Exploratory Data Analysis of Olympic Games

In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import matplotlib.cm as cm
import warnings
warnings.filterwarnings('ignore')
import plotly.express as px
```

In [2]:
```
df = pd.read_csv("dataset_olympics.csv")
df.head()
```

Out[2]:

	ID	Name	Sex	Age	Height	Weight	Team	NOC	Games	Year	Seasc
0	1	A Dijiang	M	24.0	180.0	80.0	China	CHN	1992 Summer	1992	Summ
1	2	A Lamusi	M	23.0	170.0	60.0	China	CHN	2012 Summer	2012	Summ
2	3	Gunnar Nielsen Aaby	M	24.0	NaN	NaN	Denmark	DEN	1920 Summer	1920	Summ
3	4	Edgar Lindenau Aabye	M	34.0	NaN	NaN	Denmark/Sweden	DEN	1900 Summer	1900	Summ
4	5	Christine Jacoba Aaftink	F	21.0	185.0	82.0	Netherlands	NED	1988 Winter	1988	Wint

In [3]:
```
df.shape
```

Out[3]:
```
(70000, 15)
```

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 70000 entries, 0 to 69999
Data columns (total 15 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   ID      70000 non-null  int64  
 1   Name    70000 non-null  object 
 2   Sex     70000 non-null  object 
 3   Age     67268 non-null  float64
 4   Height  53746 non-null  float64
 5   Weight  52899 non-null  float64
 6   Team    70000 non-null  object 
 7   NOC     70000 non-null  object 
 8   Games   70000 non-null  object 
 9   Year    70000 non-null  int64  
 10  Season  70000 non-null  object 
 11  City    70000 non-null  object 
 12  Sport   70000 non-null  object 
 13  Event   70000 non-null  object 
 14  Medal   9690 non-null   object 
dtypes: float64(3), int64(2), object(10)
memory usage: 8.0+ MB
```

In [5]:
```
df.describe()
```

Out[5]:

	ID	Age	Height	Weight	Year
count	70000.000000	67268.000000	53746.000000	52899.000000	70000.000000
mean	18081.846986	25.644645	175.505303	70.900216	1977.766457
std	10235.613253	6.485239	10.384203	14.217489	30.103306
min	1.000000	11.000000	127.000000	25.000000	1896.000000
25%	9325.750000	21.000000	168.000000	61.000000	1960.000000
50%	18032.000000	25.000000	175.000000	70.000000	1984.000000
75%	26978.000000	28.000000	183.000000	79.000000	2002.000000
max	35658.000000	88.000000	223.000000	214.000000	2016.000000

In [6]:
```
df.describe(include=['object'])
```

Out[6]:

	Name	Sex	Team	NOC	Games	Season	City	Sport	Event
count	70000	70000	70000	70000	70000	70000	70000	70000	70000
unique	35556	2	827	226	51	2	42	65	744
top	Oksana Aleksandrovna Chusovitina	M	United States	USA	2016 Summer	Summer	London	Athletics	Football Men's Football
freq	29	51877	4979	5216	3675	58467	6034	10629	1738

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

Out[7]:
```
ID            0
Name          0
Sex           0
Age        2732
Height    16254
Weight    17101
Team          0
NOC           0
Games         0
Year          0
Season        0
City          0
Sport         0
Event         0
Medal     60310
dtype: int64
```

