Data Analysis on Jay Chou 周杰倫數據分析 (as of Sep 2020)

by Brian Cheng

This is a Python Jupyter notebook where I used Spotify API data and data I compiled myself to analyze songs from Jay Chou's studio albums (up to 2016).

Some key takeaways are that:

- Jay Chou's most-frequent collaborating lyricist is 方文山 and most-frequent collaborating arranger is 林邁可.
- The longer a Jay Chou song is, the more likely that it will be popular on Spotify.
- Jay Chou's most used keys are C and D major. Jay Chou hasn't used F#M/GbM in his studio albums yet as of 2016.

The summary of this Notebook is presented at: https://brc042.github.io/Data-Analysis-on-Jay-Chou/ (https://brc042.github.io/Data-Analysis-on-Jay-Chou/)

1. Import packages

In [1]:
```
import spotipy #Spotify API
from spotipy.oauth2 import SpotifyClientCredentials #Spotify client credent
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

2. Compiling the data

2.1 Accessing the data from Spotify API

2.1.1 Accessing all the studio album tracks from Spotify

In [2]:
```
#Spotify API authentication token
#CHANGE IT TO YOUR OWN if you're running my code
CLIENT_ID = 'INPUT_YOUR_OWN'
CLIENT_SECRET = 'INPUT_YOUR_OWN'
#access the Spotify API
sp = spotipy.Spotify(client_credentials_manager = SpotifyClientCredentials(
    client_id = CLIENT_ID, client_secret = CLIENT_SECRET)
                    )
```

In [3]:
```
#access the playlist I made containing all Jay Chou's studio album tracks (
playlist = sp.user_playlist_tracks('b5jfei3kyhlyuiadni4zvzl84', 'spotify:pl
```

In [4]:
```
#get all the tracks from the playlist (while loop because Spotify only allo
tracks = playlist['items']
while playlist['next']:
    playlist = sp.next(playlist)
    tracks.extend(playlist['items'])
tracks_df = pd.DataFrame()
```

2.1.2 Obtaining the basic info for every track

In [5]:
```
#obtain basic info for the tracks
for track in tracks:
    track_df = pd.DataFrame(pd.DataFrame(track)['track']).transpose()
    tracks_df = tracks_df.append(track_df)
tracks_df = tracks_df.reset_index(drop = True)
tracks_df.head()
```

Out[5]:

	external_urls	href	
0	{'spotify': 'https://open.spotify.com/track/4R...	https://api.spotify.com/v1/tracks/4RbjlqzGc5pi...	4RbjlqzGc5pi
1	{'spotify': 'https://open.spotify.com/track/66...	https://api.spotify.com/v1/tracks/669LQQmGgcpQ...	669LQQmGgcp
2	{'spotify': 'https://open.spotify.com/track/4V...	https://api.spotify.com/v1/tracks/4VWn7L2kONeM...	4VWn7L2kONeMI
3	{'spotify': 'https://open.spotify.com/track/0E...	https://api.spotify.com/v1/tracks/0EEDSjk382WM...	0EEDSjk382WMF
4	{'spotify': 'https://open.spotify.com/track/0M...	https://api.spotify.com/v1/tracks/0MXi5biqp5KJ...	0MXi5biqp5KJw

2.1.3 Editing the basic info for every track

In [6]:
```
#extract release date as a column
tracks_df['release_date'] = tracks_df.apply(lambda x: x['album']['release_d
#extract album name as a column
tracks_df['album'] = tracks_df.apply(lambda x: x['album']['name'], axis = 1
```

In [7]:
```
#correct the release dates (some release date data on Spotify are incorrect
def correctReleaseDates(x):
    if x == '2002-07-30':
        return '2002-07-18'
    if x == '2008-03-10':
        return '2007-11-02'
    if x == '2008-11-09':
        return '2008-10-14'
    if x == '2010-05-20':
        return '2010-05-18'
    if x == '2011-11-16':
        return '2011-11-11'
    else:
        return x
tracks_df['release_date'] = tracks_df['release_date'].apply(correctReleaseD
```

In [8]:
```
#extract the release year from the release date
tracks_df['year'] = tracks_df['release_date'].apply(lambda x: int(x[0:4]))
```

In [9]:
```
#correct the names (some names were inputted wrong on Spotify)
def correctNames(x):
    if x == '蛇 舞':
        return '蛇舞'
    if x == '花 海':
        return '花海'
    if x == '爸我回來了':
        return '爸 我回來了'
    if x == '我落淚˙情緒零碎':
        return '我落淚 情緒零碎'
    else:
        return x
tracks_df['name'] = tracks_df['name'].apply(correctNames)
```

In [10]:
```
#drop unnecessary features from our basic info
tracks_df = tracks_df[['name', 'id', 'album', 'year', 'track_number', 'popu
tracks_df['track_number'] = pd.to_numeric(tracks_df['track_number'])
tracks_df['popularity'] = pd.to_numeric(tracks_df['popularity'])
tracks_df.head()
```

Out[10]:

	name	id	album	year	track_number	popularity
0	可愛女人	4RbjlqzGc5piUTTr32XMlv	杰倫	2000	1	50
1	完美主義	669LQQmGgcpQqfbliojj5qR	杰倫	2000	2	33
2	星晴	4VWn7L2kONeMEQ6cAIfzXC	杰倫	2000	3	52
3	娘子	0EEDSjk382WMP9PKsYPKIZ	杰倫	2000	4	33
4	鬥牛	0MXi5biqp5KJw2wHh89o03	杰倫	2000	5	32

2.1.4 Obtaining the audio features for every track

In [11]:
```
#audio features for the tracks
audio_features_df = pd.DataFrame()
for index, row in tracks_df.iterrows():
    audio_feature = pd.DataFrame(sp.audio_features('spotify:track:' + row['
    audio_features_df = audio_features_df.append(audio_feature)
audio_features_df = audio_features_df.reset_index(drop = True)
audio_features_df.head()
```

Out[11]:

	danceability	energy	key	loudness	mode	speechiness	acousticness	instrumentalness	livenes
0	0.767	0.671	5	-9.995	1	0.0317	0.552	0.000032	0.20
1	0.658	0.605	2	-9.036	0	0.1740	0.627	0.000000	0.34
2	0.637	0.329	7	-10.366	1	0.0349	0.725	0.000009	0.24
3	0.874	0.620	5	-8.700	0	0.0555	0.306	0.000000	0.11
4	0.844	0.645	6	-9.175	0	0.0770	0.437	0.000027	0.37

2.1.5 Editing the audio features for every track

In [12]:
```
#change duration to seconds
audio_features_df['duration_ms'] = audio_features_df['duration_ms'].apply(l
audio_features_df = audio_features_df.rename(columns = {'duration_ms': 'dur
```

In [13]:
```
#get the Major/minor keys from the given key code and mode
def getMmKeys(x):
    if x['key'] == 0 and x['mode'] == 1:
        return 'CM'
    if x['key'] == 0 and x['mode'] == 0:
        return 'Cm'
    if x['key'] == 1 and x['mode'] == 1:
        return 'C#M/DbM'
    if x['key'] == 1 and x['mode'] == 0:
        return 'C#m/Dbm'
    if x['key'] == 2 and x['mode'] == 1:
        return 'DM'
    if x['key'] == 2 and x['mode'] == 0:
        return 'Dm'
    if x['key'] == 3 and x['mode'] == 1:
        return 'EbM'
    if x['key'] == 3 and x['mode'] == 0:
        return 'Ebm'
    if x['key'] == 4 and x['mode'] == 1:
        return 'EM'
    if x['key'] == 4 and x['mode'] == 0:
        return 'Em'
    if x['key'] == 5 and x['mode'] == 1:
        return 'FM'
    if x['key'] == 5 and x['mode'] == 0:
        return 'Fm'
    if x['key'] == 6 and x['mode'] == 1:
        return 'F#M/GbM'
    if x['key'] == 6 and x['mode'] == 0:
        return 'F#m/Gbm'
    if x['key'] == 7 and x['mode'] == 1:
        return 'GM'
    if x['key'] == 7 and x['mode'] == 0:
        return 'Gm'
    if x['key'] == 8 and x['mode'] == 1:
        return 'AbM'
    if x['key'] == 8 and x['mode'] == 0:
        return 'Abm'
    if x['key'] == 9 and x['mode'] == 1:
        return 'AM'
    if x['key'] == 9 and x['mode'] == 0:
        return 'Am'
    if x['key'] == 10 and x['mode'] == 1:
        return 'BbM'
    if x['key'] == 10 and x['mode'] == 0:
        return 'Bbm'
    if x['key'] == 11 and x['mode'] == 1:
        return 'BM'
    if x['key'] == 11 and x['mode'] == 0:
        return 'Bm'
audio_features_df['Mmkey'] = audio_features_df.apply(getMmKeys, axis = 1)
```

In [14]:
```
#drop unnecessary audio features
audio_features_df = audio_features_df.drop(columns = ['analysis_url', 'live
audio_features_df.head()
```

Out[14]:

	danceability	energy	key	loudness	mode	speechiness	acousticness	instrumentalness	valenc
0	0.767	0.671	5	-9.995	1	0.0317	0.552	0.000032	0.92
1	0.658	0.605	2	-9.036	0	0.1740	0.627	0.000000	0.64
2	0.637	0.329	7	-10.366	1	0.0349	0.725	0.000009	0.25
3	0.874	0.620	5	-8.700	0	0.0555	0.306	0.000000	0.83
4	0.844	0.645	6	-9.175	0	0.0770	0.437	0.000027	0.73

2.2 Import the music credits data

In [15]:
```
#read in the credits data I compiled
credits_df = pd.read_csv('Jay Chou - Main Albums.csv')
credits_df
```

Out[15]:

	name	year	album	lyricist	arranger
0	可愛女人	2000	杰倫	徐若瑄	周杰倫
1	完美主義	2000	杰倫	方文山	洪敬堯
2	星晴	2000	杰倫	周杰倫	洪敬堯
3	娘子	2000	杰倫	方文山	周杰倫
4	鬥牛	2000	杰倫	方文山	洪敬堯
...	...	...	...	...	...
