Dataset Resource : https://www.kaggle.com/atulanandjha/temperature-readings-iot-devices

Task :

1.Variance of temprature inside and outside room?

2.How inside temprature related to outside temprature

There are 5 columns are present in our dataset. that's means,we are having 5-dimensional spaces:

1. id : Unique id for each reading
2. room_id/ : room id in which device was installed(inside/and or outside)
3. note_data : date and time of reading
4. temp : temprature readings
5. out/In: whether reading was taken from device installed inside or outside of Room

Let's import the library

In [1]:

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

In [29]:

```
from google.colab import files
uploaded = files.upload()
```

Choose File No file selected

Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving IOT_filter_data.csv to IOT_filter_data (1).csv
```

We read the IOT dataset

In [30]:

```
data = pd.read_csv("IOT_filter_data.csv")
```

By default, we get top 5 rows

In [31]:

```
data.head()
```

Out[31]:

	id	room_id/id	noted_date	temp	out/in
0	__export__.temp_log_196134_bd201015	Room Admin	12/8/2018 9:30	29	In
1	__export__.temp_log_196131_7bca51bc	Room Admin	12/8/2018 9:30	29	In
2	__export__.temp_log_196127_522915e3	Room Admin	12/8/2018 9:29	41	Out
3	__export__.temp_log_196128_be0919cf	Room Admin	12/8/2018 9:29	41	Out

		id	room_id/id	noted_date	temp	out/in
4	__export__.temp_log_196126_d30b72f8	4	Room Admin	12/8/2018 9:29	31	In

Using shape, let's get shape of dataset

In [32]:

```
data.shape
```

Out[32]:

```
(6999, 5)
```

Observation : There are 6999 rows and 5 columns

In [33]:

```
data.columns
```

Out[33]:

```
Index(['id', 'room_id/id', 'noted_date', 'temp', 'out/in'], dtype='object')
```

Observation : We got number of columns which are existing in DataFrame

In [34]:

```
data['out/in'].value_counts()
```

Out[34]:

```
Out    4531
In     2468
Name: out/in, dtype: int64
```

Observation : temprature reading was taken by installed device inside room = 4531 and outside room = 2468

In [35]:

```
print("Unique values in every column \n"+'-'*25)
for i in data.columns:
  print("\t"+i+"=",len(set(data[i])))
```

```
Unique values in every column
-------------------------
 id= 6998
 room_id/id= 1
 noted_date= 3307
 temp= 23
 out/in= 2
```

Observation : We got unique value for every column

In [36]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6999 entries, 0 to 6998
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype 
---  ------      --------------  ----- 
 0   id          6999 non-null   object
 1   room_id/id  6999 non-null   object
 2   noted_date  6999 non-null   object
 3   temp        6999 non-null   int64 
```

```
 4   out/in      6999 non-null   object
dtypes: int64(1), object(4)
memory usage: 273.5+ KB
```

In [37]:

```
data.describe()
```

Out[37]:

	temp
count	6999.000000
mean	34.150450
std	4.828534
min	21.000000
25%	29.000000
50%	36.000000
75%	38.000000
max	43.000000

Using data.describe(), we got total row count: 6999 mean = 34.150450 standard_deviation: 4.828534 min value = 21 25% = 29.0 50% = 36.000 75% = 38.000 maximum value = 43.000000

In [38]:

```
df = data.drop(['id','room_id/id'],axis=1)
df.head()
```

Out[38]:

	noted_date	temp	out/in
0	12/8/2018 9:30	29	In
1	12/8/2018 9:30	29	In
2	12/8/2018 9:29	41	Out
3	12/8/2018 9:29	41	Out
4	12/8/2018 9:29	31	In

We check for missing value

In [39]:

```
data.isnull().sum()
```

Out[39]:

```
id             0
room_id/id     0
noted_date     0
temp           0
out/in         0
dtype: int64
```

We did not find any null value

Separate date and time

In [45]:

```
date = [] # date list is declared
time = [] # time list is declared

for i in df['noted_date']:
  #print(i)
  date.append(i.split(' ')[0])
  time.append(i.split(' ')[1])
df['date'] = date
df['time'] = time
df.head()
```

