

Cindy Li

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Object Oriented Design

Final Project Write Up

Project Description

This project is a Music Player that mimics music streaming platforms such as Spotify and Apple Music, that allow artists to upload songs and albums and allows listeners to stream music as well as create their own playlists. It is a platform where artists release music and listeners play music that artists upload. There are songs that have titles, artists, albums, how long it is (in minutes), and what genre it is. The program allows you to add songs to the music player. The songs can be stored in collections such as albums, playlists, and a queue. These collections of songs can be modified where artists can add songs to an album and listeners can create playlists and add songs to the queue to play. The listener can opt for premium or basic access. Premium access allows them to play music in order whereas basic access only allows for playlists to be shuffled. Premium access also allows you to skip songs in the queue, which is not available to basic users. Premium users can also choose to play music by one specific artist.

Song collections are array lists that hold song objects. Playlist, Album, and Queue are subclasses that extend the SongCollection parent class. Playlists and Albums differ in that playlists do not have an artist while Albums do. Playlists are a collection of songs by many different artists created by a listener whereas an album is a collection of songs released by an artist that is usually immutable by listeners. The Queue object serves a stand alone line of songs that have been queued to play by the listener. Any songs or albums or playlists that are “played” get added to the queue to be played. If a song is skipped, it is removed from the queue. The

queue can be traversed by an iterator that goes to the next song or to the previous song. The queue can be played in the order of songs added or the songs can be shuffled.

Running the Program

When you enter the program, you will be asked if you want premium (1) or basic access (2). Entering 1 will give you premium access. Then you are asked if you are releasing music (1) or listening to music (2). Enter the corresponding number to select the desired option. Artists use the release music option to add new songs and create new albums. Before anyone can listen to music, songs need to be created in the program. So let's first select the option to release music. You then have the option to add a new song (1), create a new album (2), or add songs to an album (3). You can create a new song by entering 1 and entering the song's information when prompted. Once the song is created, you will have the option again to add a new song, create a new album, or add songs to an album as well as the option to return to the main menu (release music or listen to music). You can select 2 to create a new album, giving it its name and the artist. Next, you can select 3 to add existing songs to the album.

To enter the option of listening to music, you can return to the main menu and enter 2 when prompted. I have already loaded a number of built in songs, albums, and playlists into the program so you can listen to music before adding anything. As a listener, both for premium and basic access, you can create playlists by choosing 3 when prompted to choose between Play Queue (1), Modify Queue (2), create a new playlist(3), and Add song to playlist (4), enter 3. You can then create a new playlist and then select 3 to add songs to playlists. Selecting Edit Queue (2) will allow you to choose to add songs to queue (1), add collection to queue (2) remove from queue (3). Select 1 to add songs to the queue by entering the song and select 2 to add/play a

playlist or album to the queue by entering the album or playlist. To play the queue, enter 1 and select if you want to play music in order (1) or shuffle (2).

If you enter as a basic user, you can also create playlists and add songs to it. You can also add songs, albums, and playlists to the queue. However, you will not be able to modify the queue and the only option for playing music in your queue is to shuffle the songs. There should not be an option to do so.

When the queue is played, it prints out the songs in the queue showing the songs that are going to be played. Since there are no music files, the songs are played by printing out the song. The client can use the queue in different ways. It can play the whole queue as is or it can play the music by printing out the next song, skipping the song (if premium), or printing out the previous song. It can continue to do this while there is a next song or there is a previous song.