145	不該	2016	周杰倫的床邊故事	方文山	黃雨勳
146	土耳其冰淇淋	2016	周杰倫的床邊故事	周杰倫	周杰倫
147	告白氣球	2016	周杰倫的床邊故事	方文山	林邁可
148	Now You See Me	2016	周杰倫的床邊故事	方文山	黃雨勳
149	愛情廢柴	2016	周杰倫的床邊故事	周杰倫	黃雨勳

150 rows × 5 columns

2.3 Combine the Spotify API data with my compiled data

In [16]:
```
#combine basic data of tracks and their audio features together
df = credits_df.merge(tracks_df, on = ['name', 'album', 'year'])
df = df.merge(audio_features_df, on = 'id').drop(columns = 'id')
df
```

Out[16]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	lou
0	可愛女人	2000	杰倫	徐若瑄	周杰倫	1	50	0.767	0.671	5	
1	完美主義	2000	杰倫	方文山	洪敬堯	2	33	0.658	0.605	2	
2	星晴	2000	杰倫	周杰倫	洪敬堯	3	52	0.637	0.329	7	
3	娘子	2000	杰倫	方文山	周杰倫	4	33	0.874	0.620	5	
4	鬥牛	2000	杰倫	方文山	洪敬堯	5	32	0.844	0.645	6	
...	...	...	...	...	...	...	...	...	...	...	
145	不該	2016	周杰倫的床邊故事	方文山	黃雨勳	6	57	0.441	0.619	4	
146	土耳其冰淇淋	2016	周杰倫的床邊故事	周杰倫	周杰倫	7	31	0.662	0.924	7	
147	告白氣球	2016	周杰倫的床邊故事	方文山	林邁可	8	63	0.590	0.572	11	
148	Now You See Me	2016	周杰倫的床邊故事	方文山	黃雨勳	9	34	0.566	0.851	5	
149	愛情廢柴	2016	周杰倫的床邊故事	周杰倫	黃雨勳	10	48	0.411	0.671	2	

150 rows × 20 columns

2.4 Get album data by calculating the average

In [17]:
```python
#album data
albums_df = df.groupby(['album', 'year'], as_index = False).mean().sort_val
albums_df
```

Out[17]:

album	year	popularity	danceability	energy	loudness	mode	speechiness	acousticness	ins
杰倫	2000	41.400000	0.700200	0.575200	-8.738000	0.500000	0.058750	0.408880	
范特西	2001	46.600000	0.693300	0.608900	-7.102700	0.800000	0.043370	0.225505	
八度空間	2002	41.100000	0.692600	0.647900	-5.586200	0.800000	0.046080	0.373510	
葉惠美	2003	41.454545	0.556455	0.631636	-7.465909	0.727273	0.044345	0.262927	
七里香	2004	43.900000	0.552100	0.678300	-6.768700	0.400000	0.081490	0.412330	
11月的蕭邦	2005	48.416667	0.593833	0.681833	-5.600750	0.666667	0.051425	0.386250	
依然范特西	2006	46.500000	0.636000	0.585200	-6.290900	0.600000	0.030870	0.381190	
我很忙	2007	46.900000	0.651200	0.569500	-8.292100	0.600000	0.037650	0.252196	
魔杰座	2008	41.454545	0.630000	0.648909	-6.527364	0.727273	0.042773	0.242118	
跨時代	2010	39.545455	0.634364	0.614000	-7.913364	0.818182	0.032045	0.270758	
驚嘆號	2011	31.181818	0.618545	0.683818	-7.194364	0.454545	0.038418	0.185247	
十二新作	2012	38.583333	0.565083	0.646333	-8.205083	0.750000	0.036692	0.156320	
哎呦不錯哦	2014	39.250000	0.586083	0.727167	-7.028417	0.833333	0.041092	0.128747	
周杰倫的床邊故事	2016	41.600000	0.555800	0.762400	-6.510300	0.700000	0.035270	0.104385	

3. Analyses

3.1 Collaborating Lyricist

