In [1]:

```
#importing packages

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

In [2]:

```
#Read a comma-seperated values (csv) file into DataFrame

df = pd.read_csv("LivongoChallenge.csv")
```

In [3]:

```
df.head()
```

Out[3]:

	member_id	diabetes_type	gender	date_utc	bg_checks	avg_bg_value	count_hyper_reading
0	1.021330e+13	Type 2	Female	8/1/17	4	157.00000	2
1	1.021330e+13	Type 2	Female	8/2/17	4	152.61111	1
2	1.021330e+13	Type 2	Female	8/3/17	1	157.88235	1
3	1.021330e+13	Type 2	Female	8/4/17	2	162.47058	2
4	1.021330e+13	Type 2	Female	8/5/17	4	166.22223	2

In [4]:

```
df.describe()
```

Out[4]:

	member_id	bg_checks	avg_bg_value	count_hyper_reading	count_hypo_reading
count	7.297700e+04	72977.000000	71799.000000	72977.000000	72977.000000
mean	5.298323e+12	3.858380	158.036572	1.538498	0.273113
std	4.582929e+12	2.628071	40.560806	1.670834	0.674958
min	1.022970e+12	0.000000	56.750000	0.000000	0.000000
25%	1.027170e+12	2.000000	128.126600	0.000000	0.000000
50%	1.029210e+12	3.000000	153.000000	1.000000	0.000000
75%	1.021550e+13	5.000000	179.835585	2.000000	0.000000
max	1.021810e+13	45.000000	354.000000	45.000000	12.000000

In [5]:
```
#To check if there are any null values in the features
df.isnull().sum()
```

Out[5]:
```
member_id                 0
diabetes_type             0
gender                    0
date_utc                  0
bg_checks                 0
avg_bg_value           1178
count_hyper_reading       0
count_hypo_reading        0
dtype: int64
```

It can be seen that there are 1178 null values present in the feataure avg_bg_value

Data Munging

Convert categorical variables to numerical variables

In [6]:
```
df["diabetes_type"].value_counts()
```

Out[6]:
```
Type 2    39417
Type 1    33560
Name: diabetes_type, dtype: int64
```

In [7]:
```
df["diabetes_type"] = df.apply(lambda x: 1 if x['diabetes_type'] == 'Typ
e 1' else 2, axis = 1)
```

In [8]:
```
df.describe()
```

Out[8]:

	member_id	diabetes_type	bg_checks	avg_bg_value	count_hyper_reading	count_hyp
count	7.297700e+04	72977.000000	72977.000000	71799.000000	72977.000000	7297
mean	5.298323e+12	1.540129	3.858380	158.036572	1.538498	
std	4.582929e+12	0.498390	2.628071	40.560806	1.670834	
min	1.022970e+12	1.000000	0.000000	56.750000	0.000000	
25%	1.027170e+12	1.000000	2.000000	128.126600	0.000000	
50%	1.029210e+12	2.000000	3.000000	153.000000	1.000000	
75%	1.021550e+13	2.000000	5.000000	179.835585	2.000000	
max	1.021810e+13	2.000000	45.000000	354.000000	45.000000	

Data Analysis

In [9]:

```
df['date'] = pd.to_datetime(df['date_utc'])
```

In [10]:

```
df['month'] = df.date.dt.strftime('%m')
```

In [11]:

```
df['year'] = df.date.dt.strftime('%y')
```

In [12]:

```
df['year'].unique()
```

Out[12]:

```
array(['17', '18'], dtype=object)
```

In [13]:

```
df['month'].unique()
```

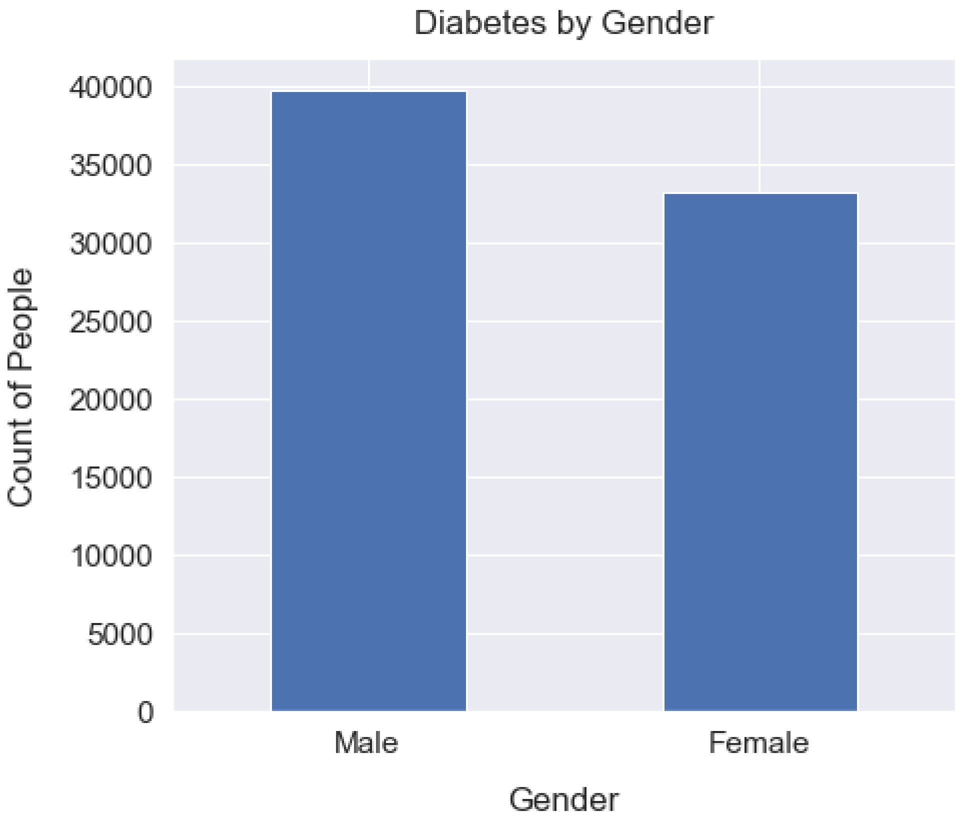
Out[13]:

```
array(['08', '09', '10', '11', '12', '01', '02', '03', '04', '05', '0
6',
       '07'], dtype=object)
```

The data comprises of years 2017 and 2018

In [14]:

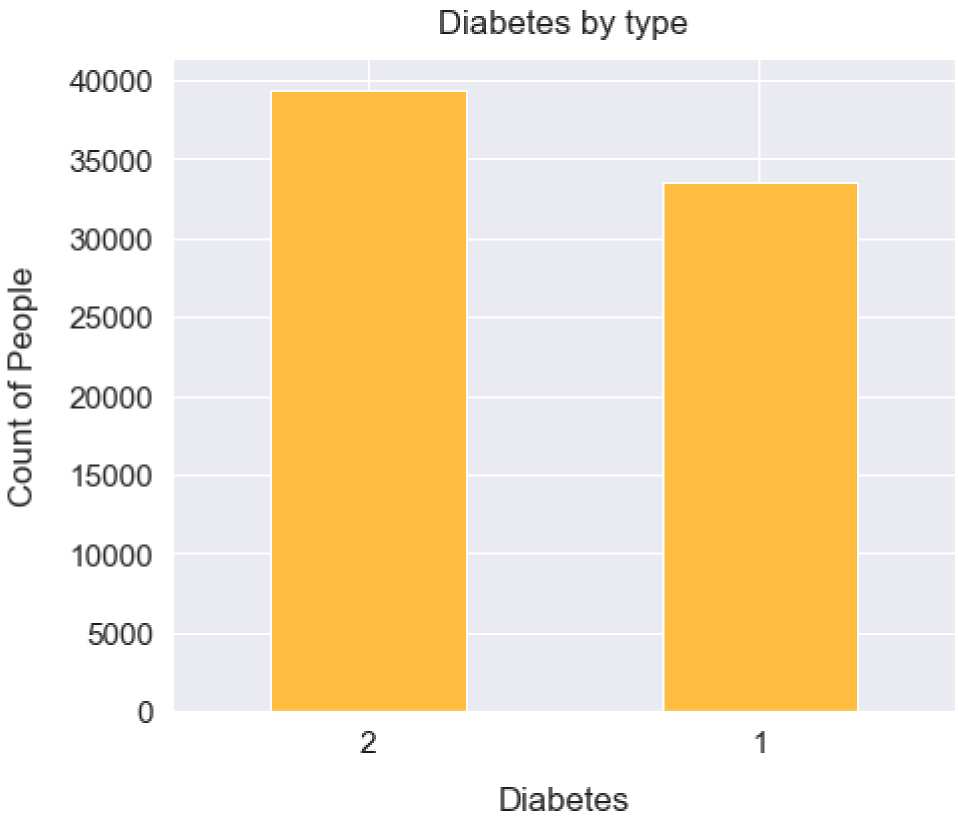
```
sns.set(font_scale=1.4)
df['gender'].value_counts().plot(kind='bar', figsize=(7, 6), rot=0)
plt.xlabel("Gender", labelpad=14)
plt.ylabel("Count of People", labelpad=14)
plt.title("Diabetes by Gender", y=1.02);
```



It can be inferred that gender has some effect on diabetes. It could be because women have less glucose level than men. (Source: Google)

In [30]:

```
sns.set(font_scale=1.4)
df['diabetes_type'].value_counts().plot(kind='bar', figsize=(7, 6), rot=
0, color="#ffbe42")
plt.xlabel("Diabetes", labelpad=14)
plt.ylabel("Count of People", labelpad=14)
plt.title("Diabetes by type", y=1.02);
```



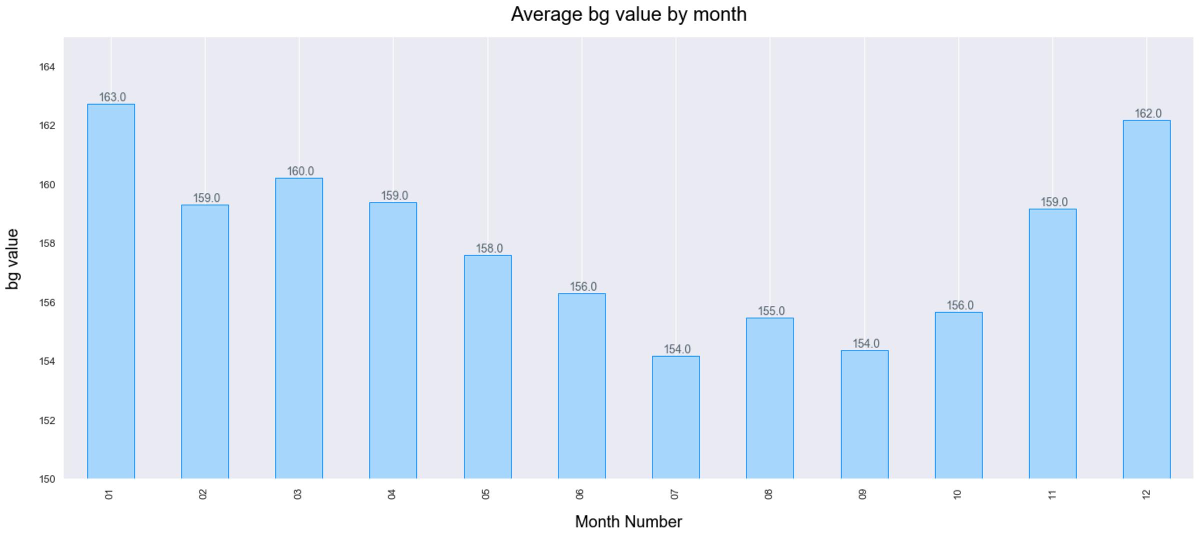
A large number of members have type 2 diabetes as compared to type 1 diabetes.

In [16]:

```
Diab_month = df.groupby(['month'])['avg_bg_value'].mean()
Diab_month.columns = ['avg_bg_value', 'month']
```

In [17]:
```
ax = Diab_month.plot.bar(colors="#A6D6FB", figsize=(25,10), fontsize=13, edgecolor='#008FFF')
for i in ax.patches:
    ax.annotate(np.round(i.get_height()), (i.get_x()+i.get_width()/2, i.get_height()),
          ha='center', va='center', color='#4F616B',fontsize =14,
          xytext=(2,8), textcoords='offset points')
ax.yaxis.grid()
ax.set_title('Average bg value by month', fontsize=24, color='black', pad=20)
plt.ylabel('bg value',fontsize=20, color='black')
plt.xlabel('Month Number',fontsize=20, color='black')
ax.yaxis.labelpad = 20
ax.xaxis.labelpad = 20
plt.ylim((150,165))
plt.show()
```