Out[45]:

	noted_date	temp	out/in	date	time
0	12/8/2018 9:30	29	In	12/8/2018	9:30
1	12/8/2018 9:30	29	In	12/8/2018	9:30
2	12/8/2018 9:29	41	Out	12/8/2018	9:29
3	12/8/2018 9:29	41	Out	12/8/2018	9:29
4	12/8/2018 9:29	31	In	12/8/2018	9:29

Observation : Need to drop the noted_date column parmanently

In [46]:

```
df.drop(['noted_date'],axis=1,inplace=True)
df.head()
```

Out[46]:

	temp	out/in	date	time
0	29	In	12/8/2018	9:30
1	29	In	12/8/2018	9:30
2	41	Out	12/8/2018	9:29
3	41	Out	12/8/2018	9:29
4	31	In	12/8/2018	9:29

Observation :We have splitted the date and time in new different columns(date and time) for simplicity

Let's separate the date in day,month and year

In [48]:

```
try:
  df['date'] = pd.to_datetime(df['date'])# converted date into standard format year-month-daye.
  df['year'] = df.date.dt.year
  df['month'] = df.date.dt.month
  df['day'] = df.date.dt.day
except:
  print("Operations already performed")
#print(df['date'])
```

In [49]:

```
df.head()
```

Out[49]:

	temp	out/in	date	time	year	month	day
0	29	In	2018-12-08	9:30	2018	12	8
1	29	In	2018-12-08	9:30	2018	12	8
2	41	Out	2018-12-08	9:29	2018	12	8
3	41	Out	2018-12-08	9:29	2018	12	8
4	31	In	2018-12-08	9:29	2018	12	8

Let's drop date column

In [50]:

```
df.drop(['date'],axis=1,inplace=True)
df.head()
```

Out[50]:

	temp	out/in	time	year	month	day
0	29	In	9:30	2018	12	8
1	29	In	9:30	2018	12	8
2	41	Out	9:29	2018	12	8
3	41	Out	9:29	2018	12	8
4	31	In	9:29	2018	12	8

let's sort the year,month and day *italicized text*

In [51]:

```
print("Days of observation:",sorted(df['day'].unique()))
print("Months of observation:",sorted(df['month'].unique()))
print("Years of observation:",sorted(df['year'].unique()))
```

```
Days of observation: [1, 2, 3, 4, 5, 6, 7, 8]
Months of observation: [12]
Years of observation: [2018]
```

In [52]:

```
df.head()
```

Out[52]:

	temp	out/in	time	year	month	day
0	29	In	9:30	2018	12	8
1	29	In	9:30	2018	12	8
2	41	Out	9:29	2018	12	8
3	41	Out	9:29	2018	12	8
4	31	In	9:29	2018	12	8

Let's reassemble the new dataframe

In [53]:

```
df = df[['day','month','year','time','out/in','temp']]
df.head()
```

Out[53]:

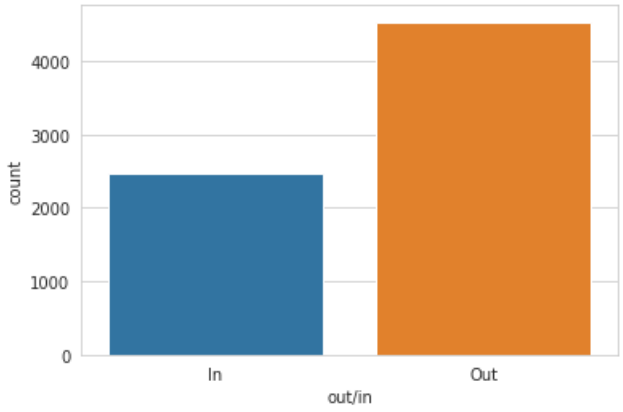
	day day	month month	year year	time time	out/in out/in	temp temp
0	8	12	2018	9:30	In	29
1	8	12	2018	9:30	In	29
2	8	12	2018	9:29	Out	41
3	8	12	2018	9:29	Out	41
4	8	12	2018	9:29	In	31