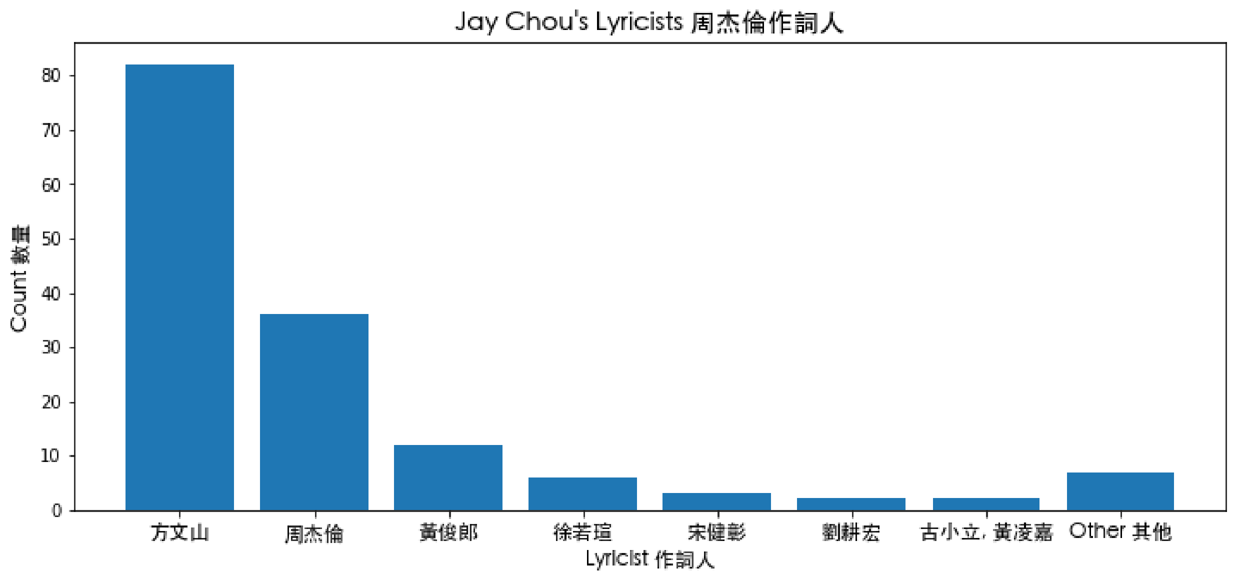
In [18]:
```
#Jay Chou's most frequently collaborated lyricists
lyricist_count_df = df.groupby('lyricist', as_index = False).count()[['lyri
original_len = len(lyricist_count_df)
lyricist_count_df = lyricist_count_df[lyricist_count_df['name'] > 1].reset_
lyricist_count_df.loc[len(lyricist_count_df)] = ['Other 其他', original_len
lyricist_count_df
```

Out[18]:

	lyricist	name
0	方文山	82
1	周杰倫	36
2	黃俊郎	12
3	徐若瑄	6
4	宋健彰	3
5	劉耕宏	2
6	古小立, 黃凌嘉	2
7	Other 其他	7

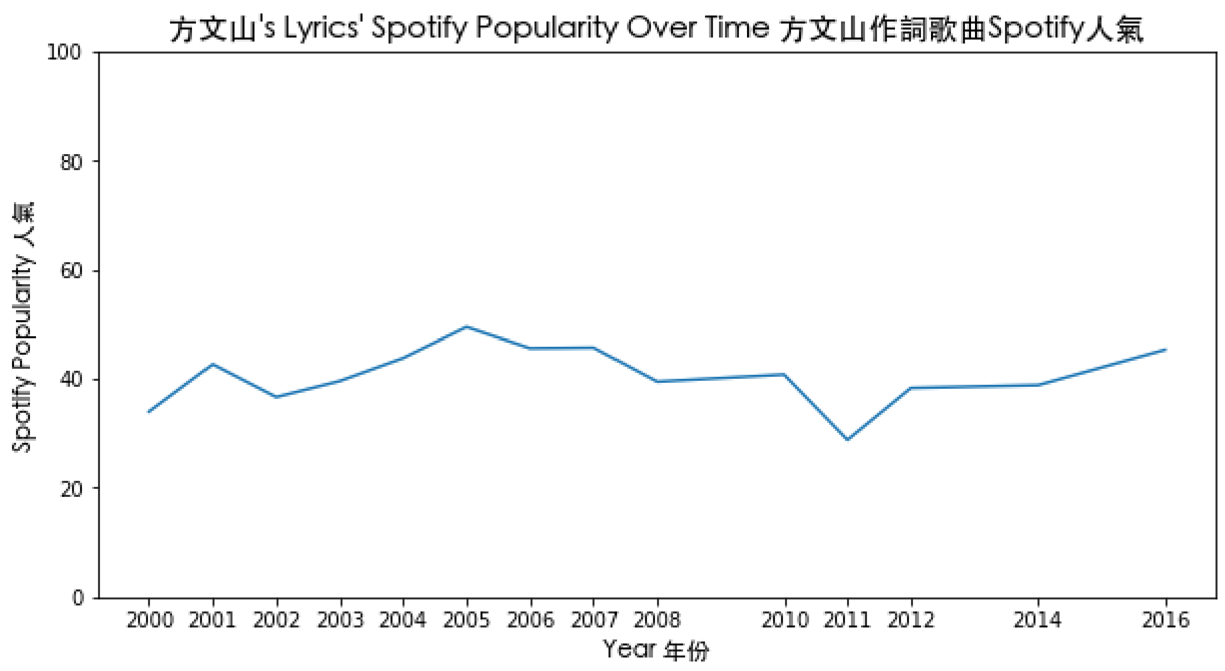
In [19]:
```
#plot of Jay Chou's most frequently collaborated lyricists
fig, ax = plt.subplots(figsize = (12, 5))
ax.bar(lyricist_count_df['lyricist'], lyricist_count_df['name'])
ax.set_xlabel('Lyricist 作詞人', fontproperties = 'Heiti TC', size = 12)
ax.set_ylabel('Count 數量', fontproperties = 'Heiti TC', size = 12)
ax.set_title("Jay Chou's Lyricists 周杰倫作詞人", fontproperties = 'Heiti TC'
ax.set_xticklabels(lyricist_count_df['lyricist'], fontproperties = 'Heiti T
plt.show()
```

```
<ipython-input-19-f1cadf410621>:7: UserWarning: FixedFormatter should onl
y be used together with FixedLocator
  ax.set_xticklabels(lyricist_count_df['lyricist'], fontproperties = 'Hei
ti TC', size = 12)
```



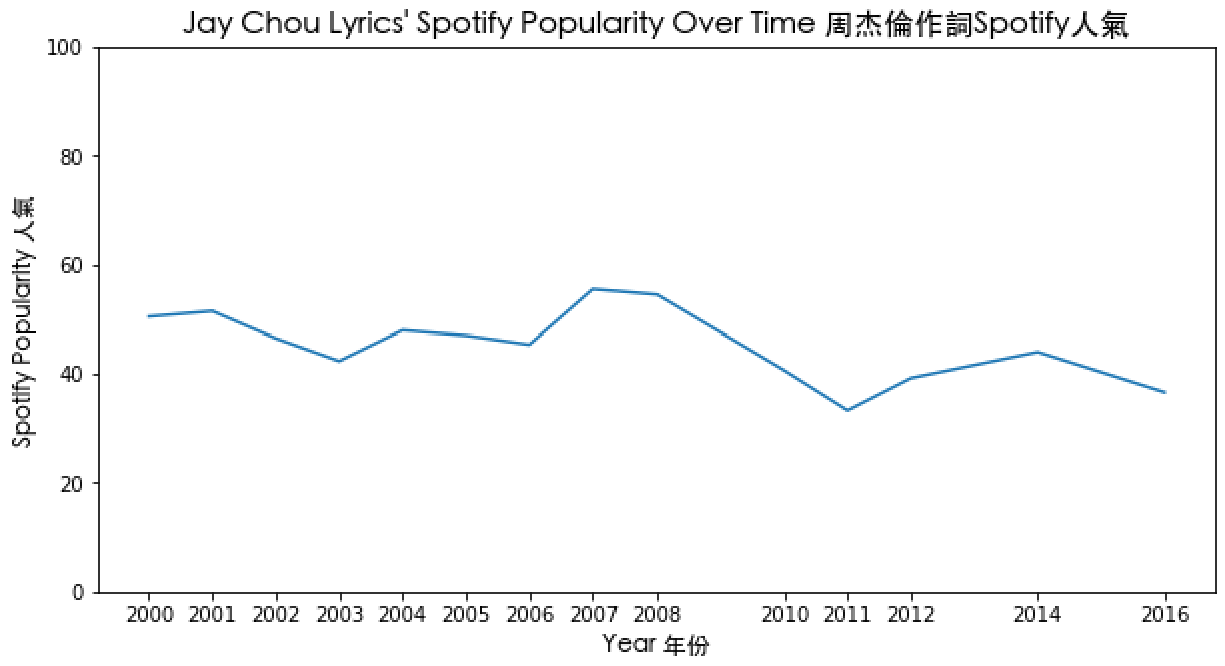
In [20]:
```
#get album data for songs that have lyrics written by 方文山
vincent_album_df = df[df['lyricist'] == '方文山'].groupby(['album', 'year'],
```

In [21]:
```
#方文山 lyrics' Spotify popularity over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(vincent_album_df['year'], vincent_album_df['popularity'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 100)
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("方文山's Lyrics' Spotify Popularity Over Time 方文山作詞歌曲Spot
ax.set_xticks(albums_df['year'])
plt.show()
```



In [22]:
```
#get album data for songs that have lyrics written by Jay Chou
jay_lyrics_album_df = df[df['lyricist'] == '周杰倫'].groupby(['album', 'year
```

In [23]:
```
#Jay Chou lyrics' Spotify popularity over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(jay_lyrics_album_df['year'], jay_lyrics_album_df['popularity'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 100)
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou Lyrics' Spotify Popularity Over Time 周杰倫作詞Spotify
ax.set_xticks(albums_df['year'])
plt.show()
```



Lyrics written by Jay Chou himself seem to be getting less popular while lyrics written by 方文山 are staying quite constant in terms of popularity.