In [8]:
```
df.duplicated().sum()
```

Out[8]:
```
np.int64(383)
```

In [9]:
```
df.drop_duplicates(inplace=True)
```

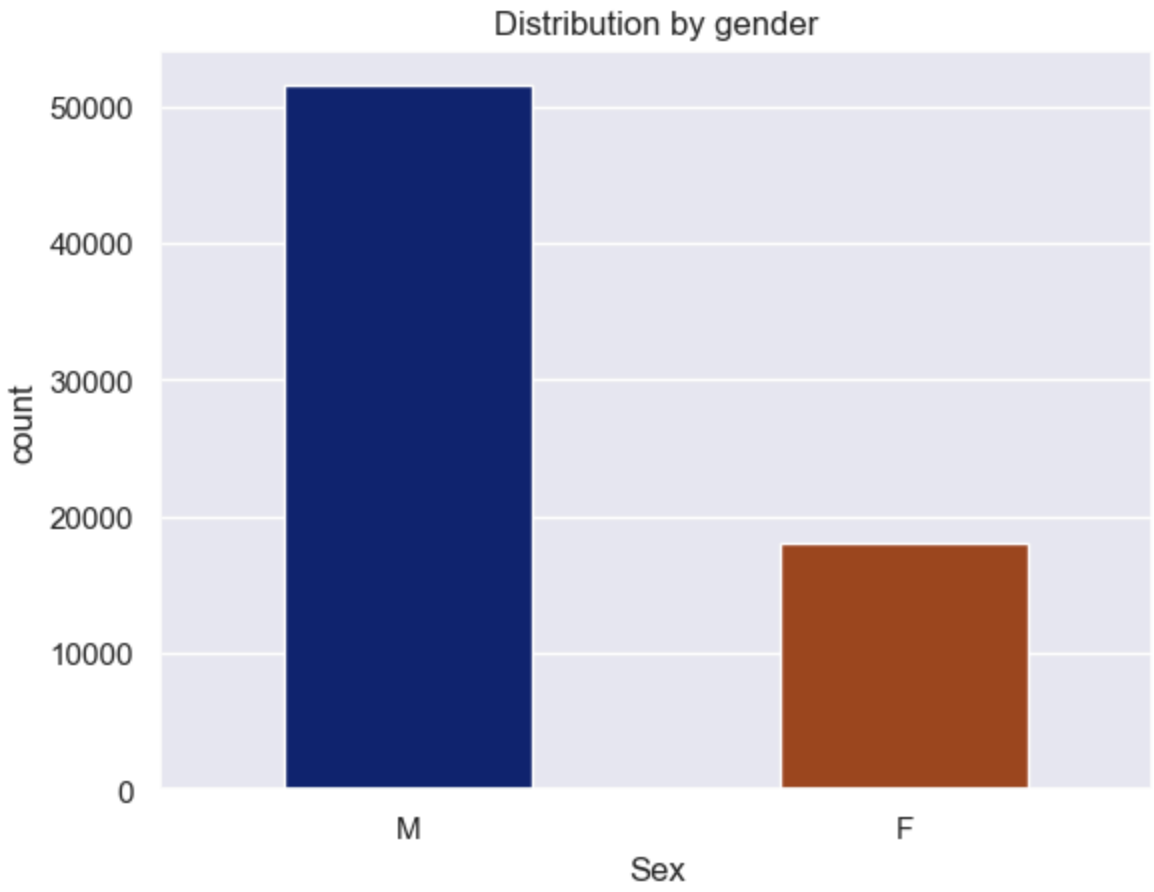
In [10]:
```
df.duplicated().sum()
```

Out[10]:
```
np.int64(0)
```

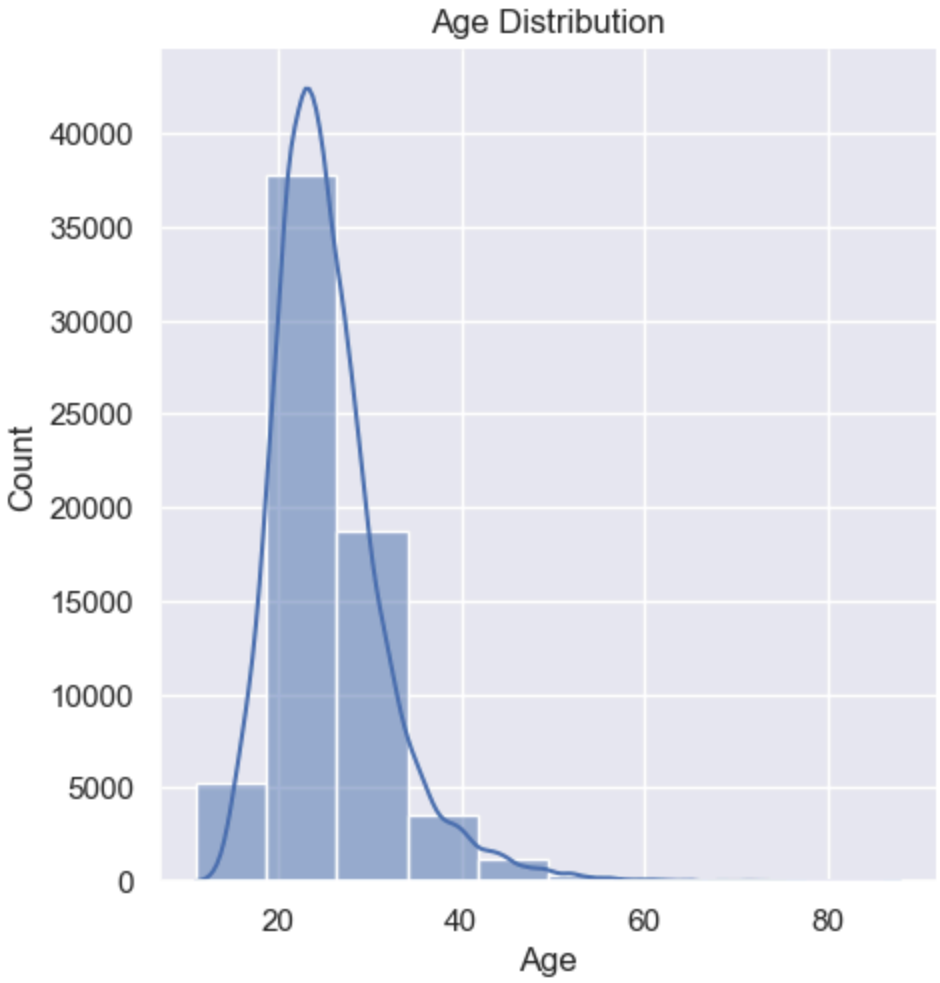
In [11]:
```
df.shape
```

Out[11]:
```
(69617, 15)
```

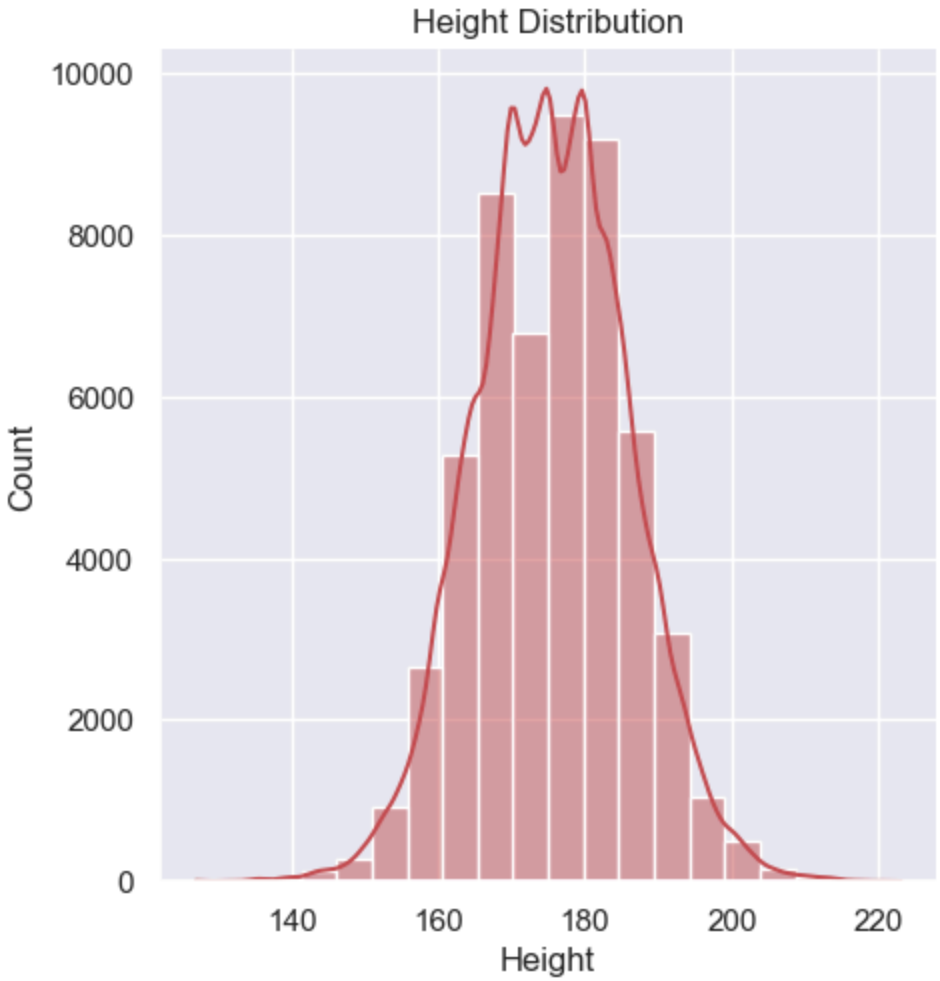
In [12]:
```
sns.set(style='darkgrid')
sns.countplot(x='Sex',data=df,width=0.5,palette='dark')
plt.title("Distribution by gender")
plt.show()
```



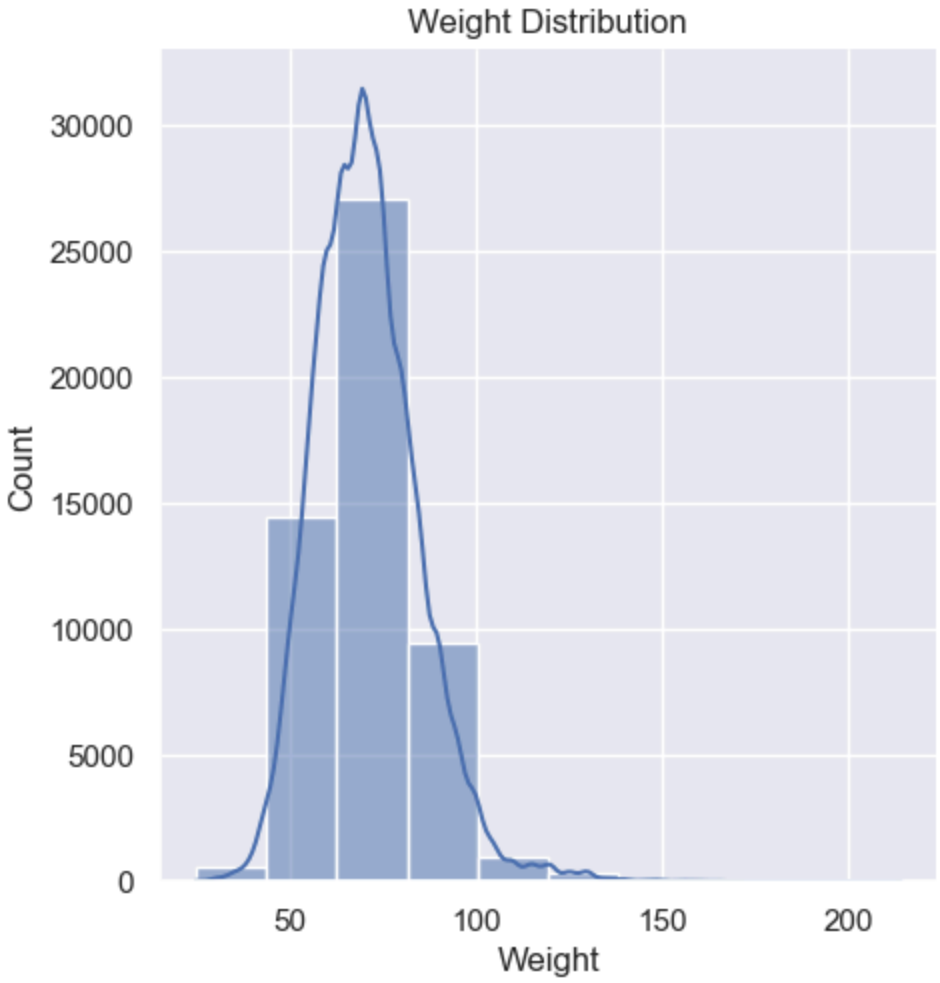
In [13]:
```
sns.displot(x='Age',data=df,bins=10,kde=True,color='b')
plt.title('Age Distribution')
plt.show()
```