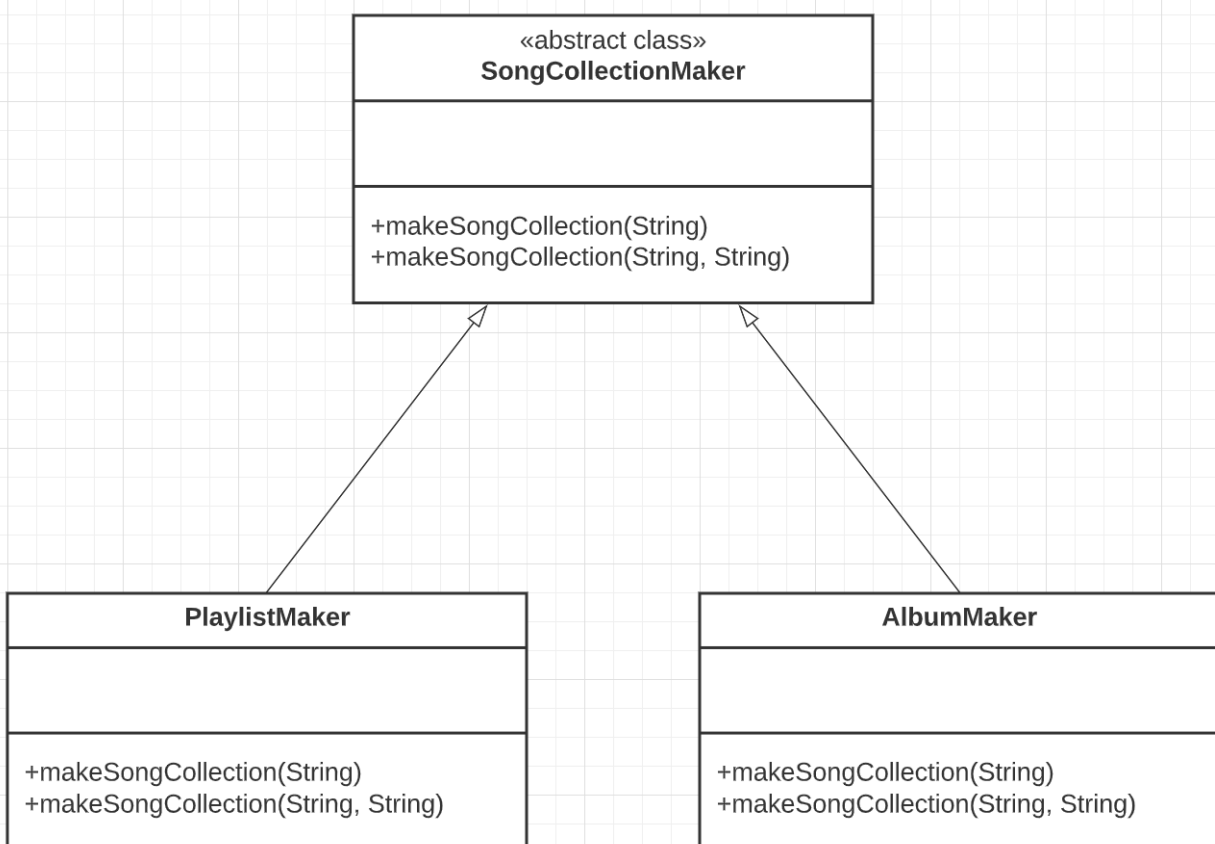
*** *See screenshots at end of writeup*

Design Patterns

The design patterns I used and why I chose them along with the UML diagrams

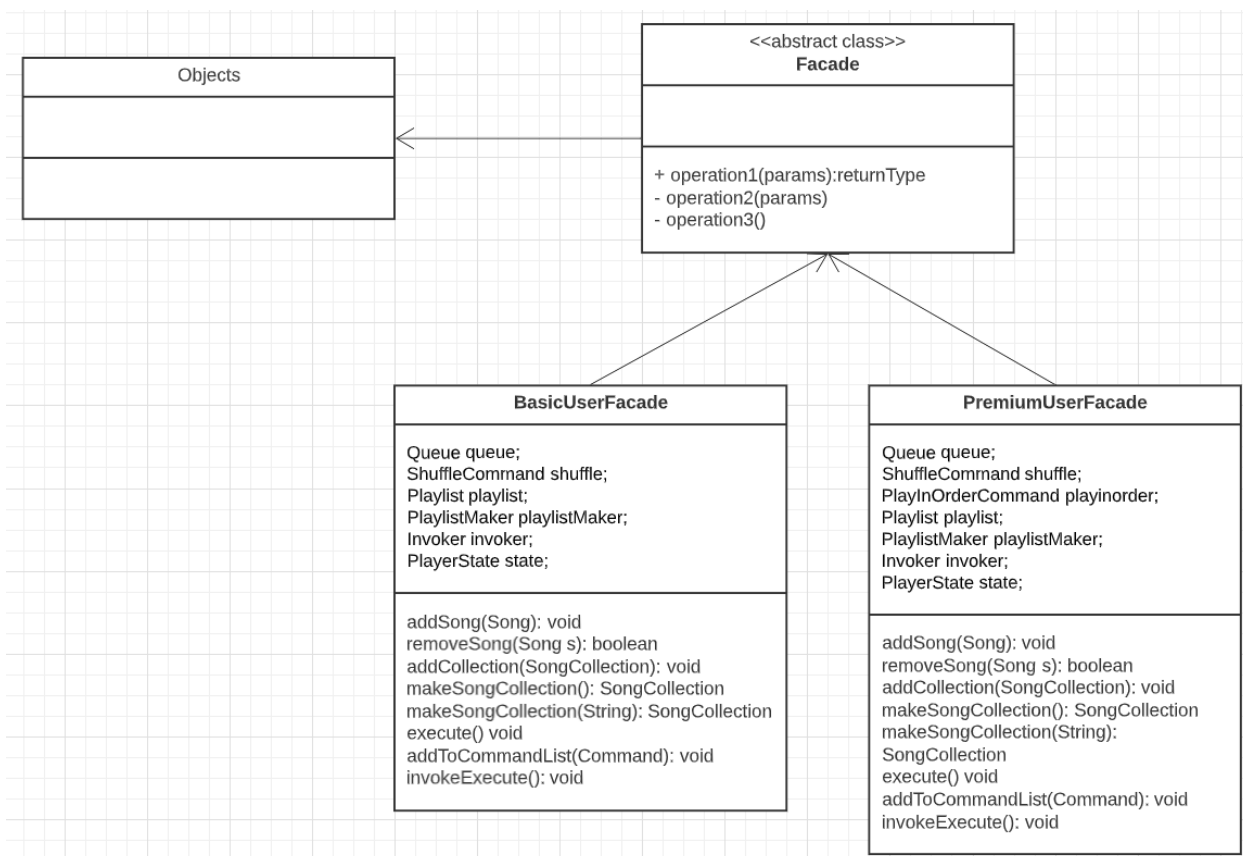
Factory Method (Creational)

For creating collections of songs, I used a factory method because the design pattern is good for separating general object creation from usage. Here, I outsource the creation of objects from the methods that act on them and delegate creation to the subclasses of playlists and albums. As seen in the UML diagram below, the objects are created in factory methods and each extended class also extends a factory using inheritance. The playlist and album subclasses have factory methods as well. The factory is the one that calls the constructor. This way, all the code is in the classes instead of in the client program. To create a song collection, the client first creates a factory.