3.2 Collaborating Arranger

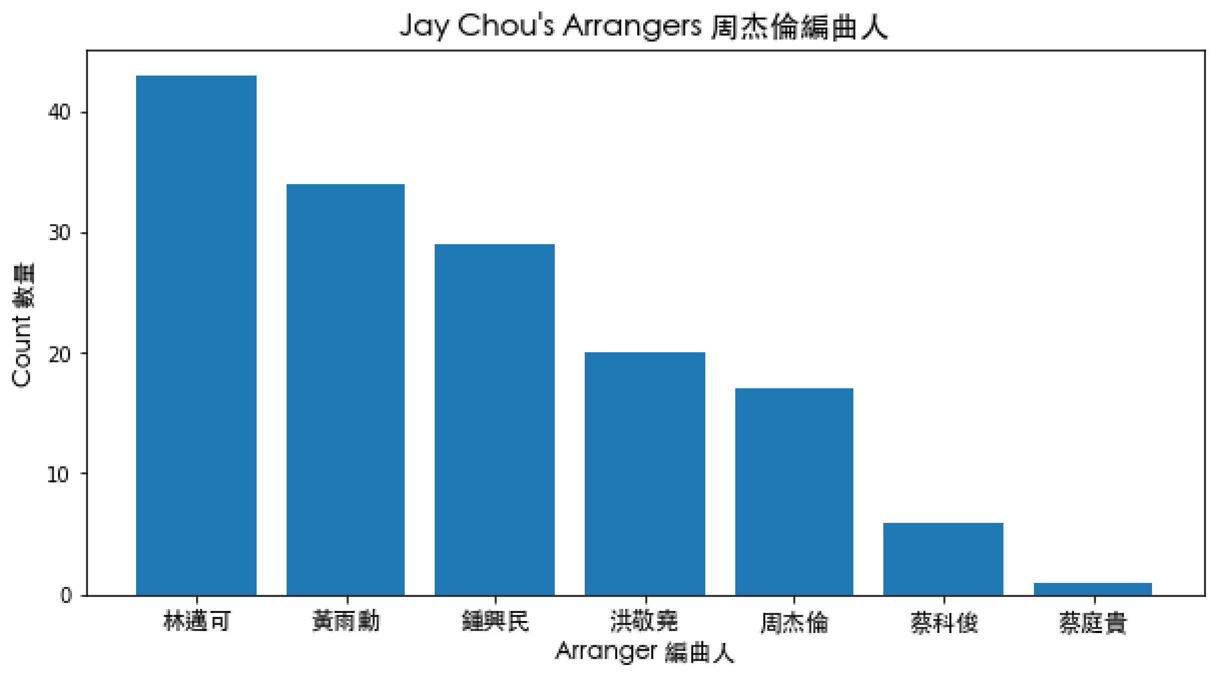
In [24]:
```
#Jay Chou's most frequently collaborated arrangers
arranger_count_df = df.groupby('arranger', as_index = False).count()[['arran
arranger_count_df
```

Out[24]:

	arranger	name
0	林邁可	43
1	黃雨勳	34
2	鍾興民	29
3	洪敬堯	20
4	周杰倫	17
5	蔡科俊	6
6	蔡庭貴	1

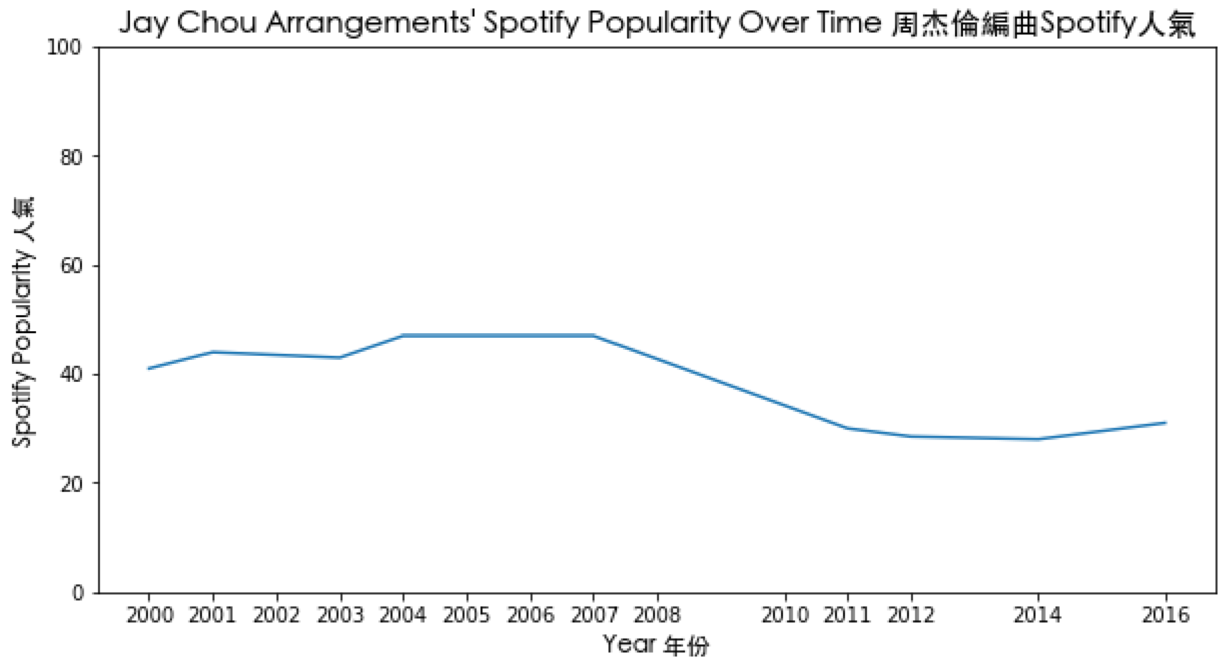
In [25]:
```
#plot of Jay Chou's most frequently collaborated arrangers
fig, ax = plt.subplots(figsize = (10, 5))
ax.bar(arranger_count_df['arranger'], arranger_count_df['name'])
ax.set_xlabel('Arranger 編曲人', fontproperties = 'Heiti TC', size = 12)
ax.set_ylabel('Count 數量', fontproperties = 'Heiti TC', size = 12)
ax.set_title("Jay Chou's Arrangers 周杰倫編曲人", fontproperties = 'Heiti TC'
ax.set_xticklabels(arranger_count_df['arranger'], fontproperties = 'Heiti T
plt.show()
```

```
<ipython-input-25-fb51659b0c44>:7: UserWarning: FixedFormatter should onl
y be used together with FixedLocator
  ax.set_xticklabels(arranger_count_df['arranger'], fontproperties = 'Hei
ti TC', size = 12)
```



In [26]:
```
#get album data for songs that have arrangements by Jay Chou
jay_arrangement_album_df = df[df['arranger'] == '周杰倫'].groupby(['album',
```

In [27]:
```
#Jay Chou arrangements' Spotify popularity over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(jay_arrangement_album_df['year'], jay_arrangement_album_df['popular
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 100)
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou Arrangements' Spotify Popularity Over Time 周杰倫編曲S
ax.set_xticks(albums_df['year'])
plt.show()
```

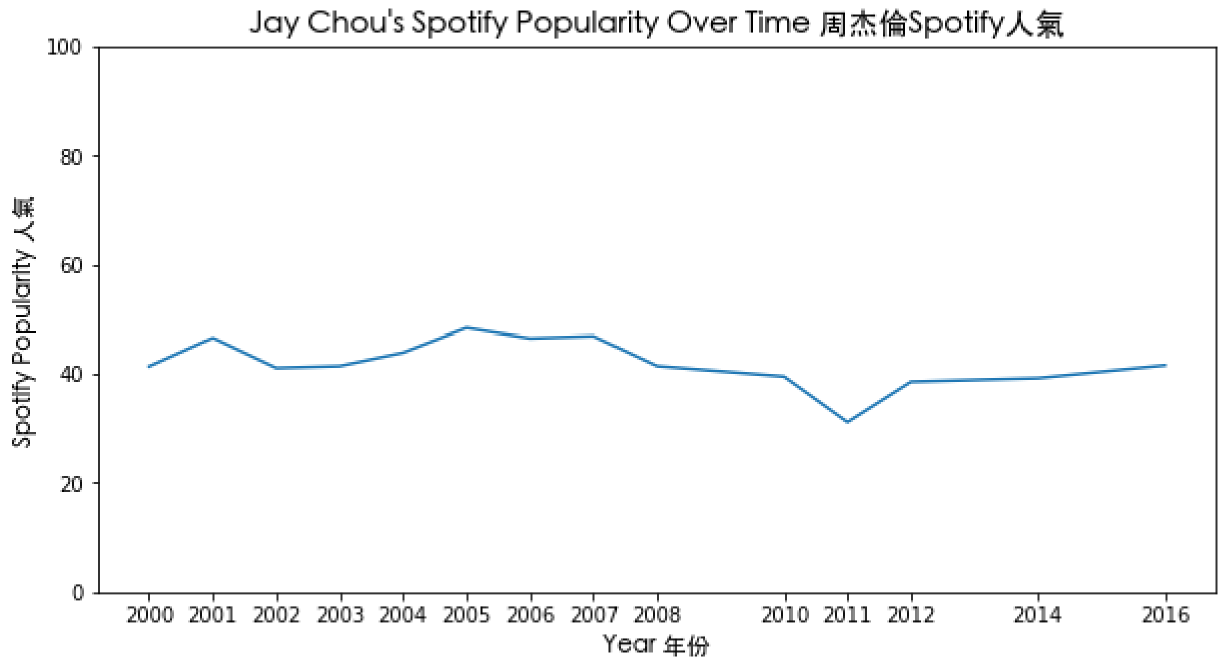


Jay Chou's arrangement quality seems to have a decrease in popularity since 2007.

3.3 Spotify Popularity

Spotify popularity is how popular the song is on Spotify out of 100.

In [28]:
```
#Jay Chou's Spotify popularity over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(albums_df['year'], albums_df['popularity'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 100)
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou's Spotify Popularity Over Time 周杰倫Spotify人氣", for
ax.set_xticks(albums_df['year'])
plt.show()
```



All of Jay Chou's albums throughout the 20 years have around the same Spotify-popularity. The most popular album is 2005's 十一月的蕭邦 (November's Chopin) and the least popular album is 2011's 驚嘆號 (Exclamation Mark).