In [73]:

```
sns.countplot(df['out/in'])
```

Out[73]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f2166768940>
```

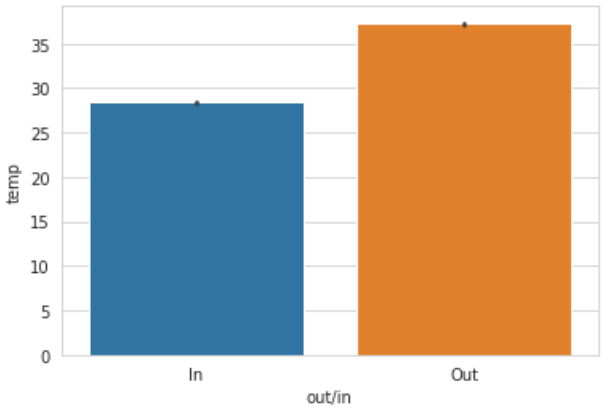


In [74]:

```
sns.barplot(df['out/in'],df['temp'])
```

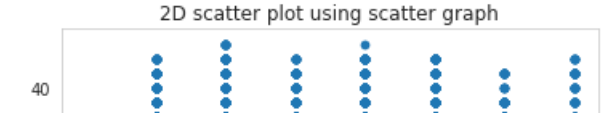
Out[74]:

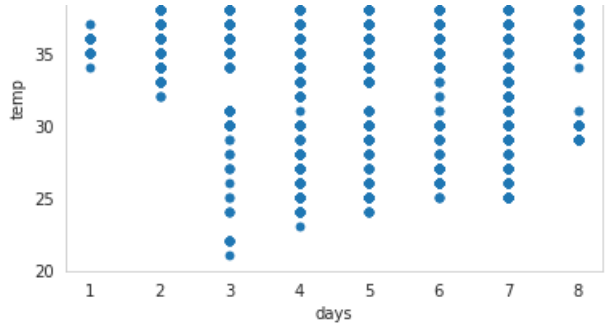
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f2166cdd048>
```



In [54]:

```
df.plot(kind = "scatter",x = "day",y = "temp")
plt.xlabel("days")
plt.ylabel("temp")
plt.title("2D scatter plot using scatter graph")
plt.grid()
plt.show()
```

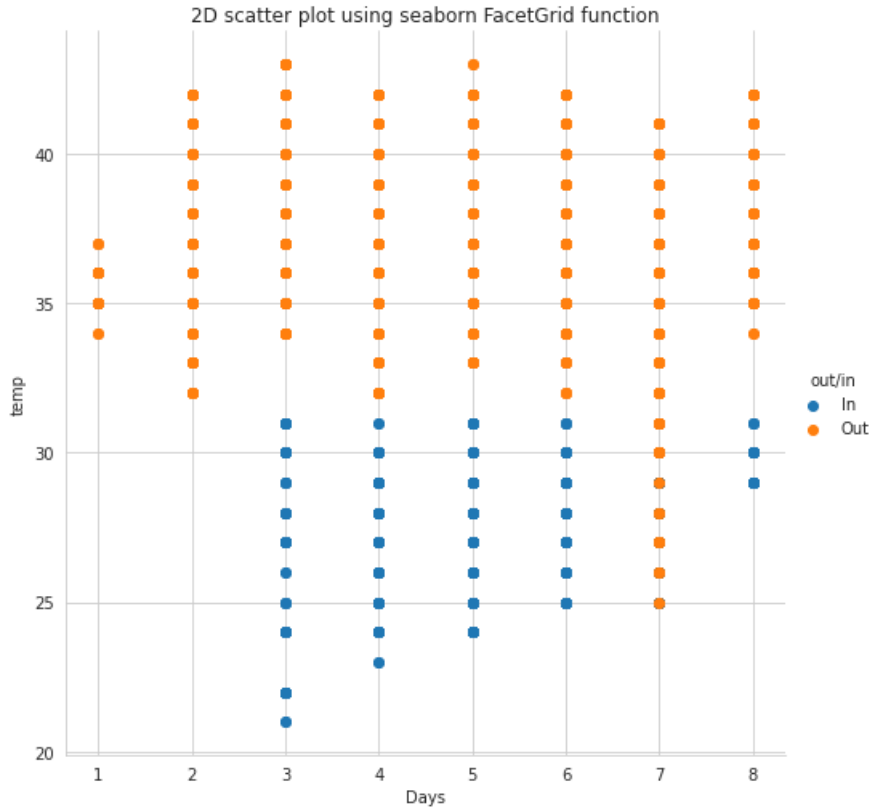




Observation: We use the scatter plot to plot the days on x-axis and temprature on y-axis. We use the matplotlib library which provides the function grid() and show(). Using those function,we plot the data into grid and also display it on console. Scatter plot shows the data as same color.We are unable to distinguish In and Out. So we use seaborn to visiualize the data in well form and make us to identify the data easily.