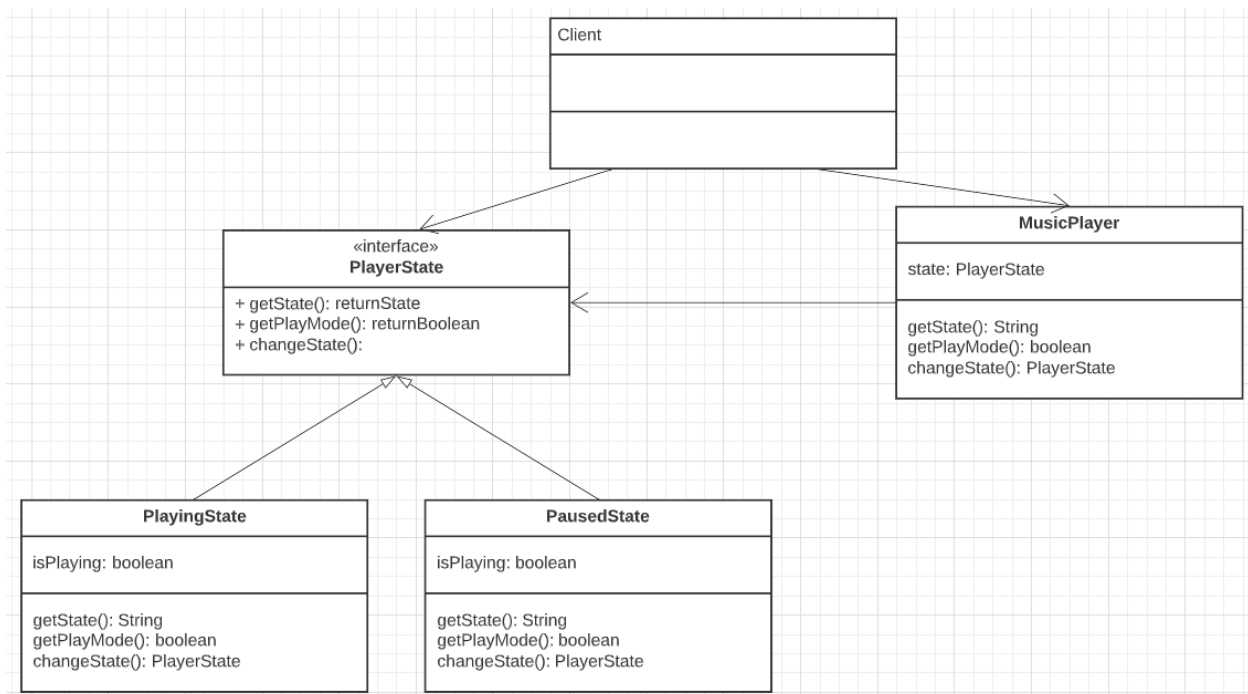
Facade (Structural)

The music player has basic and premium listener access. Full access includes adding songs and albums, which is not a part of listener access since listeners do not make new songs or create new albums, only artists do that. Premium listener access can play music in order as well as in shuffle, and can skip songs. On a simpler level, basic listener access can shuffle play the music and cannot skip songs in the queue. Both listeners can create playlists but do not have methods for creating new songs or albums. The facade design pattern allows the program to hide complex logic and methods for different usages. Each user level has a subset of features and methods.



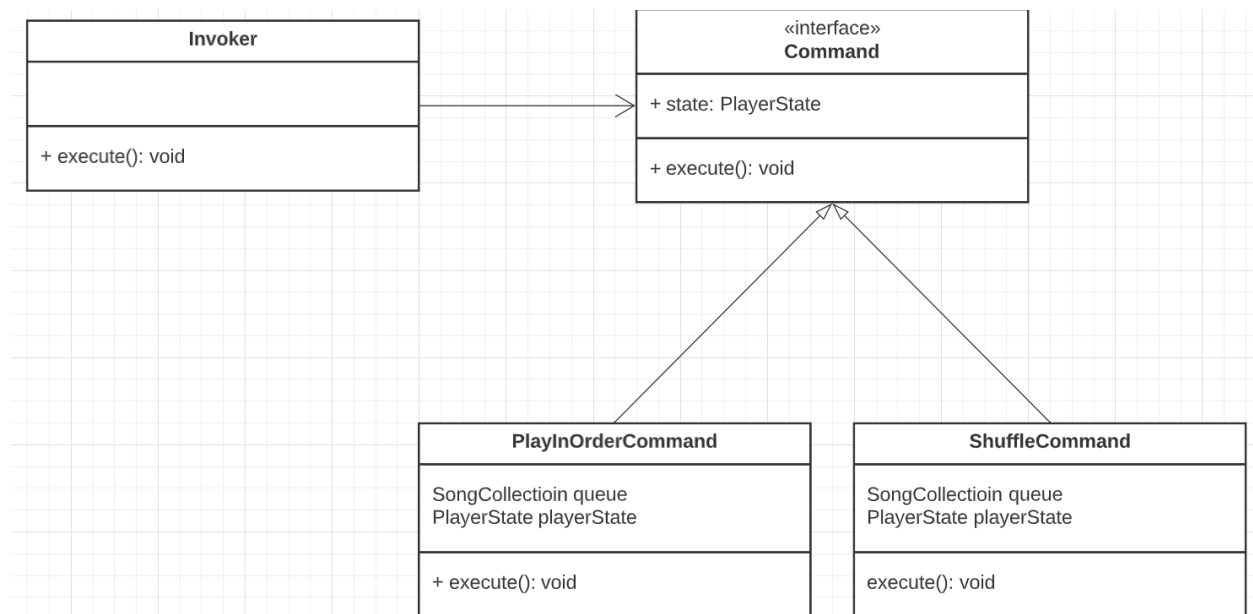
State (Behavioral)

