In [1]:

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

In [2]:

```
#Load the data
df = pd.read_csv("cardio_train.csv",delimiter=";")
```

In [3]:

```
df.head()
```

Out[3]:

	id	age	gender	height	weight	ap_hi	ap_lo	cholesterol	gluc	smoke	alco	active	cardio
0	0	18393	2	168	62.0	110	80	1	1	0	0	1	0
1	1	20228	1	156	85.0	140	90	3	1	0	0	1	1
2	2	18857	1	165	64.0	130	70	3	1	0	0	0	1
3	3	17623	2	169	82.0	150	100	1	1	0	0	1	1
4	4	17474	1	156	56.0	100	60	1	1	0	0	0	0

In [4]:

```
df.tail()
```

Out[4]:

	id	age	gender	height	weight	ap_hi	ap_lo	cholesterol	gluc	smoke	alco	active	cardio
69995	99993	19240	2	168	76.0	120	80	1	1	1	0	1	0
69996	99995	22601	1	158	126.0	140	90	2	2	0	0	1	1
69997	99996	19066	2	183	105.0	180	90	3	1	0	1	0	1
69998	99998	22431	1	163	72.0	135	80	1	2	0	0	0	1
69999	99999	20540	1	170	72.0	120	80	2	1	0	0	1	0

In [5]:

```
df = df.drop(['id'],axis=1)
```

In [6]:

```
df.dtypes
```

Out[6]:

```
age              int64
gender           int64
height           int64
weight         float64
ap_hi            int64
ap_lo            int64
cholesterol      int64
gluc             int64
smoke            int64
alco             int64
active           int64
cardio           int64
dtype: object
```

In [7]:
```
df.isnull().sum()
```

Out[7]:
```
age            0
gender         0
height         0
weight         0
ap_hi          0
ap_lo          0
cholesterol    0
gluc           0
smoke          0
alco           0
active         0
cardio         0
dtype: int64
```

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 70000 entries, 0 to 69999
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   age          70000 non-null  int64  
 1   gender       70000 non-null  int64  
 2   height       70000 non-null  int64  
 3   weight       70000 non-null  float64
 4   ap_hi        70000 non-null  int64  
 5   ap_lo        70000 non-null  int64  
 6   cholesterol  70000 non-null  int64  
 7   gluc         70000 non-null  int64  
 8   smoke        70000 non-null  int64  
 9   alco         70000 non-null  int64  
 10  active       70000 non-null  int64  
 11  cardio       70000 non-null  int64  
dtypes: float64(1), int64(11)
memory usage: 6.4 MB
```

In [9]:
```
df['age'] = (df['age']/365).round().astype(int)
```

In [10]:
```
df.describe()
```

Out[10]:

	age	gender	height	weight	ap_hi	ap_lo	cholesterol
count	70000.000000	70000.000000	70000.000000	70000.000000	70000.000000	70000.000000	70000.000000
mean	53.338686	1.349571	164.359229	74.205690	128.817286	96.630414	1.366871
std	6.765294	0.476838	8.210126	14.395757	154.011419	188.472530	0.680250
min	30.000000	1.000000	55.000000	10.000000	-150.000000	-70.000000	1.000000
25%	48.000000	1.000000	159.000000	65.000000	120.000000	80.000000	1.000000
50%	54.000000	1.000000	165.000000	72.000000	120.000000	80.000000	1.000000
75%	58.000000	2.000000	170.000000	82.000000	140.000000	90.000000	2.000000
max	65.000000	2.000000	250.000000	200.000000	16020.000000	11000.000000	3.000000

In [11]:

```
def age_group(age):
    if age>30 and age<41:
        age_group = '31-40'
    elif age>40 and age<51:
        age_group = '41-50'
    elif age>50 and age<61:
        age_group = '51-60'
    else:
        age_group = '>60'
    return(age_group)
```

In [12]:

```
df["Age_group"] = df['age'].apply(age_group)
```

In [13]:

```
df
```

Out[13]:

	age	gender	height	weight	ap_hi	ap_lo	cholesterol	gluc	smoke	alco	active	cardio	Age_grou
0	50	2	168	62.0	110	80	1	1	0	0	1	0	41-5
1	55	1	156	85.0	140	90	3	1	0	0	1	1	51-6
2	52	1	165	64.0	130	70	3	1	0	0	0	1	51-6
3	48	2	169	82.0	150	100	1	1	0	0	1	1	41-5
4	48	1	156	56.0	100	60	1	1	0	0	0	0	41-5
...	...	...	...	...	...	...	...	...	...	...	...	...	..
69995	53	2	168	76.0	120	80	1	1	1	0	1	0	51-6
69996	62	1	158	126.0	140	90	2	2	0	0	1	1	>6
69997	52	2	183	105.0	180	90	3	1	0	1	0	1	51-6
69998	61	1	163	72.0	135	80	1	2	0	0	0	1	>6
69999	56	1	170	72.0	120	80	2	1	0	0	1	0	51-6

70000 rows × 13 columns

In [14]:

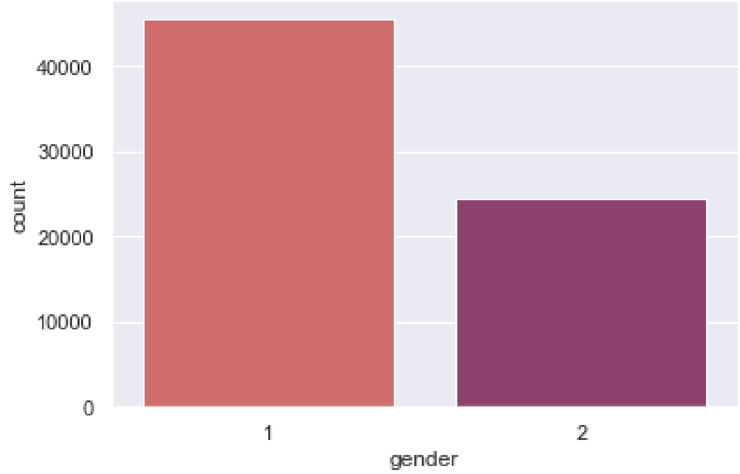
```
df['gender'].value_counts(normalize=True)*100
```

Out[14]:

```
1    65.042857
2    34.957143
Name: gender, dtype: float64
```

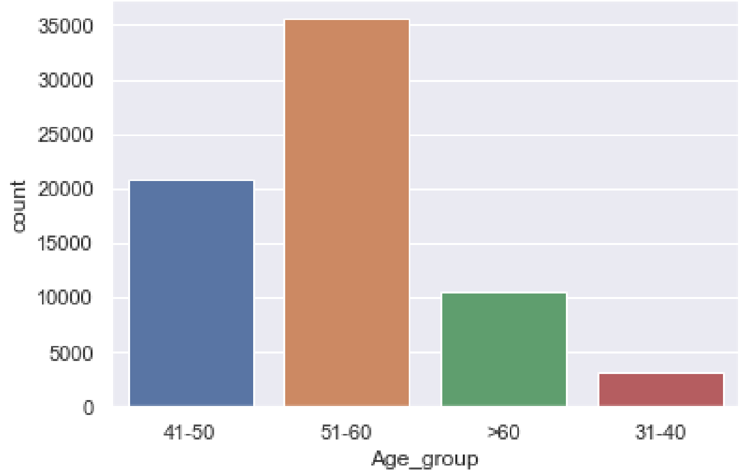
In [15]:
```
sns.set_theme(style='darkgrid')
sns.countplot(data=df, x='gender',palette='flare')
```

Out[15]:
```
<AxesSubplot:xlabel='gender', ylabel='count'>
```



In [16]:
```
sns.countplot(data=df, x = 'Age_group')
```

Out[16]:
```
<AxesSubplot:xlabel='Age_group', ylabel='count'>
```



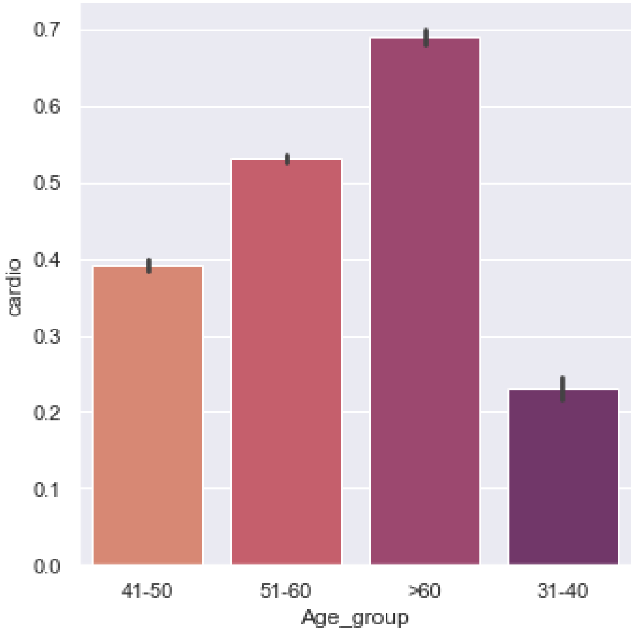
In [17]:
```
pd.crosstab(df['Age_group'],df['cardio'],margins=True)
```

Out[17]:

cardio	0	1	All
Age_group			
31-40	2394	715	3109
41-50	12715	8188	20903
51-60	16677	18872	35549
>60	3235	7204	10439
All	35021	34979	70000

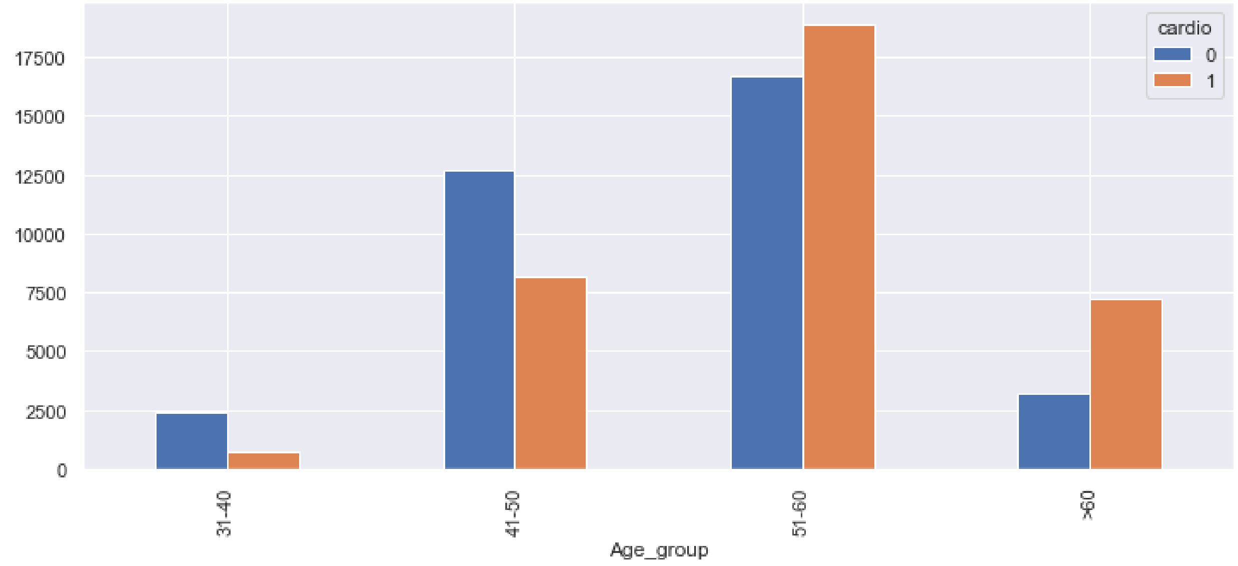
```
In [18]: sns.catplot(data=df,x='Age_group',y='cardio',kind='bar',palette='flare')
```