In [29]:
```
#Jay Chou's 5 most Spotify-popular songs from his studio albums
most_popular = df.sort_values('popularity', ascending = False).reset_index(
most_popular
```

Out[29]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loud
0	告白氣球	2016	周杰倫的床邊故事	方文山	林邁可	8	63	0.590	0.572	11	-7
1	晴天	2003	葉惠美	周杰倫	周杰倫	3	61	0.547	0.567	7	-7
2	安靜	2001	范特西	周杰倫	鍾興民	10	59	0.507	0.402	10	-7
3	一路向北	2005	11月的蕭邦	方文山	蔡科俊	12	58	0.456	0.617	5	-6
4	珊瑚海	2005	11月的蕭邦	方文山	鍾興民	10	58	0.459	0.565	8	-5

In [30]:
```
#Jay Chou's 5 least Spotify-popular songs from his studio albums
least_popular = df.sort_values('popularity').reset_index(drop = True).head(
least_popular
```

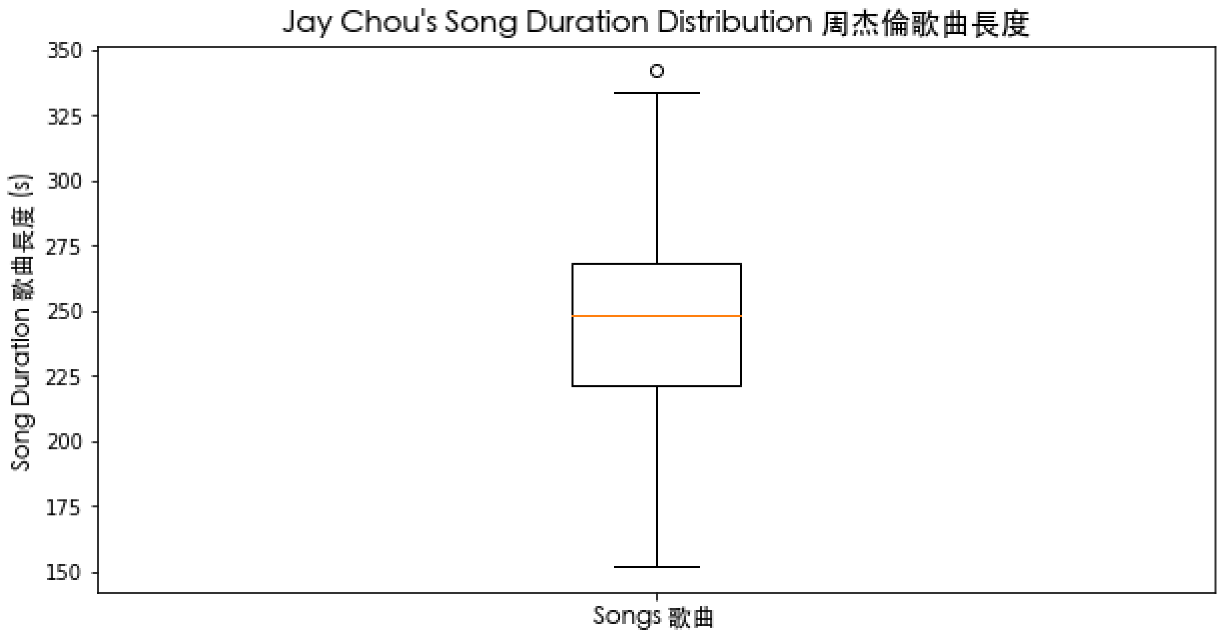
Out[30]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loud
0	皮影戲	2011	驚嘆號	從從	林邁可	10	26	0.627	0.778	11	-7
1	驚嘆號	2011	驚嘆號	方文山	林邁可	1	26	0.571	0.944	0	-3
2	比較大的大提琴	2012	十二新作	方文山	黃雨勳	6	27	0.750	0.634	10	-8
3	四季列車	2012	十二新作	方文山	周杰倫	1	27	0.539	0.914	2	-5
4	陽明山	2014	哎呦不錯哦	方文山	林邁可	1	27	0.714	0.860	2	-6

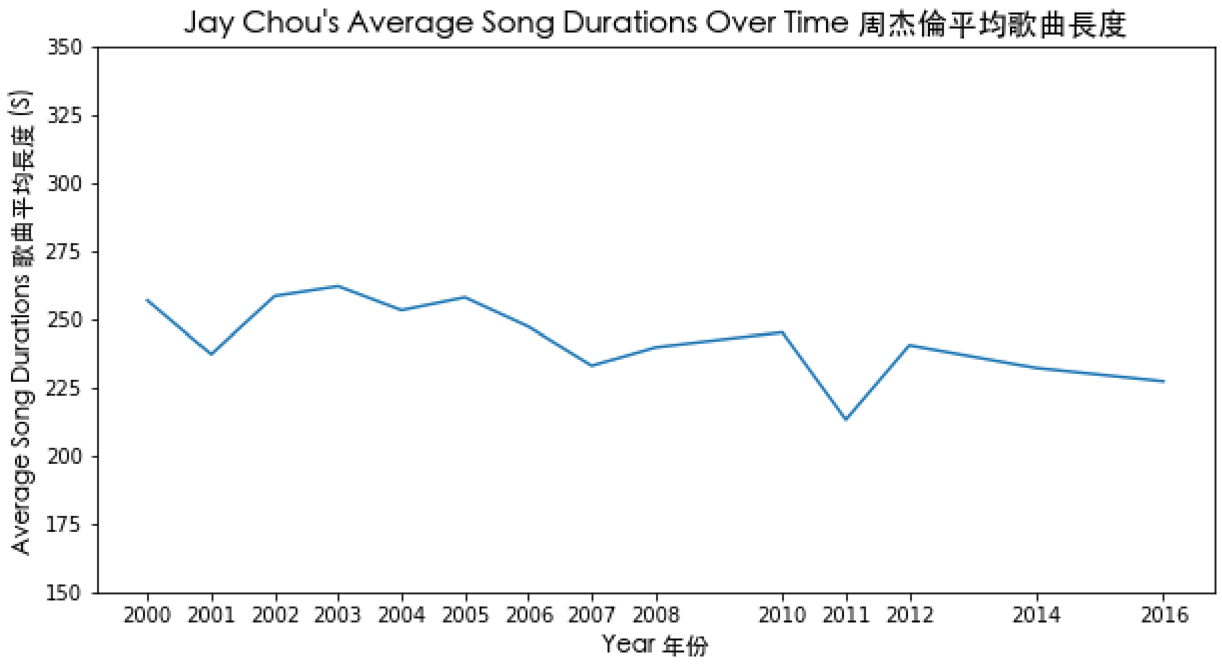
Jay Chou's 5 least Spotify-popular songs were all written between 2010 and 2012 and mostly with lyrics by 方文山 and arranged by 林邁可.

3.4 Duration

In [31]:
```
#Jay Chou's song duration distribution
fig, ax = plt.subplots(figsize = (10, 5))
ax.boxplot(df['duration_s'])
ax.set_xticklabels(['Songs 歌曲'], fontproperties = 'Heiti TC', size = 12)
ax.set_ylabel('Song Duration 歌曲長度 (s)', fontproperties = 'Heiti TC', siz
ax.set_title("Jay Chou's Song Duration Distribution 周杰倫歌曲長度", fontprop
plt.show()
```



In [32]:
```
#Jay Chou's average song durations over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(albums_df['year'], albums_df['duration_s'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 150, top = 350)
ax.set_ylabel('Average Song Durations 歌曲平均長度 (S)', fontproperties = 'He
ax.set_title("Jay Chou's Average Song Durations Over Time 周杰倫平均歌曲長度",
ax.set_xticks(albums_df['year'])
plt.show()
```



All of Jay Chou's albums throughout the 20 years have around the same average song durations, although they are slightly shortening over time. 2011's album 驚嘆號 (Exclamation Mark) is exceptionally short.

In [33]:
```
#the 5 longest songs from Jay Chou's studio albums
df.sort_values('duration_s', ascending = False).reset_index(drop = True).he
```

Out[33]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loudı
0	以父之名	2003	葉惠美	黃俊郎	洪敬堯	1	47	0.432	0.564	2	-7
1	安靜	2001	范特西	周杰倫	鍾興民	10	59	0.507	0.402	10	-7
2	半島鐵盒	2002	八度空間	周杰倫	林邁可	2	49	0.784	0.439	8	-7
3	東風破	2003	葉惠美	方文山	林邁可	5	48	0.700	0.410	7	-8
4	時光機	2008	魔杰座	方文山	黃雨勳	9	43	0.450	0.626	0	-7

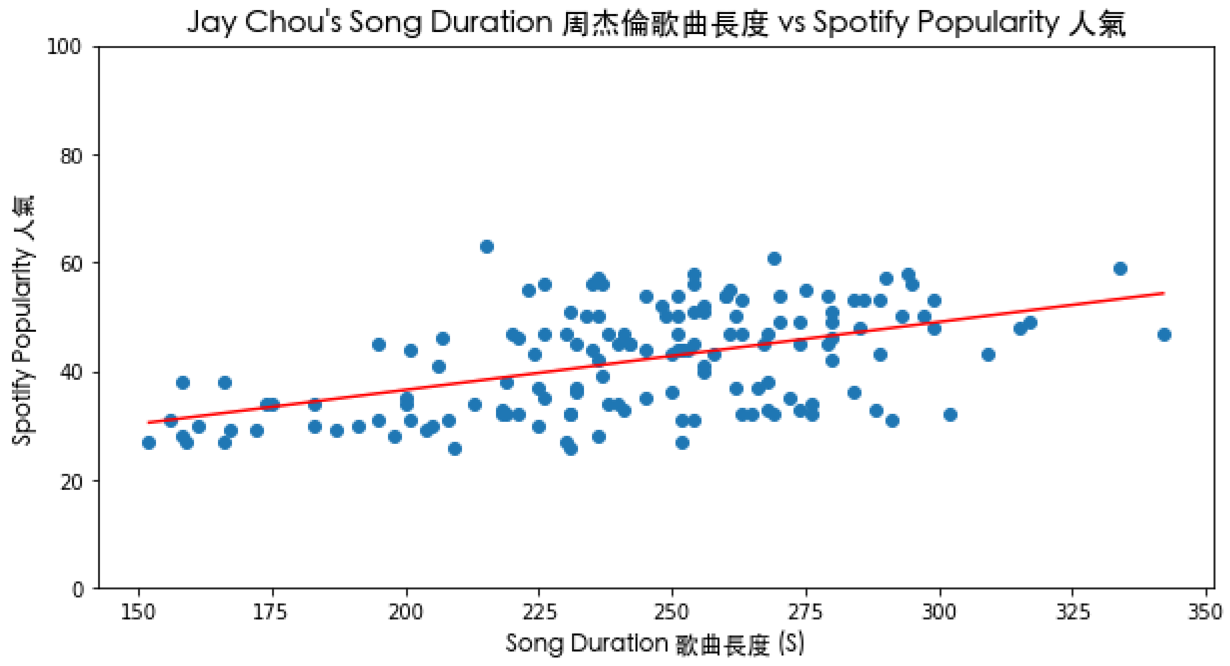
In [34]:
```
#the 5 shortest songs from Jay Chou's studio albums
df.sort_values('duration_s').reset_index(drop = True).head(5)
```

Out[34]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loud
0	陽明山	2014	哎呦不錯哦	方文山	林邁可	1	27	0.714	0.860	2	-6
1	超跑女神	2011	驚嘆號	方文山	林邁可	11	31	0.730	0.603	9	-9
2	一口氣全唸對	2014	哎呦不錯哦	方文山	周杰倫	6	28	0.697	0.842	1	-7
3	忍者	2001	范特西	方文山	林邁可	4	38	0.829	0.845	9	-4
4	四季列車	2012	十二新作	方文山	周杰倫	1	27	0.539	0.914	2	-5

All of Jay Chou's shortest songs have lyrics written by 方文山.