To track which state the music player is in, I used the state design pattern. The music player can either be playing music or paused similar to being on or off and open or closed. The behavior of the music player is dependent on this context. The state pattern also can change the state variable that dictates the behavior using the `changeState()` method. The state can be changed from Playing State to Paused State and vice versa. When the music player is in the Playing State, the state says that “music is playing” and the boolean `isPlaying` is true. When the music player is in the Paused State, the state says that “music is paused” and `isPlaying` is false. The program uses the states to know how to behave based on if the player is on or off. The client of the state pattern is the command pattern, which uses the states to determine how to behave when called. If the state is the Paused State, then the `PlayInOrder` and `Shuffle` Commands will need to change the state to Playing State before being able to play the song. When the song collection is done playing, the state is changed back to Paused.



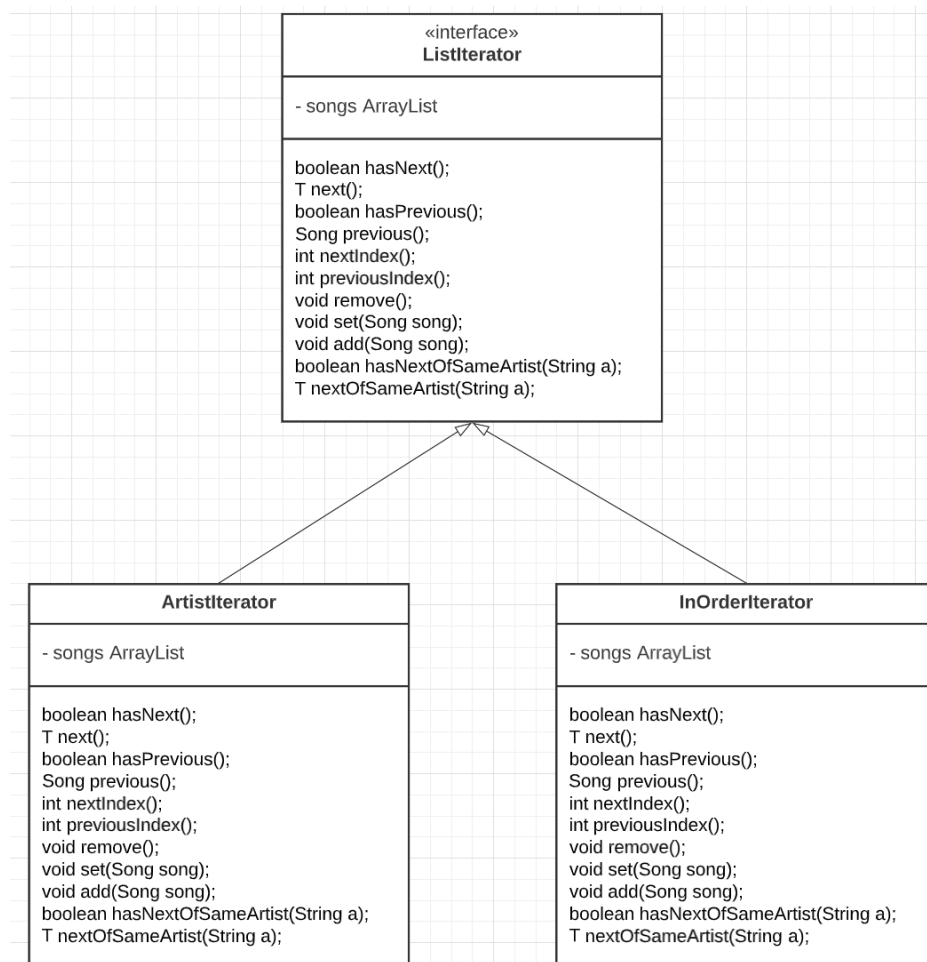
Command (Behavioral)