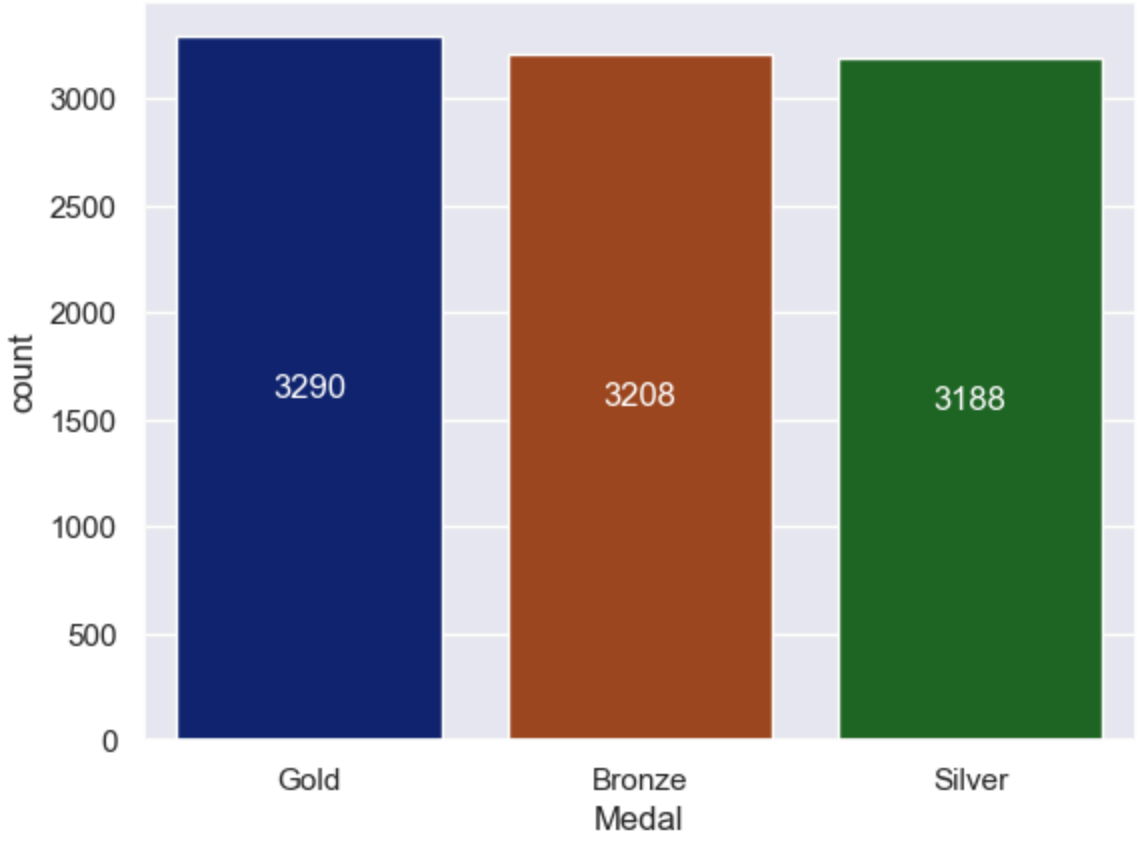
In [14]:
```
sns.displot(x='Height',data=df,bins=20,kde=True,color='r')
plt.title('Height Distribution')
plt.show()
```



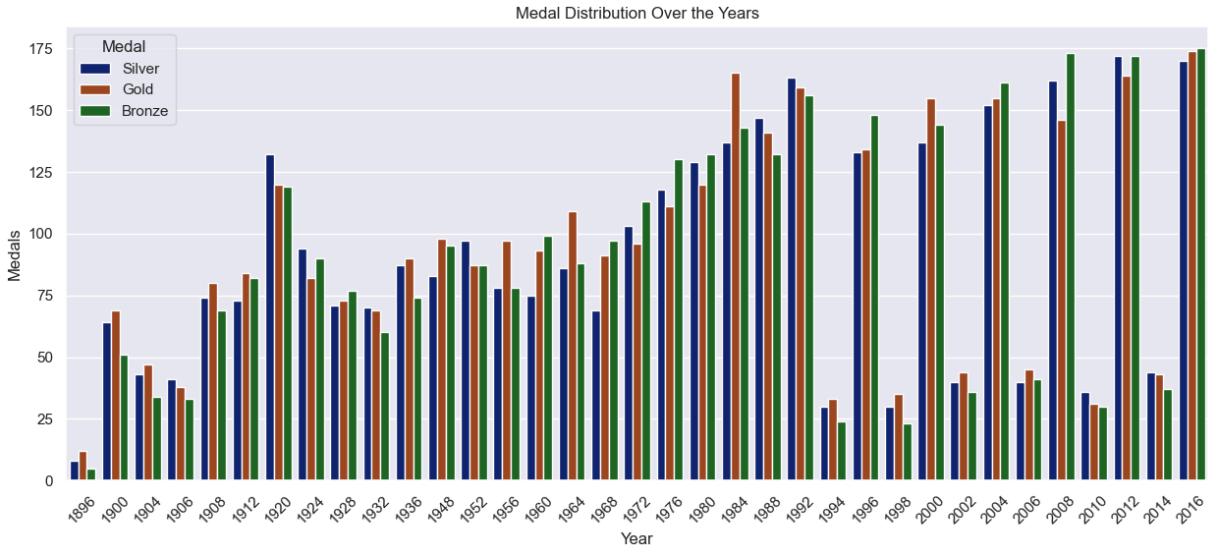
In [15]:
```
sns.displot(x='Weight',data=df,bins=10,kde=True,color='b')
plt.title('Weight Distribution')
plt.show()
```



In [16]:
```
ax = sns.countplot(x='Medal',data=df,palette='dark')
sns.set(rc={"figure.figsize":(8,4)})
for bars in ax.containers:
    ax.bar_label(bars,label_type='center',color='white')
```



In [49]:
```
plt.figure(figsize=(15,6))
sns.countplot(data=df,x='Year',hue='Medal',palette='dark')
plt.title("Medal Distribution Over the Years")
plt.ylabel('Medals')
plt.xticks(rotation=45)
plt.show()
```