```
Out[18]: <seaborn.axisgrid.FacetGrid at 0x21d55e9e310>
```



```
In [19]: pd.crosstab(df['Age_group'],df['cardio']).plot(kind = 'bar',figsize = (12,5))
```

```
Out[19]: <AxesSubplot:xlabel='Age_group'>
```

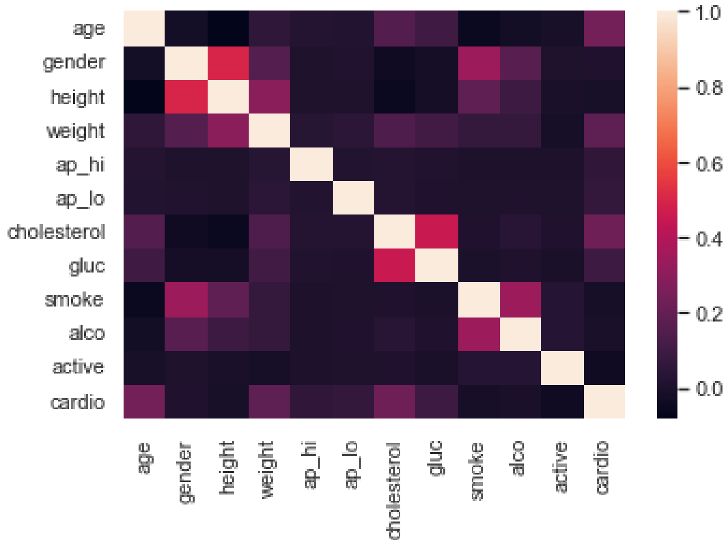


In [20]:

```
corr = df.corr()
sns.heatmap(corr)
```

Out[20]:

```
<AxesSubplot:>
```



In [21]:

```
#split into features and target
X = df.drop(['cardio','Age_group'],axis=1)
Y = df['cardio']
```

In [22]:

```
#Normalize the features
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
X = scaler.fit_transform(X)
```

In [23]:

```
print(X)
```

```
[[-0.49350546  1.36405487  0.44345206 ... -0.31087913 -0.23838436
   0.49416711]
 [ 0.24556599 -0.73310834 -1.01816804 ... -0.31087913 -0.23838436
   0.49416711]
 [-0.19787688 -0.73310834  0.07804703 ... -0.31087913 -0.23838436
  -2.02360695]
 ...
 [-0.19787688  1.36405487  2.27047718 ... -0.31087913  4.19490608
  -2.02360695]
 [ 1.13245175 -0.73310834 -0.16555632 ... -0.31087913 -0.23838436
  -2.02360695]
 [ 0.39338029 -0.73310834  0.68705541 ... -0.31087913 -0.23838436
   0.49416711]]
```

In [24]:

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
```

In [25]:

```
X_train, X_test, Y_train, Y_test = train_test_split(X,Y,test_size=0.25,random_state=(32
```

In [26]:

```
#train a logistic regression model
Lr = LogisticRegression()
Lr.fit(X_train,Y_train)
```

Out[26]:

```
LogisticRegression()
```

In [27]:

```
#Evaluate on testing dataset
y_pred = Lr.predict(X_test)
accuracy = accuracy_score(Y_test,y_pred)
```

In [28]:

```
print(accuracy)
```

```
0.7212571428571428
```

In [29]:

```
new_data = pd.DataFrame({'age': [50],'gender': [2], 'height': [165], 'weight': [75], 'a
                         'cholesterol': [2], 'gluc': [1],'smoke': [0],'alco': [0],'acti

new_data = scaler.transform(new_data)

prediction = Lr.predict(new_data)
print("Prediction:", prediction)
```

```
Prediction: [1]
```

In [ ]:

```
```