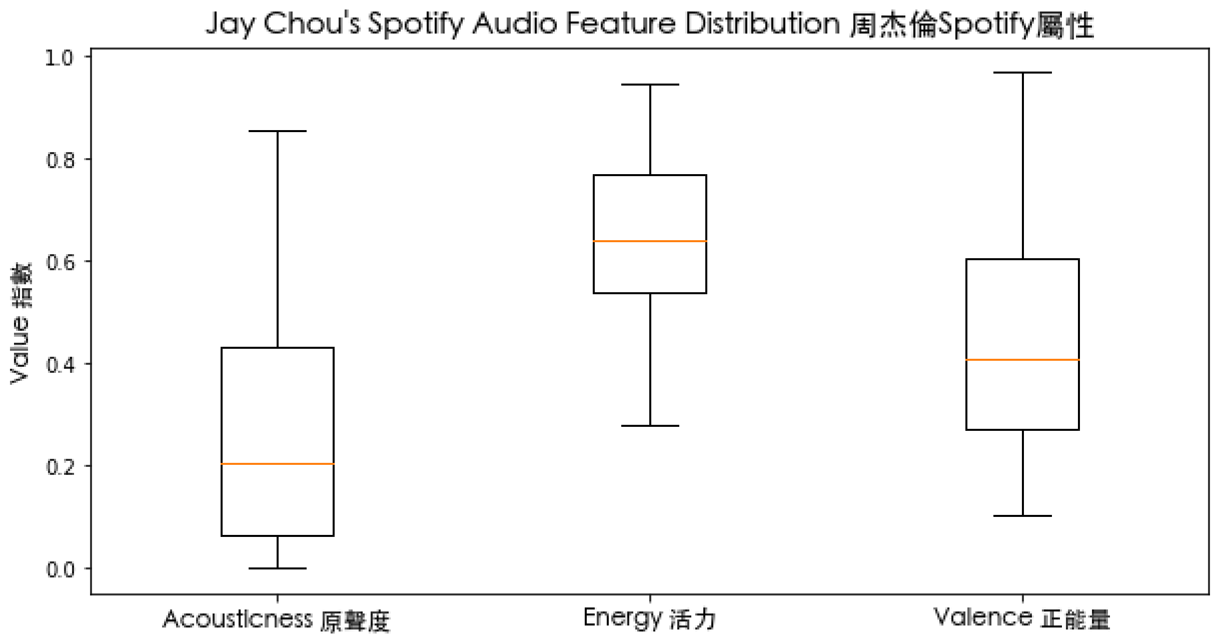
In [35]:
```
#Jay Chou's song duration vs Spotify popularity
fig, ax = plt.subplots(figsize = (10, 5))
ax.scatter(df['duration_s'], df['popularity'])
ax.set_ylim(bottom = 0, top = 100)
ax.set_xlabel('Song Duration 歌曲長度 (S)', fontproperties = 'Heiti TC', size
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou's Song Duration 周杰倫歌曲長度 vs Spotify Popularity 人
ax.plot(np.unique(df['duration_s']), np.poly1d(np.polyfit(df['duration_s'],
plt.show()
```



The longer a Jay Chou song is, the more likely it will be popular on Spotify.

3.5 Spotify Audio Features

In [36]:
```
#Jay Chou's Spotify audio feature distribution
fig, ax = plt.subplots(figsize = (10, 5))
ax.boxplot([df['acousticness'], df['energy'], df['valence']])
ax.set_xticklabels(['Acousticness 原聲度', 'Energy 活力', 'Valence 正能量'], f
ax.set_ylabel('Value 指數', fontproperties = 'Heiti TC', size = 12)
ax.set_title("Jay Chou's Spotify Audio Feature Distribution 周杰倫Spotify屬性
plt.show()
```

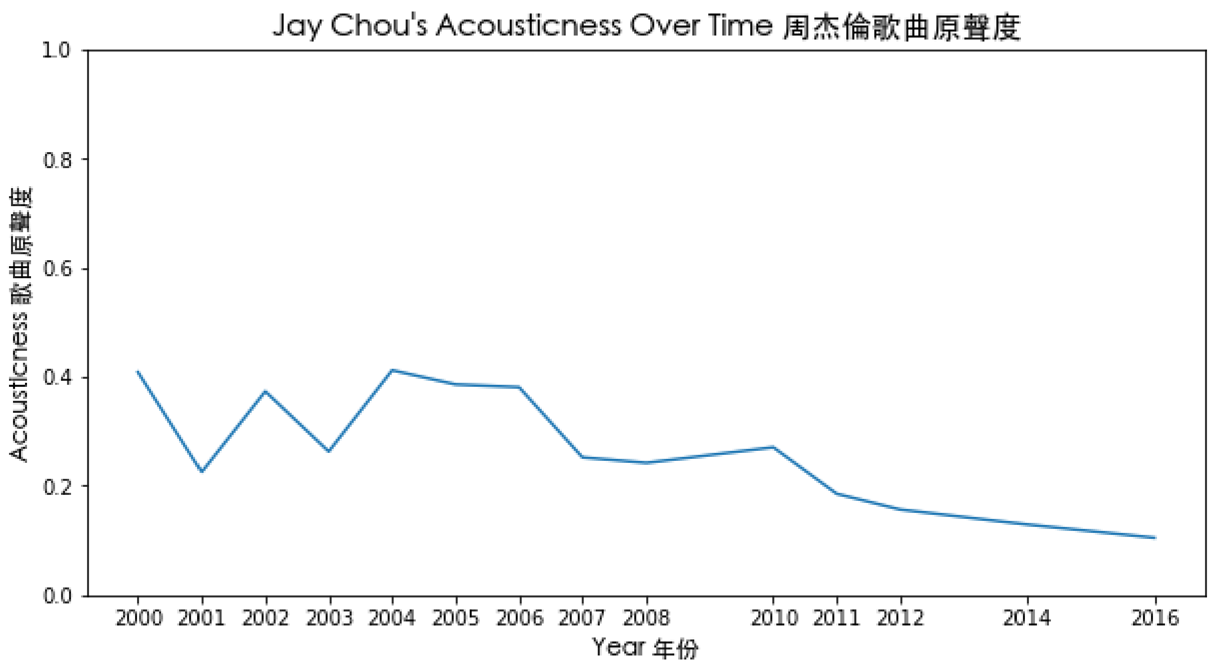


Spotify Audio Features are features generated by Spotify. I find them subjective though.

3.5.1 Acousticness

Acousticness is how naturally-produced the sound is (not produced through electronic ways).

In [37]:
```
#Jay Chou's acousticness over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(albums_df['year'], albums_df['acousticness'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 1)
ax.set_ylabel('Acousticness 歌曲原聲度', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou's Acousticness Over Time 周杰倫歌曲原聲度", fontpropert
ax.set_xticks(albums_df['year'])
plt.show()
```

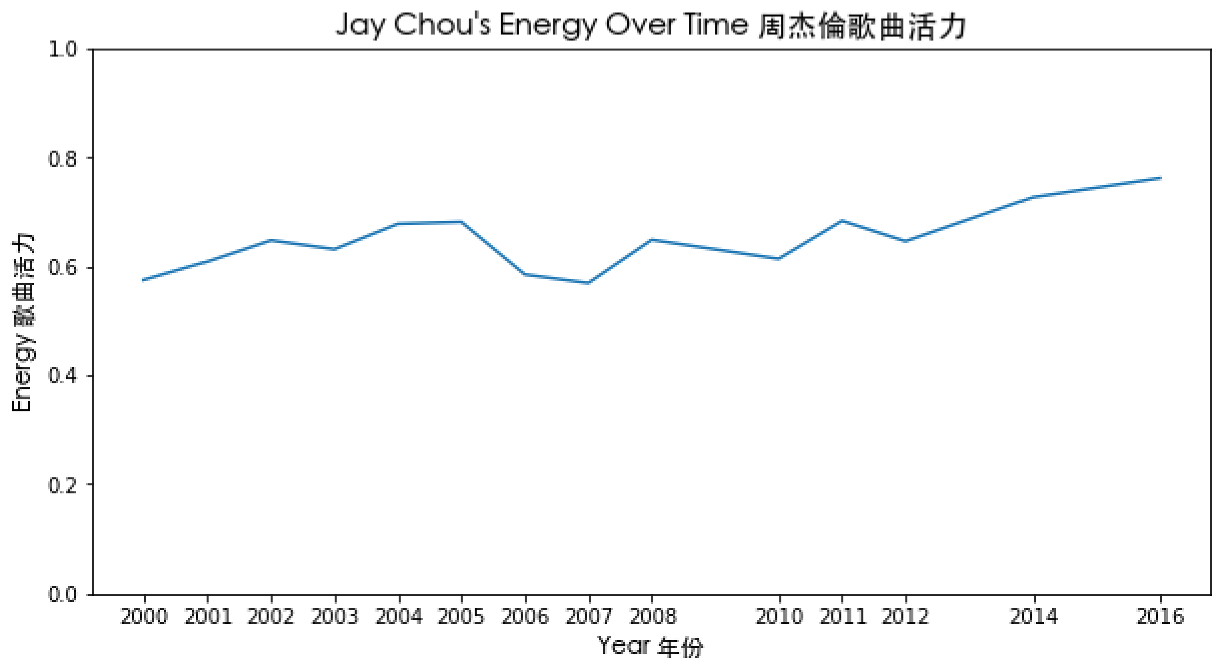


Jay Chou's most acoustic album is 2004's 七里香 (Common Jasmin Orange). Jay Chou has a notable constant drop of acousticness starting from 2011's 驚嘆號 (Exclamation Mark) where his style changed to be more electrical.