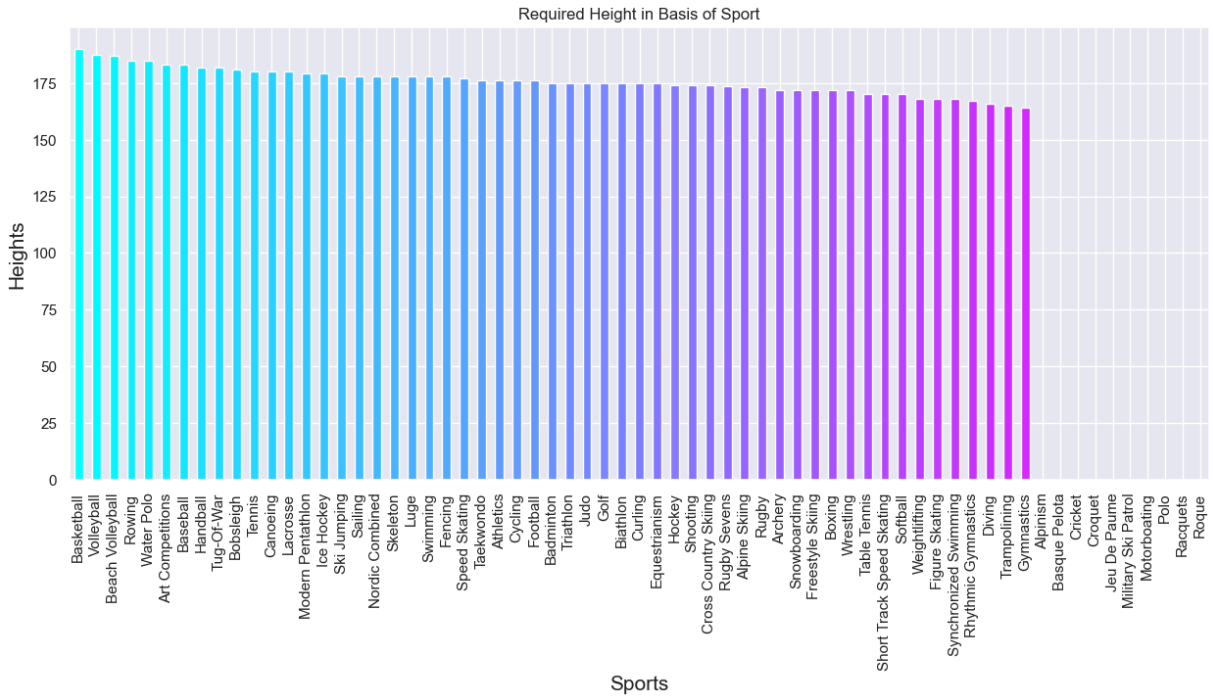
In [18]:
```
year_avg_age = df.groupby('Year')['Age'].mean()
year_avg_age
```

Out[18]:
```
Year
1896    23.029412
1900    29.119883
1904    27.063241
1906    26.989474
1908    27.000000
1912    27.965552
1920    29.241135
1924    28.252267
1928    27.973564
1932    29.606987
1936    27.245665
1948    28.363170
1952    26.273684
1956    26.316156
1960    25.136156
1964    24.852107
1968    24.316722
1972    24.126448
1976    23.656820
1980    23.312364
1984    24.060328
1988    24.257374
1992    24.637827
1994    24.487516
1996    25.338210
1998    25.143860
2000    25.435177
2002    26.029095
2004    25.780111
2006    26.091716
2008    25.685148
2010    26.150776
2012    25.993485
2014    26.082814
2016    26.259592
Name: Age, dtype: float64
```

In [19]:
```
sport_median_height = df.groupby('Sport')['Height'].median().sort_values(ascending=
sport_median_height
```

Out[19]:
```
Sport
Basketball            190.0
Volleyball            187.5
Beach Volleyball      187.0
Rowing                185.0
Water Polo            185.0
                      ...
Military Ski Patrol     NaN
Motorboating            NaN
Polo                    NaN
Racquets                NaN
Roque                   NaN
Name: Height, Length: 65, dtype: float64
```

In [20]:
```
colors = cm.get_cmap('cool',len(sport_median_height))(np.arange(len(sport_median_he
ax = sport_median_height.plot(kind='bar',color=colors,figsize=(15,6))
ax.set_title("Required Height in Basis of Sport")
ax.set_xlabel("Sports",fontsize=15)
ax.set_ylabel("Heights",fontsize=15)
plt.show()
```



In [21]:
```
sport_median_height.min()
```

Out[21]:
```
np.float64(164.0)
```

In [22]:
```
sport_median_height[sport_median_height == 164.0]
```

Out[22]:
```
Sport
Gymnastics    164.0
Name: Height, dtype: float64
```

In [23]:
```
country_gender_count = df.groupby(['NOC','Sex'])['Sex'].count()
country_gender_count
```

Out[23]:
```
NOC  Sex
AFG  M       38
AHO  F        6
     M       27
ALB  F        4
     M        7
            ...
YUG  M      455
ZAM  F        3
     M       40
ZIM  F       41
     M       47
Name: Sex, Length: 432, dtype: int64
```

In [24]:
```
df['Medal'].value_counts()
```

Out[24]:
```
Medal
Gold      3290
Bronze    3208
Silver    3188
Name: count, dtype: int64
```

In [25]:
```
country_gold_medals = df[df["Medal"] == "Gold"]
country_gold_medals.head()
```

Out[25]:

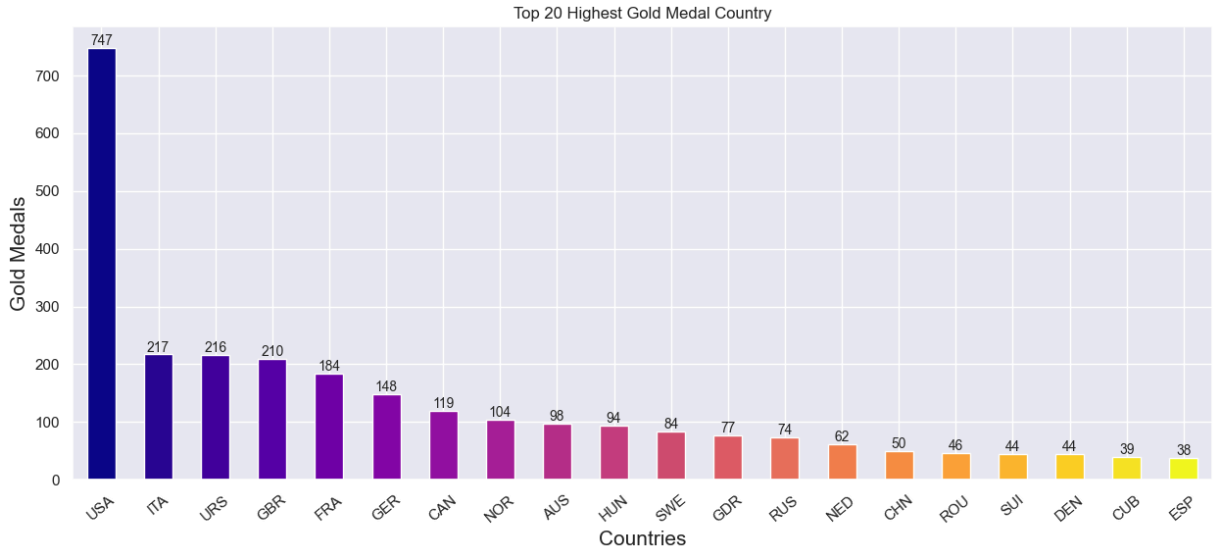
	ID	Name	Sex	Age	Height	Weight	Team	NOC	Games	Year	Seas
3	4	Edgar Lindenau Aabye	M	34.0	NaN	NaN	Denmark/Sweden	DEN	1900 Summer	1900	Sumr
42	17	Paavo Johannes Aaltonen	M	28.0	175.0	64.0	Finland	FIN	1948 Summer	1948	Sumr
44	17	Paavo Johannes Aaltonen	M	28.0	175.0	64.0	Finland	FIN	1948 Summer	1948	Sumr
48	17	Paavo Johannes Aaltonen	M	28.0	175.0	64.0	Finland	FIN	1948 Summer	1948	Sumr
60	20	Kjetil Andr Aamodt	M	20.0	176.0	85.0	Norway	NOR	1992 Winter	1992	Wir