I chose to use the command pattern for the function of playing the music. There are two commands for playing music, shuffle and play in order. The shuffle command essentially shuffles the queue before iterating through the queue while the play in order command iterates through the queue without changing the order. Here, the behavior is the focus and the command pattern encapsulates the action. The command pattern fits well because it allows the program to receive and execute a command. Only the execute() method is exposed and allows actions to be invoked on the receiver. The code is extensible and I can add new commands. When the command is called it gets added to a list of commands that then get executed.



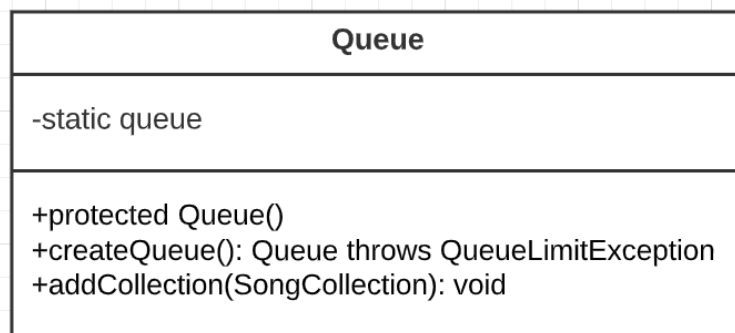
Iterator (Behavioral)

I needed the iterator pattern to go through the lists of songs in the song collections. This allows me to iterate through my song collections both in the forwards and backwards directions using `next()` and `previous()`. I use the iterator pattern to then create a custom algorithm for the iterator to go through the list. With the artist iterator, the iterator traverses by the same artist and `next()` returns the next song by the same artist. This allows listeners to listen to music by one artist if they wanted to. On Spotify, you can click on an artist and play all the songs by them. The `ArtistIterator` recreates that feature where the client can find the next song by the same artist.



Singleton

In the music player, songs are added to a queue that is played. When an album or playlist is played, it also gets added to the queue. As such, there should only be one queue. Although there can be multiple playlists and albums, the queue is a stand alone collection of songs in line to be played and there cannot be multiple lines. I used the singleton pattern for the queue so that only one instance of the queue can be created. In the singleton pattern, there is a static variable to hold the reference to the object so that it is encapsulated. The program then checks if the object already exists before creating an object if not.



Possible Further Additions

- Observer pattern to make buttons

Attachments

Menus:

1. Premium User
 2. Basic User
-
1. Release Music
 1. Create new song
 2. Create new album
 3. Add song to existing album
 4. Exit back to menu
 2. Listen to Music
 1. Play Queue
 1. Play in Order
 2. Shuffle
 2. Modify Queue
 1. Add song to queue
 2. Add playlist to queue
 3. Add album to queue
 4. Skip song
 3. Create new playlist
 4. Add song to existing playlist

Screenshots

```
Welcome to the Music Player
The music player is playing music in
state: Music is Paused
isPlaying: false
Select your plan:

1. Premium:
  - Listen to music in order
  - Listen to music on shuffle
  - Skip songs in the queue
2. Basic:
  - Listen to music on shuffle
  - No skipping songs
1
1. Release music. 2. Listen to music.
Enter 1 or 2:
1
Enter a number:
1. Create new song.
2. Create new album.
3. Add song to existing album.
4. Exit back to menu.
1
Song Name:
All I Want for Christmas is You
Artist/s:
Mariah Carey
Album Name:
Merry Christmas
Length in minutes:
4
```