```
/anaconda3/lib/python3.6/site-packages/pandas/plotting/_core.py:185: UserWarning: 'colors' is being deprecated. Please use 'color'instead of 'colors'
  warnings.warn(("'colors' is being deprecated. Please use 'color'"
```

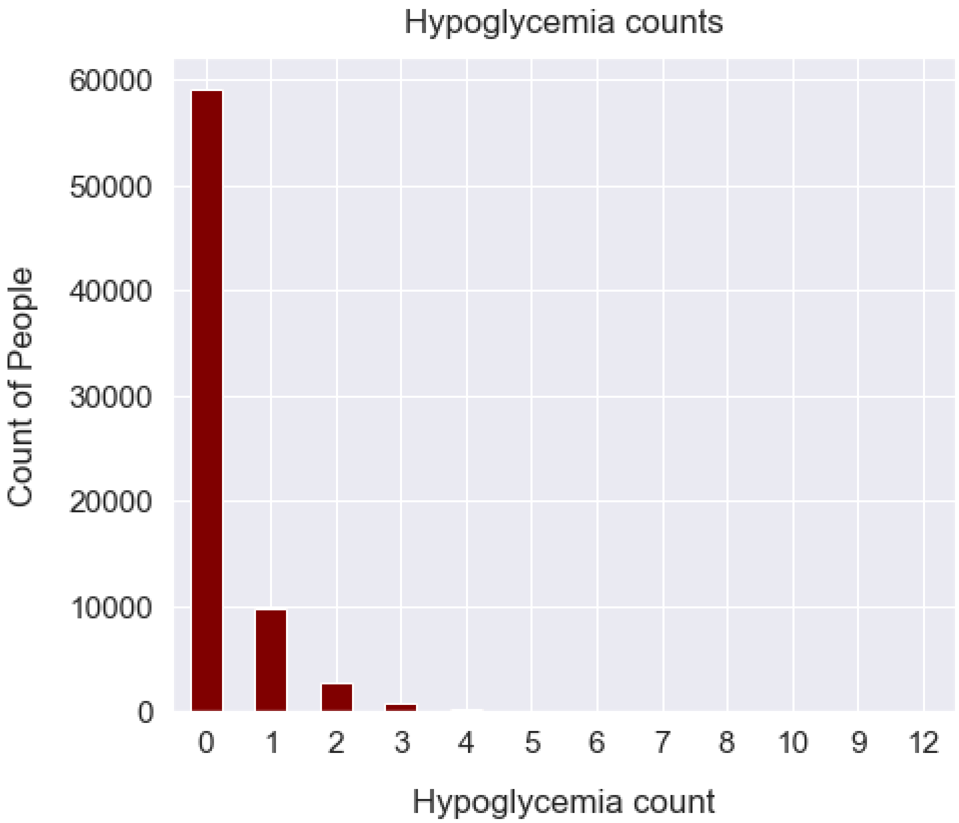


The bar chart above indicates that members showed higher blood glucose levels on a monthly average. This can be used to monitor monthly average per member and reasons for the fluctuations.

The hike we see in January to December months could be because of Christmas/New Year celebrations.

In [24]:

```
sns.set(font_scale=1.4)
df['count_hypo_reading'].value_counts().plot(kind='bar', figsize=(7, 6),
rot=0, color = '#800000')
plt.xlabel("Hypoglycemia count", labelpad=14)
plt.ylabel("Count of People", labelpad=14)
plt.title("Hypoglycemia counts", y=1.02);
```

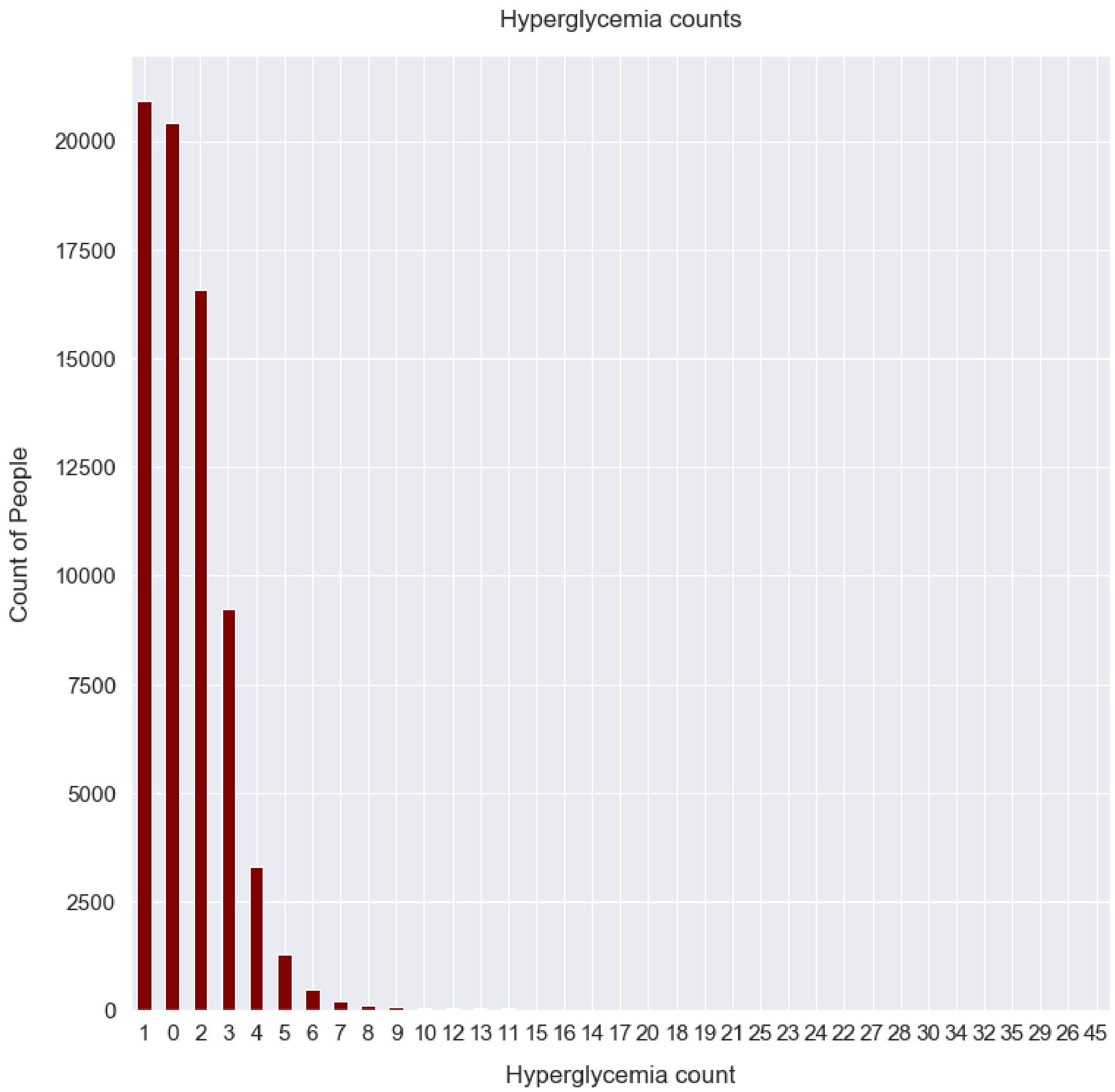


The above graph shows hypoglycemia counts for all the people. It can be obseved that most of the diabetic people do not have hypoglycemia. Only 10000 people have counted hypoglycemia once.

We can filter it to show only type-1 or type-2 diabetic people using groupby function.

In [25]:

```
sns.set(font_scale=1.4)
df['count_hyper_reading'].value_counts().plot(kind='bar', figsize=(12, 1
2), rot=0, color="#800000")
plt.xlabel("Hyperglycemia count", labelpad=14)
plt.ylabel("Count of People", labelpad=14)
plt.title("Hyperglycemia counts", y=1.02);
```



From the above graph we can see that a majority portion of diabetic people have hyperglycemia counts.