3.5.2 Energy

Energy is how energetic the song is.

In [38]:
```
#Jay Chou's energy over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(albums_df['year'], albums_df['energy'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 1)
ax.set_ylabel('Energy 歌曲活力', fontproperties = 'Heiti TC', size = 12)
ax.set_title("Jay Chou's Energy Over Time 周杰倫歌曲活力", fontproperties = '
ax.set_xticks(albums_df['year'])
plt.show()
```



For the past 20 years, Jay Chou's energy in songs has been pretty consistent. However, there has been a slight increase. The most recent albums 哎呦 不錯哦 (Aiyo, Not Bad) and 周杰倫的床邊故事 (Jay Chou's Bedtime Stories) are his most energetic albums so far.

In [39]:
```
#the 5 most energetic songs from Jay Chou's studio albums
df.sort_values('energy', ascending = False).reset_index(drop = True).head(5
```

Out[39]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loudı
0	驚嘆號	2011	驚嘆號	方文山	林邁可	1	26	0.571	0.944	0	-3
1	藍色風暴	2005	11月的蕭邦	方文山	洪敬堯	2	36	0.333	0.940	2	-4
2	英雄	2016	周杰倫的床邊故事	周杰倫	黃雨勳	5	31	0.549	0.939	7	-5
3	水手怕水	2011	驚嘆號	黃俊郎	周杰倫	8	30	0.718	0.924	6	-5
4	土耳其冰淇淋	2016	周杰倫的床邊故事	周杰倫	周杰倫	7	31	0.662	0.924	7	-6

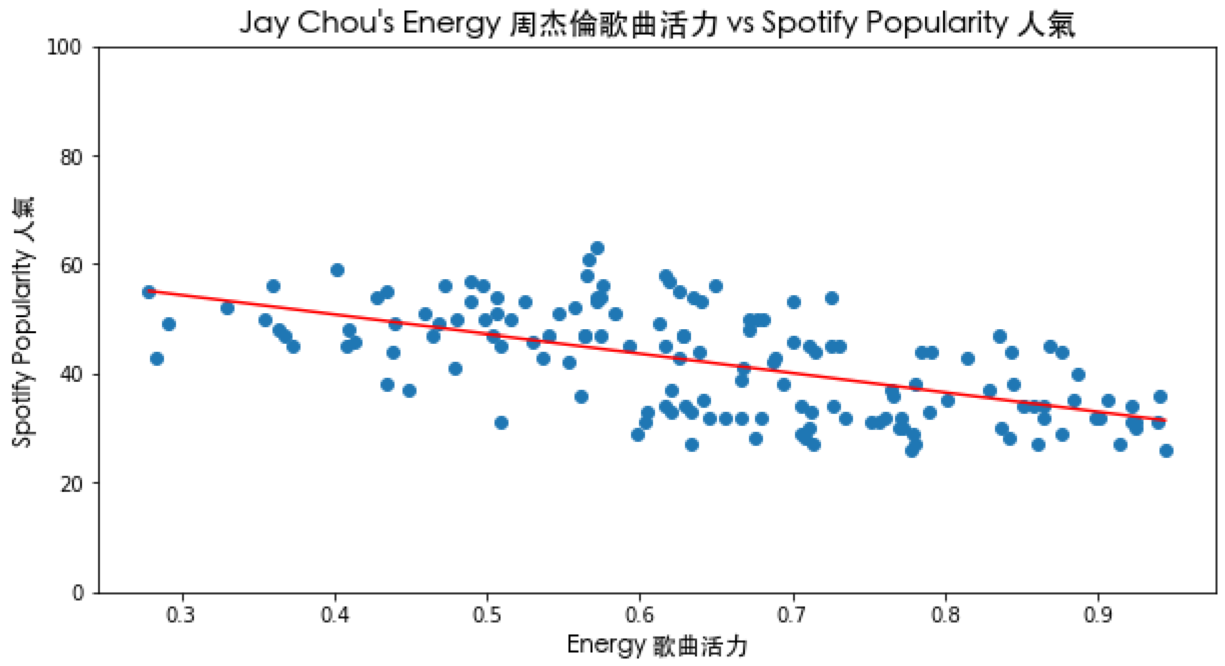
In [40]:
```
#the 5 least energetic songs from Jay Chou's studio albums
df.sort_values('energy').reset_index(drop = True).head(5)
```

Out[40]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loudı
0	彩虹	2007	我很忙	周杰倫	林邁可	2	55	0.612	0.279	0	-10
1	你好嗎	2011	驚嘆號	羅宇軒, 李汪哲	黃雨勳	5	43	0.281	0.284	8	-11
2	黑色幽默	2000	杰倫	周杰倫	鍾興民	6	49	0.603	0.292	10	-7
3	星晴	2000	杰倫	周杰倫	洪敬堯	3	52	0.637	0.329	7	-10
4	菊花台	2006	依然范特西	方文山	鍾興民	10	50	0.406	0.354	5	-6

His most energetic songs are mostly new songs and his least energetic songs are mostly old songs.

In [41]:
```
#Jay Chou's energy vs Spotify popularity
fig, ax = plt.subplots(figsize = (10, 5))
ax.scatter(df['energy'], df['popularity'])
ax.set_ylim(bottom = 0, top = 100)
ax.set_xlabel('Energy 歌曲活力', fontproperties = 'Heiti TC', size = 12)
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou's Energy 周杰倫歌曲活力 vs Spotify Popularity 人氣", fo
ax.plot(np.unique(df['energy']), np.poly1d(np.polyfit(df['energy'], df['pop
plt.show()
```

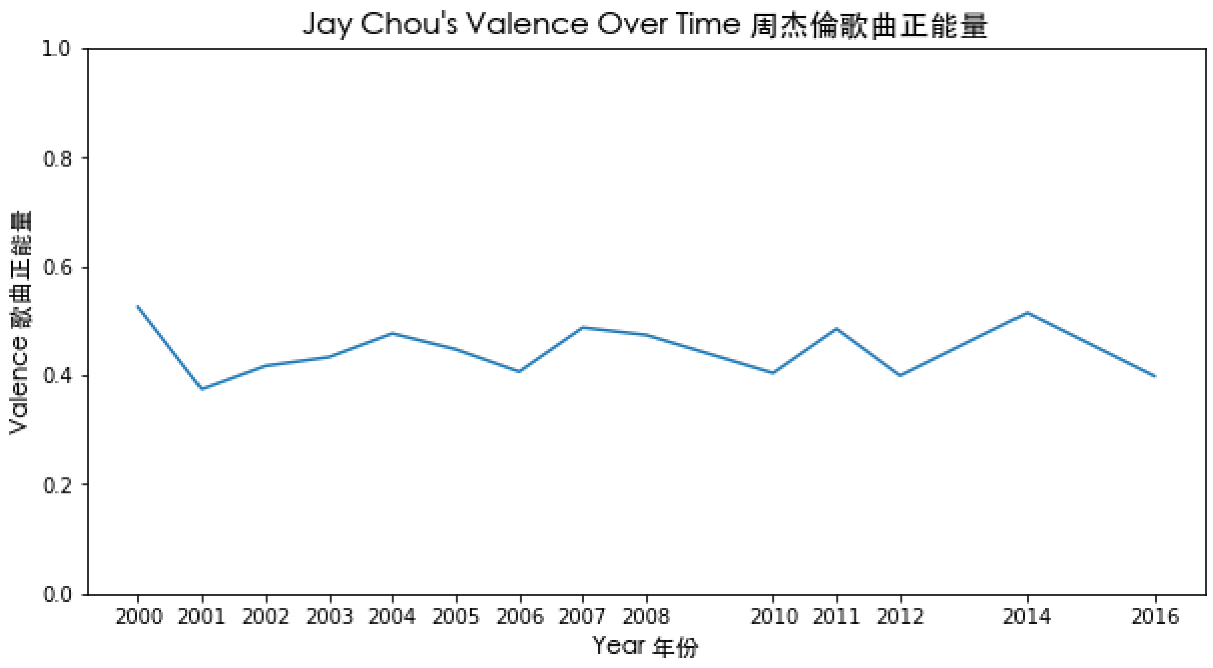


Looking at all of Jay Chou's studio album songs, we can see that the less energetic a song is, the more likely it will be popular on Spotify.