In [55]:

```
sns.set_style("whitegrid")
sns.FacetGrid(df,hue="out/in",height=7)\
   .map(plt.scatter,"day","temp")\
   .add_legend()
plt.xlabel("Days")
plt.ylabel("temp")
plt.title("2D scatter plot using seaborn FacetGrid function")
plt.show()
```



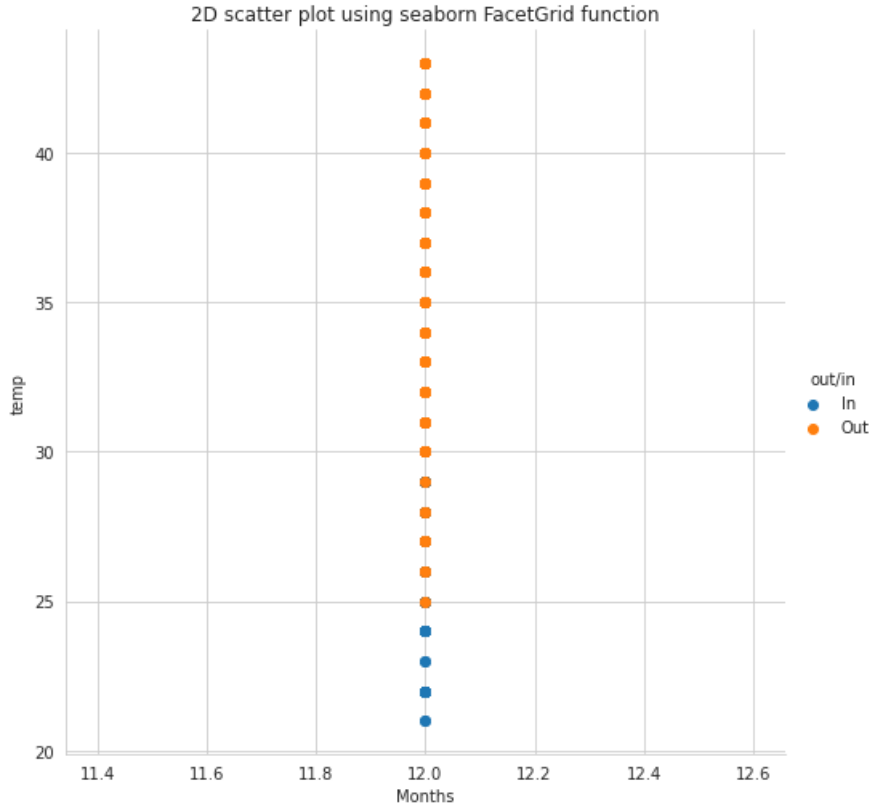
Observation: We use seaborn library function FacetGrid(which plot multigrid object) show the difference between In and Out temprature. We can distingish the orange and blue color. Hence the blue color represents temprature by installed device inside room and orange color represents tempratrue by installed device outside room

Similarly, we visualize the temprature on behalf of month and year

In [56]:

```
sns.set_style("whitegrid")
sns.FacetGrid(df,hue="out/in",height=7)\
   .map(plt.scatter,"month","temp")\
```

