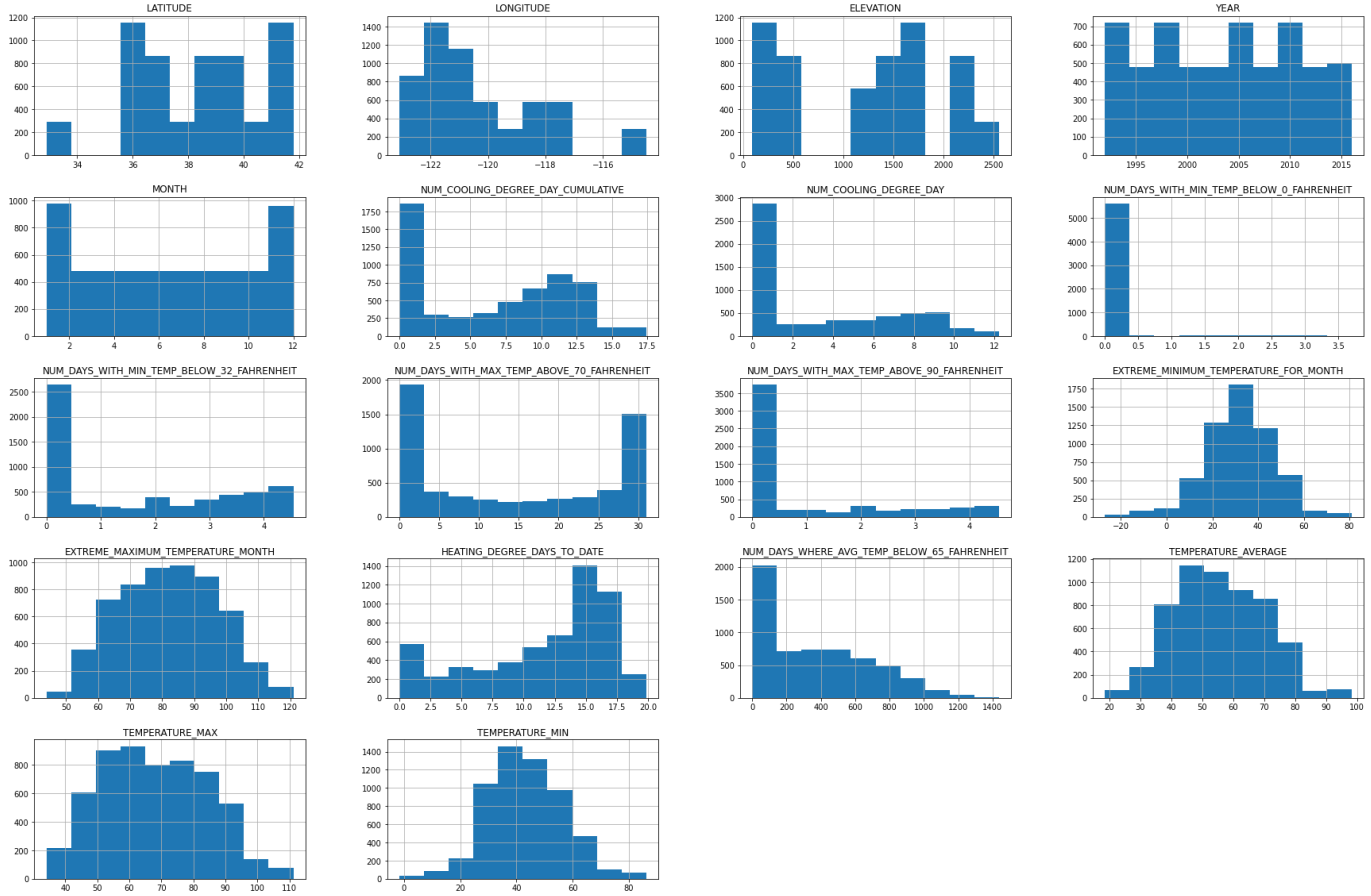
Correct Skew of Data

```
from scipy.stats import skew

numeric_feats = noaa_weather.dtypes[noaa_weather.dtypes != "object"]
numeric_feats = numeric_feats.drop(["LATITUDE", "LONGITUDE", "YEAR", "MONTH"])
numeric_feats = numeric_feats.index

# Check skew in numerical features:
skewed_feats = noaa_weather[numeric_feats].apply(lambda x: skew(x)).sort_values(ascending=False)
print(skewed_feats)
```

```
NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT      9.213557
NUM_COOLING_DEGREE_DAY_CUMULATIVE              3.124595
NUM_COOLING_DEGREE_DAY                         2.682703
NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT     2.044313
NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT     1.081981
HEATING_DEGREE_DAYS_TO_DATE                    0.934166
NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT    0.568674
TEMPERATURE_AVERAGE                            0.180799
TEMPERATURE_MAX                                0.168518
NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT     0.122478
TEMPERATURE_MIN                                0.107454
EXTREME_MAXIMUM_TEMPERATURE_MONTH              0.019898
ELEVATION                                     -0.081768
EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH         -0.214279
dtype: float64
```

```
from scipy.special import boxcox1p

# Next, we will fixed highly skewed features.
skewed_feats = skewed_feats[abs(skewed_feats) > 0.75]
skewed_feats_index = skewed_feats.index
lam = 0.15
for feat in skewed_feats_index:
  noaa_weather[feat] = boxcox1p(noaa_weather[feat], lam)
print("Corrected skew in the numerical features!")

plot_numerical_features(noaa_weather)
```

```
Corrected skew in the numerical features!
```