In [26]:
```
country_gold_medals.groupby(['NOC'])['Medal'].count().sort_values(ascending=False)
```

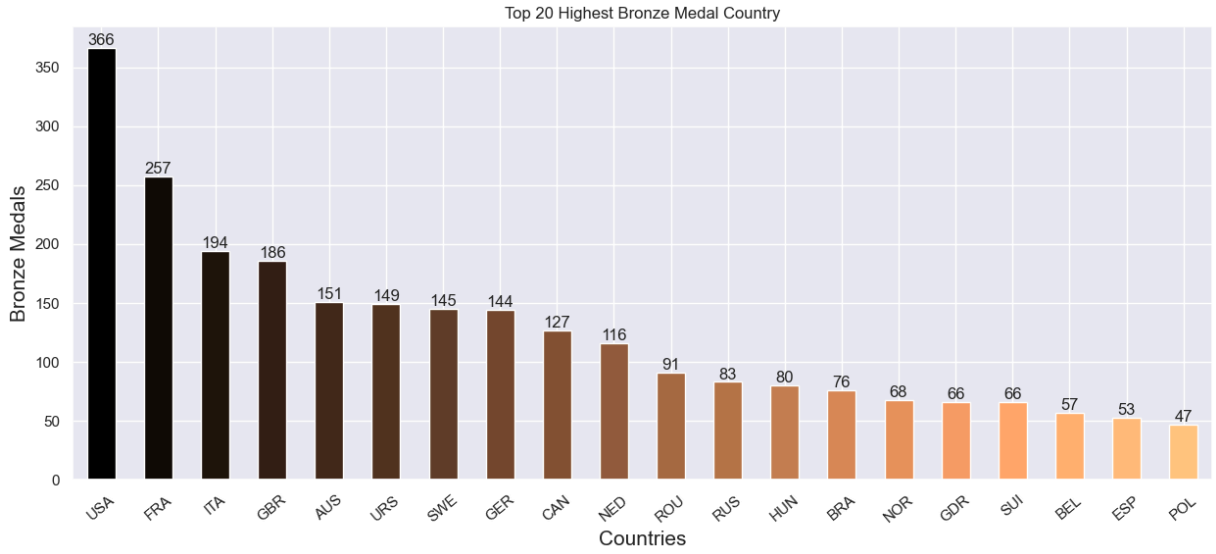
Out[26]:
```
NOC
USA    747
ITA    217
URS    216
GBR    210
FRA    184
      ...
MGL      1
POR      1
THA      1
UAE      1
UGA      1
Name: Medal, Length: 84, dtype: int64
```

In [27]:
```
gold_medal = country_gold_medals.groupby(['NOC'])['Medal'].count().sort_values(asce
```

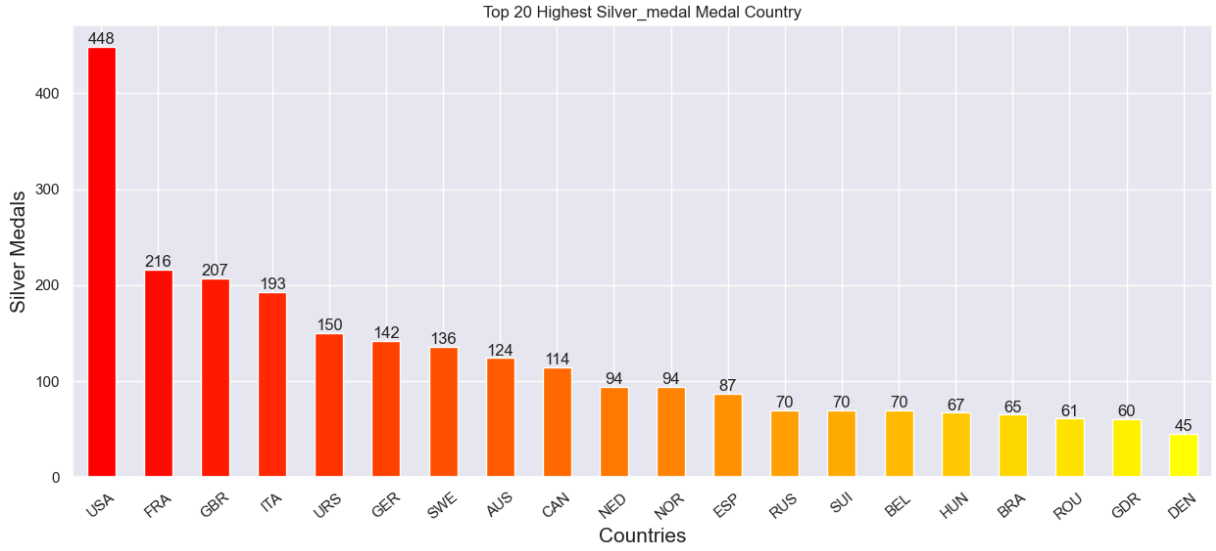
In [28]:
```
import matplotlib.pyplot as plt
import numpy as np
import matplotlib.cm as cm
colors = cm.get_cmap('plasma', len(gold_medal))(np.arange(len(gold_medal)))
ax = gold_medal.plot(kind='bar', color=colors, figsize=(15,6))
for container in ax.containers:
    ax.bar_label(container, label_type='edge', fontsize=10)
ax.set_title("Top 20 Highest Gold Medal Country")
ax.set_xlabel("Countries", fontsize=15)
ax.set_ylabel("Gold Medals", fontsize=15)
plt.xticks(rotation=40)
plt.show()
```



In [29]:
```
country_bronze_medals = df[df["Medal"] == "Bronze"]
bronze_medal = country_bronze_medals.groupby(['NOC'])['Medal'].count().sort_values(
colors = cm.get_cmap('copper',len(bronze_medal))(np.arange(len(bronze_medal)))
ax = bronze_medal.plot(kind='bar',color=colors,figsize=(15,6))
for contain in ax.containers:
    ax.bar_label(contain)
ax.set_title("Top 20 Highest Bronze Medal Country")
ax.set_xlabel("Countries",fontsize=15)
ax.set_ylabel("Bronze Medals",fontsize=15)
plt.xticks(rotation=40)
plt.show()
```



In [30]:
```
country_silver_medals = df[df["Medal"] == "Silver"]
silver_medal = country_silver_medals.groupby(['NOC'])['Medal'].count().sort_values(
colors = cm.get_cmap('autumn',len(silver_medal))(np.arange(len(silver_medal)))
ax = silver_medal.plot(kind='bar',color=colors,figsize=(15,6))
for contain in ax.containers:
    ax.bar_label(contain)
ax.set_title("Top 20 Highest Silver_medal Medal Country")
ax.set_xlabel("Countries",fontsize=15)
ax.set_ylabel("Silver Medals",fontsize=15)
plt.xticks(rotation=40)
plt.show()
```