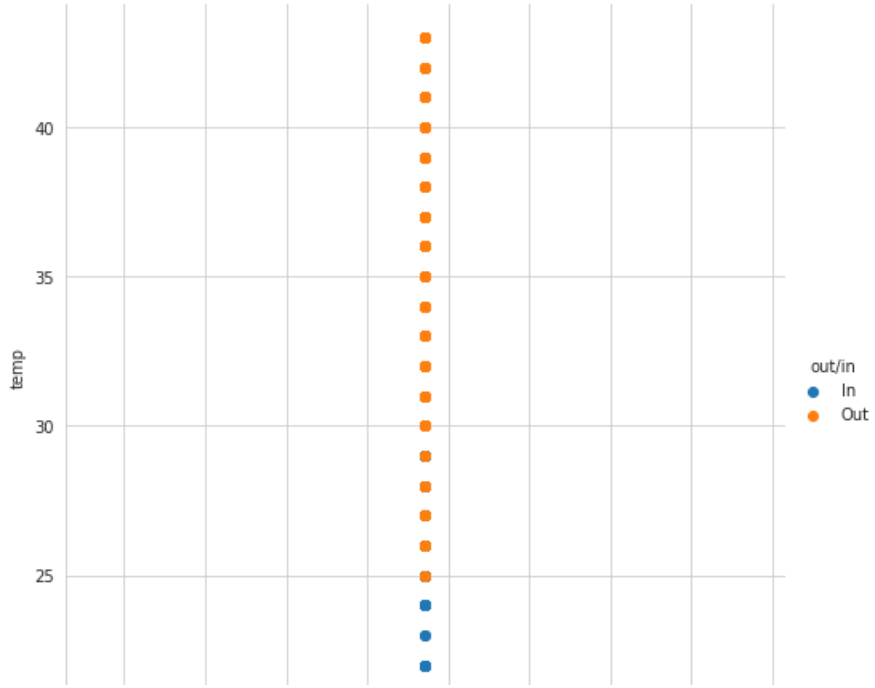
```
    .add_legend()
plt.xlabel("Months")
plt.ylabel("temp")
plt.title("2D scatter plot using seaborn FacetGrid function")
plt.show()
```

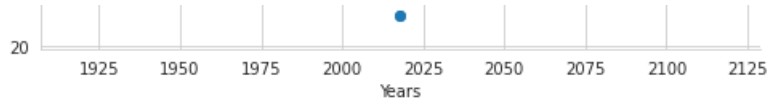


Let's visualize the temprature on behalf on years

In [57]:

```
sns.set_style("whitegrid")
sns.FacetGrid(df,hue="out/in",height=7)\
    .map(plt.scatter,"year","temp")\
    .add_legend()
plt.xlabel("Years")
plt.ylabel("temp")
plt.show()
```