3.5.3 Valence

Valence is how positive the song sounds.

In [42]:
```
#Jay Chou's valence over time
fig, ax = plt.subplots(figsize = (10, 5))
ax.plot(albums_df['year'], albums_df['valence'])
ax.set_xlabel('Year 年份', fontproperties = 'Heiti TC', size = 12)
ax.set_ylim(bottom = 0, top = 1)
ax.set_ylabel('Valence 歌曲正能量', fontproperties = 'Heiti TC', size = 12)
ax.set_title("Jay Chou's Valence Over Time 周杰倫歌曲正能量", fontproperties =
ax.set_xticks(albums_df['year'])
plt.show()
```



Jay Chou's valence is pretty constant throughout his career.

In [43]:
```
#the 5 most valent songs from Jay Chou's studio albums
df.sort_values('valence', ascending = False).reset_index(drop = True).head(
```

Out[43]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loud
0	公公偏頭痛	2012	十二新作	方文山	周杰倫	3	30	0.468	0.770	5	-1C
1	竊愛	2014	哎呦不錯哦	黃俊郎	黃雨勳	2	29	0.651	0.876	0	-6
2	魔術先生	2008	魔杰座	方文山	鍾興民	5	30	0.730	0.711	0	-6
3	可愛女人	2000	杰倫	徐若瑄	周杰倫	1	50	0.767	0.671	5	-9
4	水手怕水	2011	驚嘆號	黃俊郎	周杰倫	8	30	0.718	0.924	6	-5

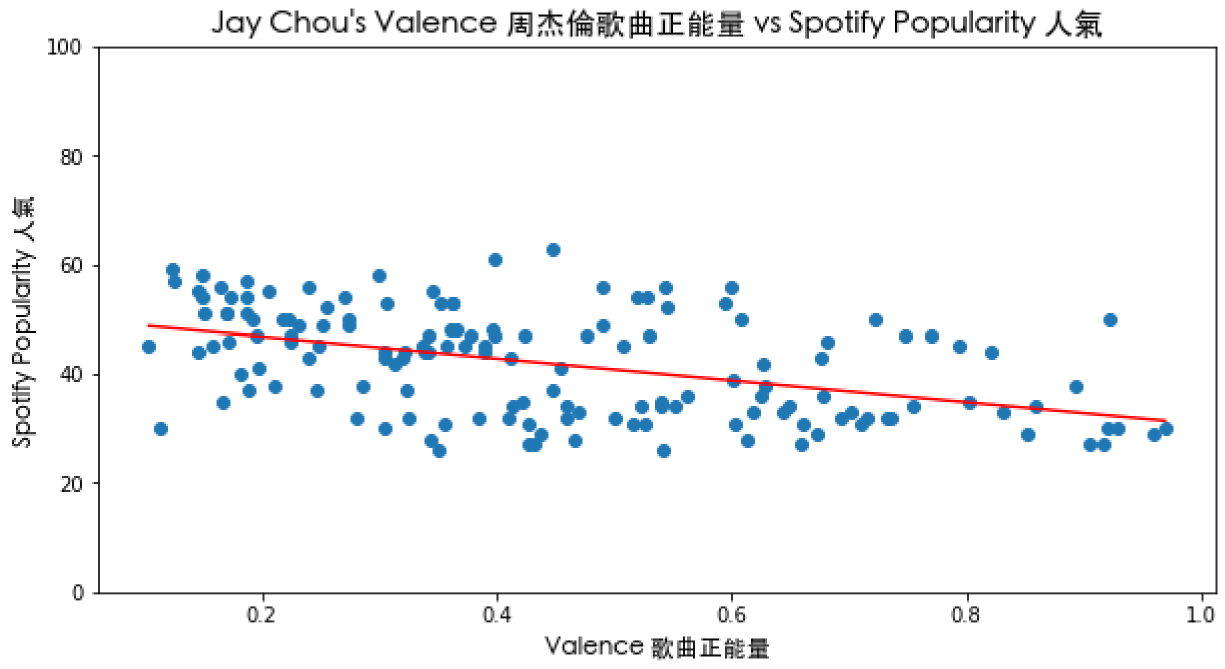
In [44]:
```
#the 5 least valent songs from Jay Chou's studio albums
df.sort_values('valence').reset_index(drop = True).head(5)
```

Out[44]:

	name	year	album	lyricist	arranger	track_number	popularity	danceability	energy	key	loud
0	心雨	2006	依然范特西	方文山	林邁可	7	45	0.572	0.509	0	-7
1	夢想啟動	2012	十二新作	林義傑	林邁可	9	30	0.558	0.773	3	-1C
2	安靜	2001	范特西	周杰倫	鍾興民	10	59	0.507	0.402	10	-7
3	擱淺	2004	七里香	宋健彰	鍾興民	6	57	0.497	0.490	5	-7
4	分裂	2002	八度空間	周杰倫	鍾興民	6	44	0.637	0.438	1	-8

夢想啟動 (Dream) being among the least valent songs is very surprising because the song is about self-motivation and following one's dreams.

In [45]:
```
#Jay Chou's valence vs Spotify popularity
fig, ax = plt.subplots(figsize = (10, 5))
ax.scatter(df['valence'], df['popularity'])
ax.set_ylim(bottom = 0, top = 100)
ax.set_xlabel('Valence 歌曲正能量', fontproperties = 'Heiti TC', size = 12)
ax.set_ylabel('Spotify Popularity 人氣', fontproperties = 'Heiti TC', size =
ax.set_title("Jay Chou's Valence 周杰倫歌曲正能量 vs Spotify Popularity 人氣",
ax.plot(np.unique(df['valence']), np.poly1d(np.polyfit(df['valence'], df['p
plt.show()
```

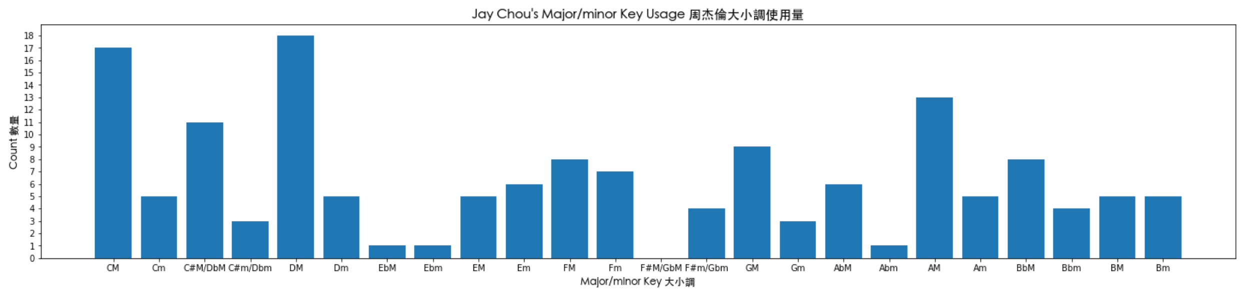


The less valennt a Jay Chou song is, the more likely that it will be popular on Spotify.

3.6 Jay Chou's Major/minor Key Usage

In [46]:
```
#get the count of each Major/minor key Jay Chou used
keys = ['CM', 'Cm', 'C#M/DbM', 'C#m/Dbm', 'DM', 'Dm', 'EbM', 'Ebm',
        'EM', 'Em', 'FM', 'Fm', 'F#M/GbM', 'F#m/Gbm', 'GM', 'Gm', 'AbM', 'Ab
        'AM', 'Am', 'BbM', 'Bbm', 'BM', 'Bm']
keys_groupby = df.groupby('Mmkey').count()
keys_df = pd.DataFrame(index = keys)
key_count = keys_df.join(keys_groupby)['name'].rename('count').fillna(0)
```

In [47]:
```
#Jay Chou's Major/minor key usage in all studio albums
fig, ax = plt.subplots(figsize = (25, 5))
ax.bar(key_count.index, key_count.values)
ax.set_xlabel('Major/minor Key 大小調', fontproperties = 'Heiti TC', size =
ax.set_ylabel('Count 數量', fontproperties = 'Heiti TC', size = 12)
ax.set_title("Jay Chou's Major/minor Key Usage 周杰倫大小調使用量", fontproper
ax.set_xticks(key_count.index)
ax.set_yticks(range(0, 19))
plt.show()
```



Jay Chou's most used keys are C and D major. Jay Chou haven't used F#M/GbM in his studio albums as of 2016.

4. Final Words

Some key takeaways are that:

- Jay Chou's most-frequent collaborating lyricist is 方文山 and most-frequent collaborating arranger is 林邁可.
- The longer a Jay Chou song is, the more likely that it will be popular on Spotify.
- Jay Chou's most used keys are C and D major. Jay Chou hasn't used F#M/GbM in his studio albums yet as of 2016.

Summaries of this Notebook is presented at: https://brc042.github.io/Data-Analysis-on-Jay-Chou/ (https://brc042.github.io/Data-Analysis-on-Jay-Chou/)

Finally, I will like to thank the Spotify API for having these data for me to analyze. I hope you enjoyed this data analysis on Jay Chou.

-Brian Cheng 2020

In [ ]:
```
```