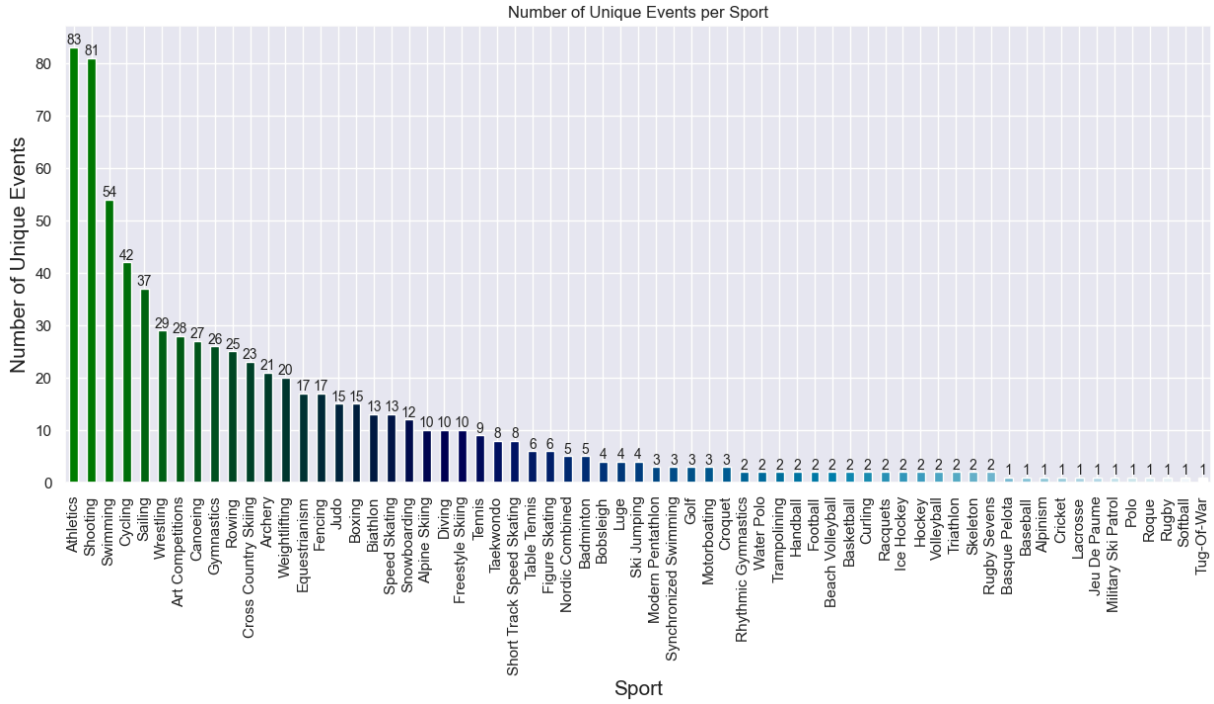
In [31]:
```
sport_gender_avg_weight = df.groupby(['Sport','Sex'])['Weight'].mean()
sport_gender_avg_weight
```

Out[31]:
```
Sport          Sex
Alpine Skiing  F      62.154589
               M      77.725309
Alpinism       F            NaN
               M            NaN
Archery        F      61.023256
                        ...
Water Polo     M      87.584973
Weightlifting  F      66.189474
               M      79.927852
Wrestling      F      58.169014
               M      77.256240
Name: Weight, Length: 114, dtype: float64
```

In [32]:
```
sport_event_count = df.groupby('Sport')['Event'].nunique().sort_values(ascending=Fa
sport_event_count
```

Out[32]:
```
Sport
Athletics     83
Shooting      81
Swimming      54
Cycling       42
Sailing       37
              ..
Polo           1
Roque          1
Rugby          1
Softball       1
Tug-Of-War     1
Name: Event, Length: 65, dtype: int64
```

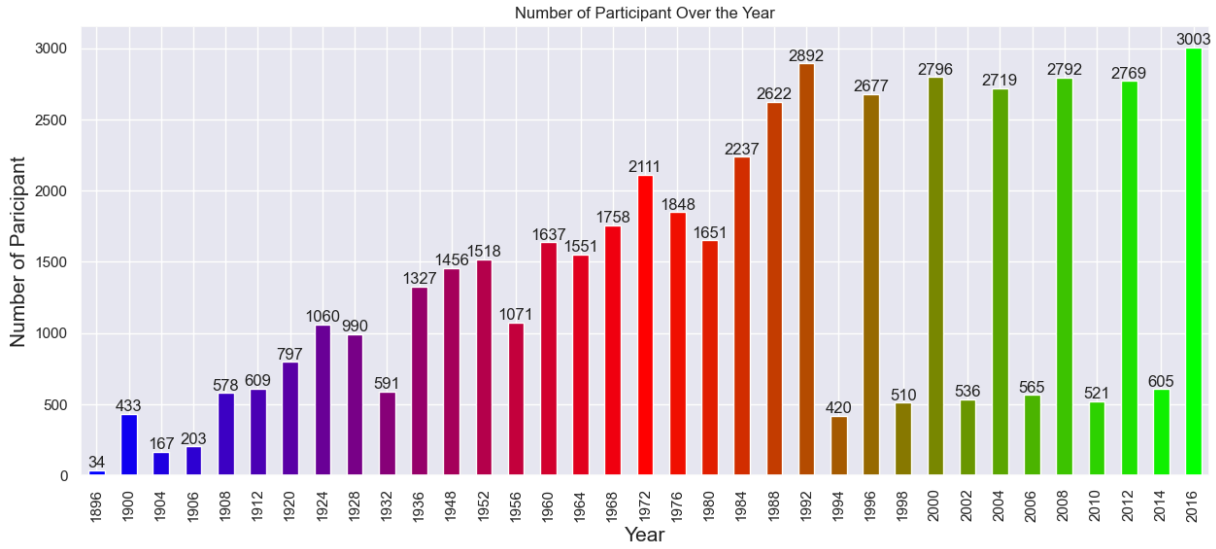
In [33]:
```
colors = cm.get_cmap('ocean',len(sport_event_count))(np.arange(len(sport_event_coun
ax = sport_event_count.plot(kind='bar',color=colors,figsize=(15,6))
for i in ax.containers:
    ax.bar_label(i,fontsize=10)
ax.set_title('Number of Unique Events per Sport')
ax.set_xlabel('Sport',fontsize=15)
ax.set_ylabel('Number of Unique Events',fontsize=15)
plt.show()
```



In [34]:
```
year_participant_count = df.groupby(['Year'])['ID'].nunique()
year_participant_count.head()
```

Out[34]:
```
Year
1896     34
1900    433
1904    167
1906    203
1908    578
Name: ID, dtype: int64
```