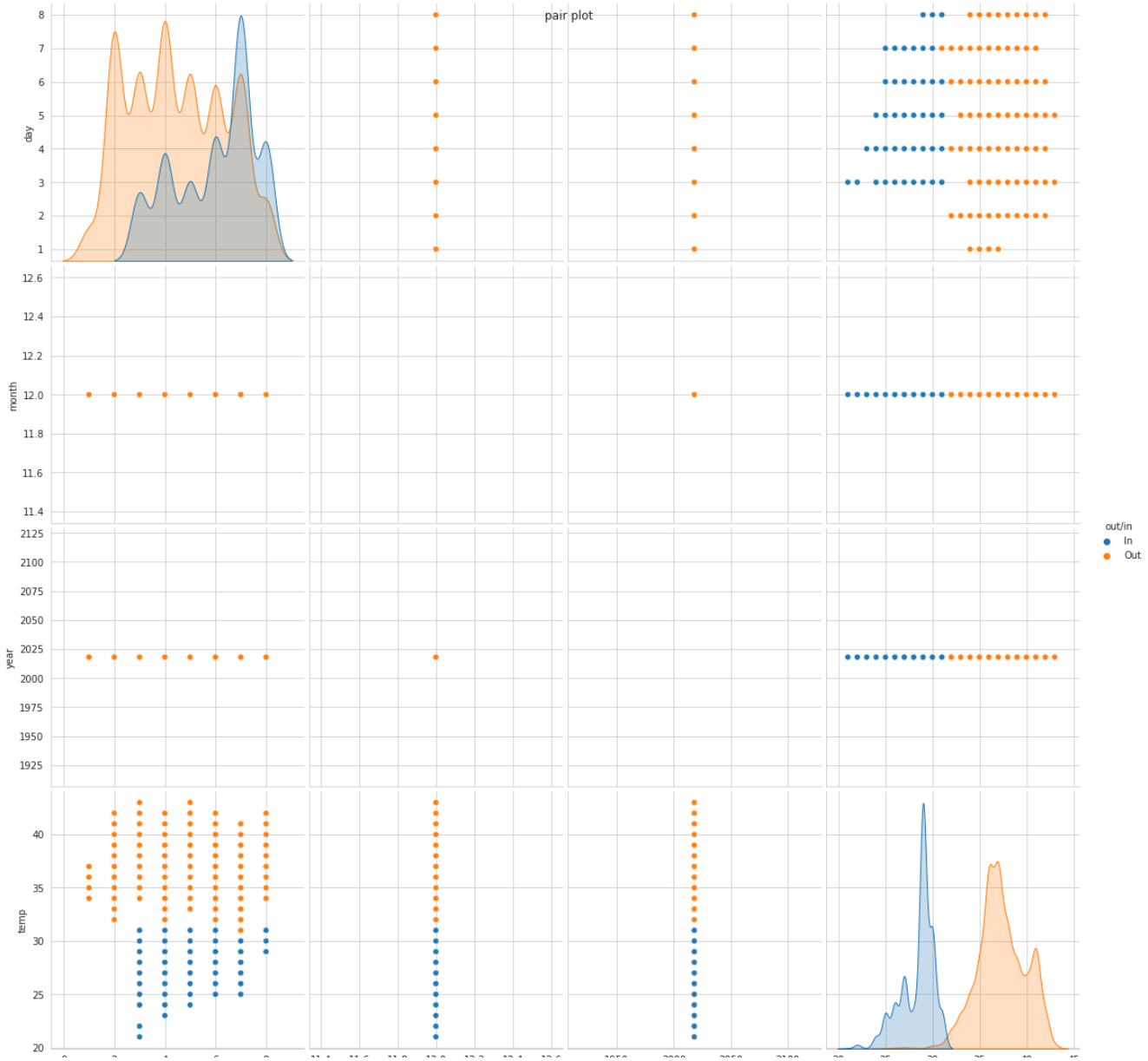
Let's use pairplot

In [59]:

```
import warnings
warnings.filterwarnings("ignore")
sns.set_style("whitegrid")
g = sns.pairplot(df,hue="out/in",height=4,vars=['day','month','year','temp'])
plt.suptitle("pair plot")
xlabel,ylabel = [],[]
for ax in g.axes[-1,:]:
  xlabels = ax.xaxis.get_label_text()
  xlabel.append(xlabels)
for ax in g.axes[:0]:
  ylabels = ax.yaxis.get_label_text()
  ylabel.append(ylabels)

for i in range(len(xlabel)):
  for j in range(len(ylabel)):
    g.axes[j,i].xaxis.set_label_text(xlabel[i])
    g.axes[j,i].yaxis.set_label_text(ylabel[j])


plt.show()
```

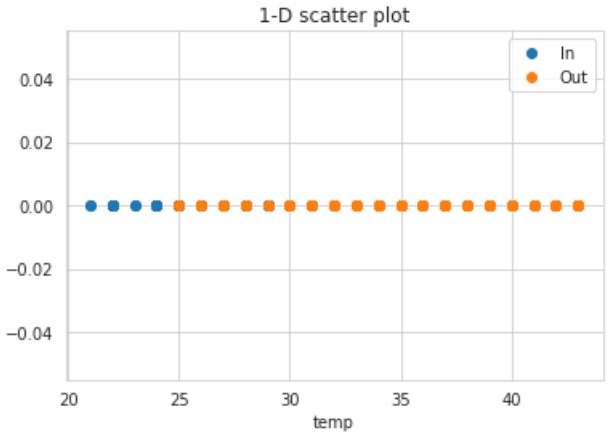


When we seems that we can not plot 4D scatter so we used pairplot which visualize the data in 2D spaces

Univariate Data Analysis

In [64]:

```
df_in = df.loc[df["out/in"]=='In']
df_out = df.loc[df["out/in"]=='Out']
plt.plot(df_in["temp"],np.zeros_like(df_in["temp"]),'o',label = "In")
plt.plot(df_out["temp"],np.zeros_like(df_out["temp"]),'o',label = 'Out')
plt.xlabel("temp")
plt.title("1-D scatter plot")
plt.legend()
plt.show()
```