Here is your song: Song Title: All I Want for Christmas is You by Mariah Carey
Album: Merry Christmas

4min

1. Create new song.
2. Create new album.
3. Add song to existing album.
4. Exit back to menu.

2

Album Name:

Merry Christmas

Artist:

Mariah Carey

Here is your album: Album: Merry Christmas by: Mariah Carey

1. Create new song.
2. Create new album.
3. Add songs to existing album.
4. Exit back to menu.

3

Built In Album1

Built In Album - Single

Merry Christmas

Which album do you want to add to? Type in the name of the album:

Rockin' Around the Christmas Tree by Brenda Lee
Let It Snow! by Nat King Cole
A Holly Jolly Christmas by Burl Ives
White Christmas by Bing Crosby, Ken Darby Singers, John Scott Trotter & His Orchestra
Feliz Navidad by Jose Feliciano
Jingle Bells by Frank Sinatra
Deck The Halls by Nat King Cole
Santa Claus Is Back In Town by Elvis Presley
White Christmas by Elvis Presley
Here Comes Santa Clause by Elvis Presley
I'll Be Home for Christmas by Elvis Presley
Blue Christmas by Elvis Presley
Santa Bring My Baby Back by Elvis Presley
O Little Town of Bethlehem by Elvis Presley
Silent Night by Elvis Presley
Peace In the Valley by Elvis Presley
I Believe by Elvis Presley
Take My Hand, Precious Lord by Elvis Presley
It Is No Secret by Elvis Presley
Rockin' Around the Christmas Tree by Brenda Lee
Which song are you adding? Choose from the songs in your music library above.

```
1. Create new song.
2. Create new album.
3. Add songs to existing album.
4. Exit back to menu.
3
Built In Album1
Built In Album - Single
Merry Christmas
Which album do you want to add to? Type in the name of the album:
Merry Christmas
Rockin' Around the Christmas Tree by Brenda Lee
Let It Snow! by Nat King Cole
A Holly Jolly Christmas by Burl Ives
White Christmas by Bing Crosby, Ken Darby Singers, John Scott Trotter & His Orchestra
Feliz Navidad by Jose Feliciano
Jingle Bells by Frank Sinatra
Deck The Halls by Nat King Cole
Santa Claus Is Back In Town by Elvis Presley
White Christmas by Elvis Presley
Here Comes Santa Clause by Elvis Presley
I'll Be Home for Christmas by Elvis Presley
Blue Christmas by Elvis Presley
Santa Bring My Baby Back by Elvis Presley
O Little Town of Bethlehem by Elvis Presley
Silent Night by Elvis Presley
Peace In the Valley by Elvis Presley
I Believe by Elvis Presley
Take My Hand, Precious Lord by Elvis Presley
It Is No Secret by Elvis Presley
All I Want for Christmas is Youu by Mariah Carey
Which song are you adding? Choose from the songs in your music library above.
All I Want for Christmas
```

```
Here is your album: Album: Merry Christmas by: Mariah Carey
1. Create new song.
2. Create new album.
3. Add another song.
4. Exit.
4
1. Upload music.
2. Listen to music.
2
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
3
Give your playlist a name:
White Christmas
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
4
Which playlist do you want to add to? Enter the name of the playlist:
White Christmas
Which song are you adding? Enter the name of the song:
Let It Snow!
Here is your playlist: Playlist: White Christmas Songs: 1, Length: 1
```

```
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
4
Which playlist do you want to add to? Enter the name of the playlist:
White Christmas
Which song are you adding? Enter the name of the song:
Blue Christmas
Here is your playlist: Playlist: White Christmas Songs: 2, Length: 4
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
4
Which playlist do you want to add to? Enter the name of the playlist:
White Christmas
Which song are you adding? Enter the name of the song:
White Christmas
Here is your playlist: Playlist: White Christmas Songs: 3, Length: 10
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
4
```

```
Which playlist do you want to add to? Enter the name of the playlist:
White Christmas
Which song are you adding? Enter the name of the song:
Deck The Halls
Here is your playlist: Playlist: White Christmas Songs: 4, Length: 17
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
2
How would you like to modify the queue?
1.Add song to queue
2.Add playlist to queue
3.Add Album to queue
4.Skip song in queue
1
Here is a list of all songs in your music library:
Rockin' Around the Christmas Tree by Brenda Lee
Let It Snow! by Nat King Cole
A Holly Jolly Christmas by Burl Ives
White Christmas by Bing Crosby, Ken Darby Singers, John Scott Trotter & His Orchestra
Feliz Navidad by Jose Feliciano
Jingle Bells by Frank Sinatra
Deck The Halls by Nat King Cole
Santa Claus Is Back In Town by Elvis Presley
White Christmas by Elvis Presley
Here Comes Santa Clause by Elvis Presley
I'll Be Home for Christmas by Elvis Presley
Blue Christmas by Elvis Presley
Santa Bring My Baby Back by Elvis Presley
```