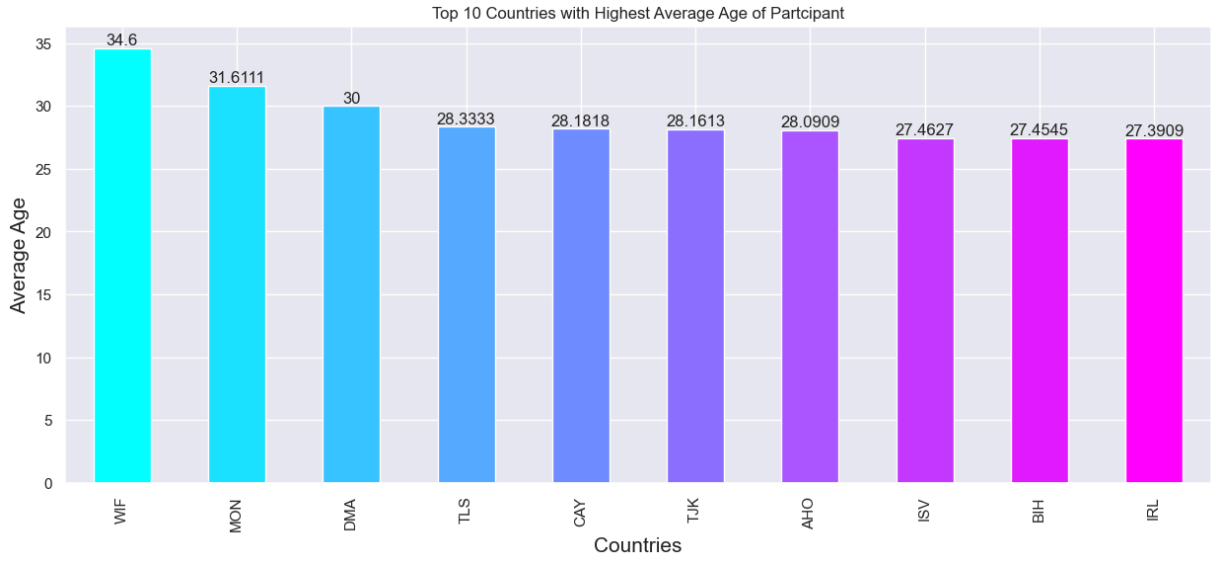
In [35]:
```
colors = cm.get_cmap('brg',len(year_participant_count))(np.arange(len(year_particip
ax = year_participant_count.plot(kind='bar',color=colors,figsize=(15,6))
for i in ax.containers:
    ax.bar_label(i)
ax.set_title('Number of Participant Over the Year')
ax.set_xlabel('Year',fontsize=15)
ax.set_ylabel('Number of Paricipant',fontsize=15)
plt.show()
```



In [36]:
```
country_avg_age = df.groupby(['NOC'])['Age'].mean().sort_values(ascending=False).he
country_avg_age
```

Out[36]:
```
NOC
WIF    34.600000
MON    31.611111
DMA    30.000000
TLS    28.333333
CAY    28.181818
TJK    28.161290
AHO    28.090909
ISV    27.462687
BIH    27.454545
IRL    27.390935
Name: Age, dtype: float64
```

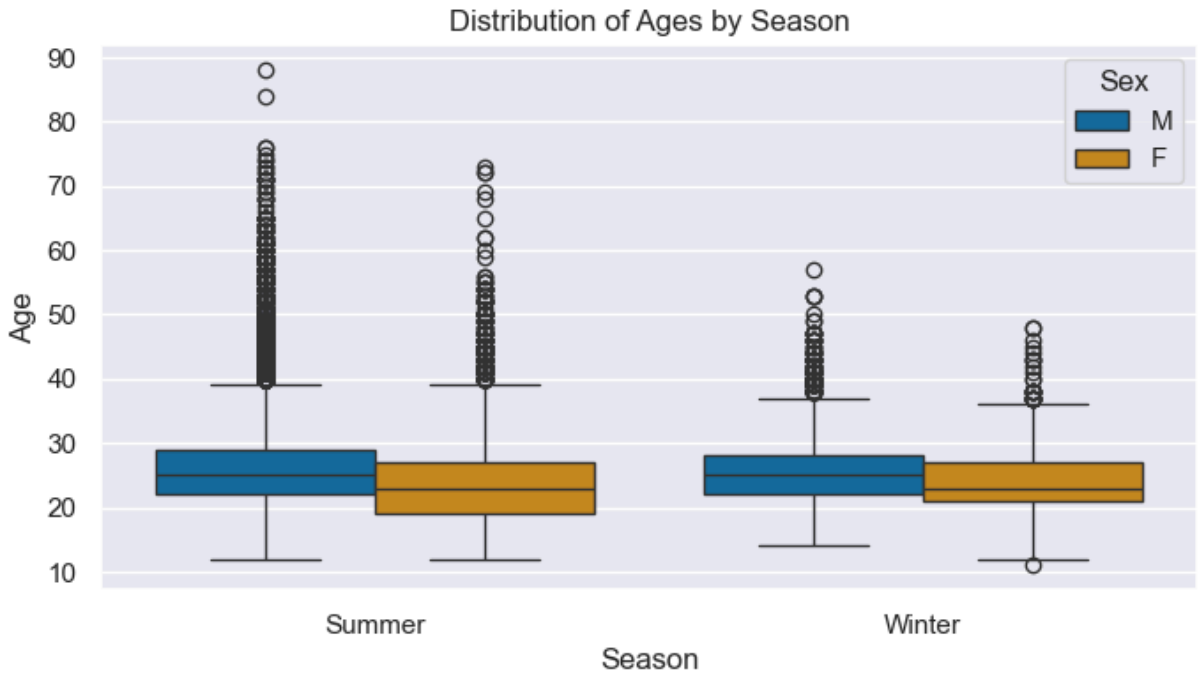
In [37]:
```
colors = cm.get_cmap('cool',len(country_avg_age))(np.arange(len(country_avg_age)))
ax = country_avg_age.plot(kind='bar',color=colors,figsize=(15,6))
for i in ax.containers:
    ax.bar_label(i)
ax.set_title('Top 10 Countries with Highest Average Age of Partcipant')
ax.set_xlabel('Countries',fontsize=15)
ax.set_ylabel('Average Age',fontsize=15)
plt.show()
```



In [38]:
```
df['Season'].value_counts()
```

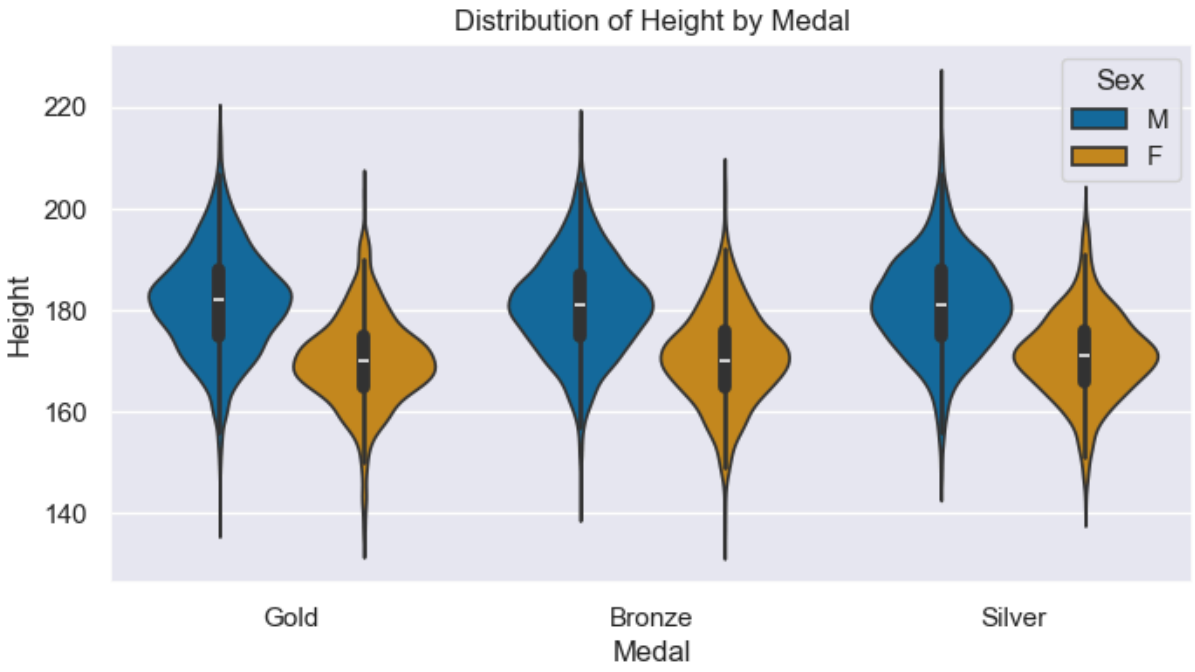
Out[38]:
```
Season
Summer    58084
Winter    11533
Name: count, dtype: int64
```