Normalization

```
from sklearn.preprocessing import StandardScaler, MinMaxScaler
print(noaa_weather.info())
labels_std_normalize = ["ELEVATION", "NUM_COOLING_DEGREE_DAY_CUMULATIVE", "NUM_COOLING_DEGREE_DAY", "NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT", "NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT", "NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEI
for label in labels_std_normalize:
  mean = noaa_weather[label].mean()
  std = noaa_weather[label].std()
  noaa_weather[label] = (noaa_weather[label] - mean) / std
display(noaa_weather)
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5779 entries, 0 to 8386
Data columns (total 20 columns):
 #   Column                                     Non-Null Count  Dtype
---  ------                                     --------------  -----
 0   STATION                                    5779 non-null   object
 1   LATITUDE                                   5779 non-null   float64
 2   LONGITUDE                                  5779 non-null   float64
 3   ELEVATION                                  5779 non-null   float64
 4   STATION_NAME                               5779 non-null   object
 5   YEAR                                       5779 non-null   int64
 6   MONTH                                      5779 non-null   int64
 7   NUM_COOLING_DEGREE_DAY_CUMULATIVE          5779 non-null   float64
 8   NUM_COOLING_DEGREE_DAY                     5779 non-null   float64
 9   NUM_DAYS_WITH_MIN_TEMP_BELOW_0_FAHRENHEIT  5779 non-null   float64
 10  NUM_DAYS_WITH_MIN_TEMP_BELOW_32_FAHRENHEIT 5779 non-null   float64
 11  NUM_DAYS_WITH_MAX_TEMP_ABOVE_70_FAHRENHEIT 5779 non-null   float64
 12  NUM_DAYS_WITH_MAX_TEMP_ABOVE_90_FAHRENHEIT 5779 non-null   float64
 13  EXTREME_MINIMUM_TEMPERATURE_FOR_MONTH      5779 non-null   float64
 14  EXTREME_MAXIMUM_TEMPERATURE_MONTH          5779 non-null   float64
 15  HEATING_DEGREE_DAYS_TO_DATE                5779 non-null   float64
 16  NUM_DAYS_WHERE_AVG_TEMP_BELOW_65_FAHRENHEIT 5779 non-null  float64
 17  TEMPERATURE_AVERAGE                        5779 non-null   float64
 18  TEMPERATURE_MAX                            5779 non-null   float64
 19  TEMPERATURE_MIN                            5779 non-null   float64
dtypes: float64(16), int64(2), object(2)
memory usage: 948.1+ KB
None
```

	STATION	LATITUDE	LONGITUDE	ELEVATION	STATION_NAME	YEAR	MONTH	NUM_COOLING_DEGREE_DAY_CUMULATIVE	NUM_COOLING_DEGREE_DAY	NUM_DAYS_WITH_MIN_TEMP_BE
0	USR0000CCOH	39.8717	-121.7689	-0.913217	COHASSET	1992	1	-1.239760	-0.886171	
1	USR0000CCOH	39.8717	-121.7689	-0.913217	COHASSET	1992	2	-0.850883	-0.338919	
2	USR0000CCOH	39.8717	-121.7689	-0.913217	COHASSET	1992	3	-0.850883	-0.886171	
3	USR0000CCOH	39.8717	-121.7689	-0.913217	COHASSET	1992	4	-0.316022	0.351139	
4	USR0000CCOH	39.8717	-121.7689	-0.913217	COHASSET	1992	5	0.477971	1.449139	
...	...	...	...	...	...	...	...	...	...	
8394	USR0000CHNM	36.5625	-117.4736	1.197506	HUNTER_MOUNTAIN	2011	11	0.739154	-0.886171	
8199	USR0000CHNM	36.5625	-117.4736	1.197506	HUNTER_MOUNTAIN	1994	12	0.728818	-0.886171	

Write the data to a CSV for use in later processing

8386	USR0000CHNM	36.5625	-117.4736	1.197506	HUNTER_MOUNTAIN	2012	12	0.772949	-0.886171	

```
get_matching_station = lambda weather_table, station, month, year: (weather_table[((weather_table["STATION_NAME"] == station) & (weather_table["MONTH"] == month) & (weather_table["YEAR"] == year))])
get_matching_station(noaa_weather, "HELL_HOLE", 4, 2004)
# HUNTER_MOUNTAIN, 12, 2012
get_matching_station(noaa_weather, "HUNTER_MOUNTAIN", 12, 2012)
```

	STATION	LATITUDE	LONGITUDE	ELEVATION	STATION_NAME	YEAR	MONTH	NUM_COOLING_DEGREE_DAY_CUMULATIVE	NUM_COOLING_DEGREE_DAY	NUM_DAYS_WITH_MIN_TEMP_BE
8386	USR0000CHNM	36.5625	-117.4736	1.197506	HUNTER_MOUNTAIN	2012	12	0.772949	-0.886171	

```
noaa_weather.to_csv("/content/drive/Shareddrives/Data Science 303 Group Project/csv/noaa_weather/noaa_CA_1992_2016_weather_2781174_CLEANED.csv")
```