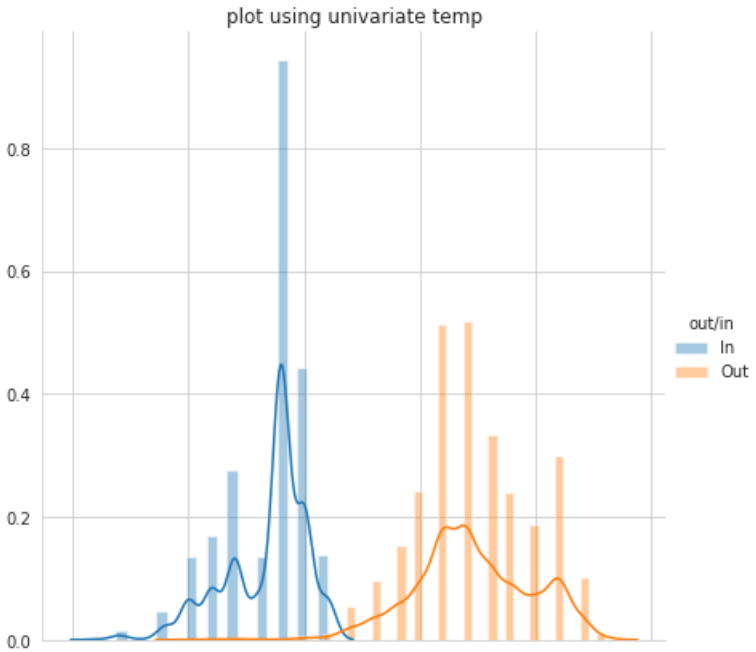


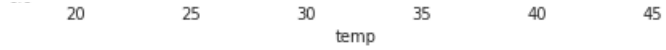
In [66]:

```
#PDF

import warnings
warnings.filterwarnings("ignore")

sns.FacetGrid(df,hue="out/in",height=6)\
   .map(sns.distplot,'temp')\
   .add_legend()
plt.title("plot using univariate temp")
plt.xlabel("temp")
plt.show()
```





Range of temprature inside room between 20 to 32 and outside room is 23 to 44

In [77]:

```
import numpy as np
print("means and std-dev for df_in")
print(np.mean(df_in['temp']))
print(np.std(df_in['temp']))

print("mean and std-dev for df_out")
print(np.mean(df_out['temp']))


print(np.std(df_out['temp']))
```

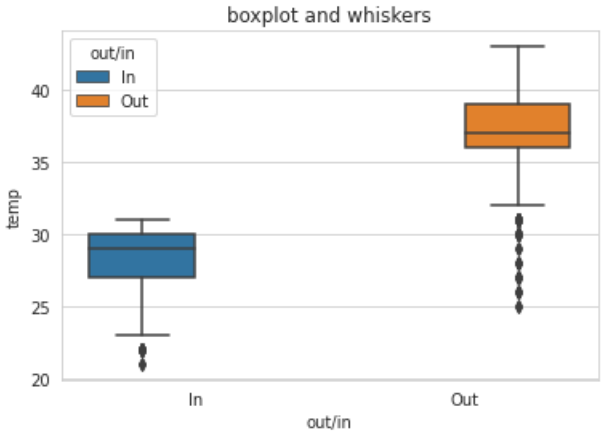
```
means and std-dev for df_in
28.4015397082658
1.7639320565960288
mean and std-dev for df_out
37.28183623924079
2.550790406471302
```

Observation: The value of mean and std-dev for outside room temprature comparatively high than inside room temprature

Let's boxplot and whiskers

In [78]:

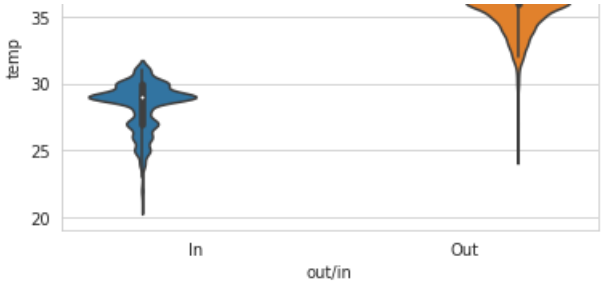
```
sns.boxplot(x = "out/in",y="temp",data = df,hue="out/in")
plt.title("boxplot and whiskers")
plt.xlabel("out/in")
plt.ylabel("temp")
plt.show()
```



In [79]:

```
#Voilin plot

sns.violinplot(x="out/in",y="temp",data=df,size=8,hue="out/in")
plt.title("Voilin Plot")
plt.xlabel("out/in")
plt.ylabel("temp")
plt.show()
```


35
30
25
20
temp
In
Out
out/in