Which song are you adding? Enter the name of the song:

Silent Night

Song Title: Silent Night by Elvis Presley

Album: Elvis' Christmas Album

3min has been added to the queue

Select an option from the menu:

1.Play music from the queue

2.Modify queue

3.Create new playlist

4.Add song to playlist

5. Exit

2

How would you like to modify the queue?

1.Add song to queue

2.Add playlist to queue

3.Add Album to queue

4.Skip song in queue

2

Here is a list of all playlists in your music library:

Built In Playlist

White Christmas

Which playlist do you want to add to the queue?

White Christmas

White Christmas has been added to the queue

Select an option from the menu:

1.Play music from the queue

2.Modify queue

3.Create new playlist

4.Add song to playlist

5. Exit

2

How would you like to modify the queue?

1.Add song to queue

2.Add playlist to queue

3.Add Album to queue

4.Skip song in queue

3

Here is a list of all albums in your music library:

Built In Album1

Built In Album - Single

Merry Christmas

Which album do you want to add to the queue? Enter the name of the album:

Merry Christmas

Merry Christmas has been added to the queue

Play In Order

Now playing the songs in order:
Fearless by The Goo Goo Dolls
Hotline Bling by Drake
What Do You Mean? by Justin Bieber
Watch Me by Silento
679 by Fetty Wap ft. Remy Boyz
Can't Feel My Face by The Weeknd
Good for You by Selena Gomez ft. A\$AP Rocky
If You by Big Bang

Shuffle

Shuffling it up!
679 by Fetty Wap ft. Remy Boyz
Good for You by Selena Gomez ft. A\$AP Rocky
What Do You Mean? by Justin Bieber
Can't Feel My Face by The Weeknd
Watch Me by Silento
If You by Big Bang
Hotline Bling by Drake
Fearless by The Goo Goo Dolls

Album Does Not Exist

```
Here is a list of all albums in your music library:
Built In Album1
Built In Album - Single
Which album do you want to add to the queue? Enter the name of the album:
Built In Album1
Built In Album1 does not exist in your music library
```

Shuffle and Skip throw Basic User Exception

```
Select your plan:

1. Premium:
  - Listen to music in order
  - Listen to music on shuffle
  - Skip songs in the queue
2. Basic:
  - Listen to music on shuffle
  - No skipping songs
2
Select an option from the menu:
1.Play music from the queue
2.Modify queue
3.Create new playlist
4.Add song to playlist
5. Exit
1
1.Play music in order
2.Shuffle Play
1
Upgrade to Premium for this feature. Basic users can only listen to music on shuffle.

Which song would you like to skip?
Hotline Bling
Basic users cannot skip songs.
```