In [39]:
```
sns.set(style='darkgrid')
sns.boxplot(data=df,x='Season',y='Age',hue='Sex',palette='colorblind')
plt.title("Distribution of Ages by Season")
plt.xlabel("Season")
plt.ylabel("Age")
plt.show()
```



In [40]:
```
sns.set(style='darkgrid')
sns.violinplot(data=df,x='Medal',y='Height',hue='Sex',palette='colorblind')
plt.title("Distribution of Height by Medal")
```

```
plt.xlabel("Medal")
plt.ylabel("Height")
plt.show()
```



In [41]:
```
most_medals_counrty = df['NOC'].value_counts().idxmax()
print("Most Medal-Winning Country:",most_medals_counrty)
```

```
Most Medal-Winning Country: USA
```

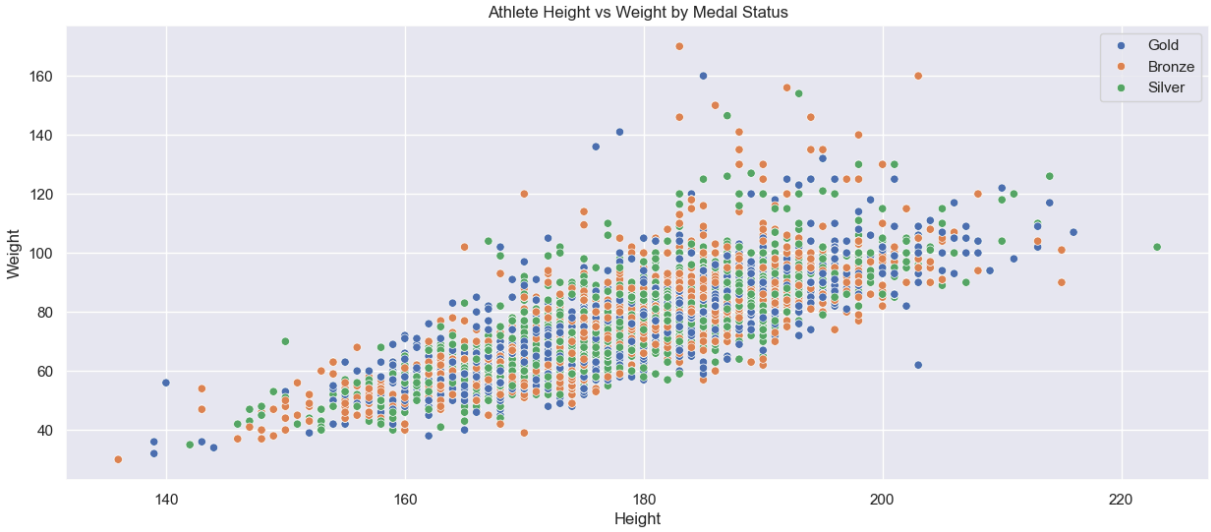
In [42]:
```
tallest_athlete = df[df['Height'] == df['Height'].max()]
print("Tallest Athlete:")
print(tallest_athlete[["ID","Name","Height","Sport"]])
```

```
Tallest Athlete:
          ID                  Name  Height       Sport
32376  16639  Tommy Loren Burleson   223.0  Basketball
```

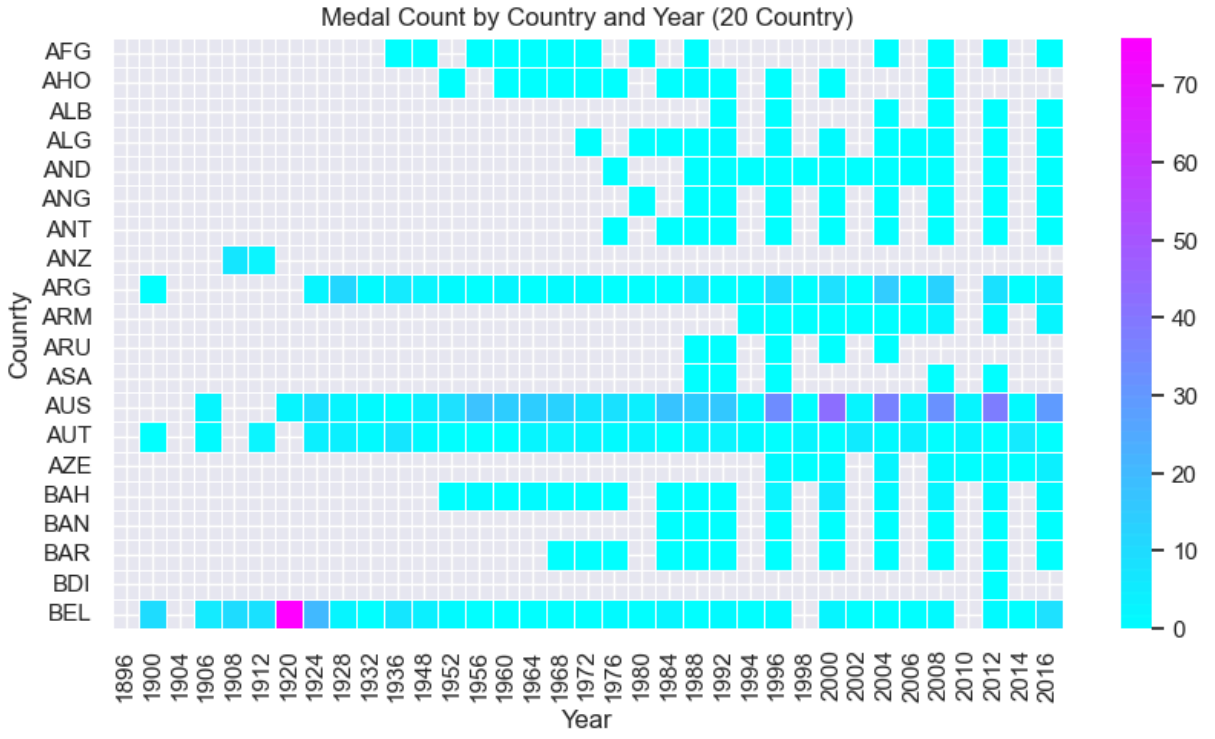
In [43]:
```
heaviest_athlete = df[df['Weight'] == df['Weight'].max()]
print("Heaviest Athlete:")
print(heaviest_athlete[["ID","Name","Height","Sport"]])
```

```
Heaviest Athlete:
          ID               Name  Height Sport
23155  12177  Ricardo Blas, Jr.   183.0  Judo
23156  12177  Ricardo Blas, Jr.   183.0  Judo
```

In [44]:
```
plt.figure(figsize=(15,6))
sns.scatterplot(data=df,x='Height',y='Weight',hue='Medal')
plt.title("Athlete Height vs Weight by Medal Status")
plt.xlabel("Height")
plt.ylabel("Weight")
plt.legend()
plt.show()
```



In [45]:
```
medals_by_country_year = df.pivot_table(index='NOC', columns='Year', values='Medal'
plt.figure(figsize=(10,5))
sns.heatmap(medals_by_country_year,linewidths=0.5,cmap='cool')
plt.title("Medal Count by Country and Year (20 Country)")
plt.xlabel("Year")
plt.ylabel("Counrty")
plt.show()
```



Conclusion ...

From this analysis, it is clear that a few countries such as the USA, ITA, URS and GBR have consistently dominated medal tallies, while several smaller nations show excellence in specific sports. The data also highlights increasing female participation over the decades, reflecting broader social change. However, some limitations exist due to missing data in early years. A future step could involve applying machine learning models to predict medal counts or analyzing athlete performance across specific sports.