ie400-project-q1

Decision variables

-	1	2	3	4	5	6
artists	"Far Eastern"	"Higher Days"	"Mark A Day"	"Steps Away"	"The Filaments"	"Toni Travis"

$A_i = $ Artist i

$1 \le i \le 6$

-	1	2	3	4	5	6
genres	"Country"	"EDM"	"Folk"	"Hip Hop"	"Pop"	"Rock"

$G_j = $ Genre j

$1 \le j \le 6$

-	1	2	3	4	5	6
songs	"All For Love"	"Ceiling"	"Dear Daisy"	"Heaven"	"On The Edge"	"Seven Years"

$S_k = $ Song k

$1 \le k \le 6$

-	1	2	3	4	5	6
lengths	"2:34"	"2:58"	"3:12"	"3:36"	"4:00"	"4:14"

$L_l = $ Length l

$1 \le l \le 6$

$x_{ijkl} = 1$ if song S_k of artist A_i is in genre G_j and it is L_l minute long is correct

$1 \le i \le 6$

$1 \le j \le 6$

$1 \le k \le 6$

$1 \le l \le 6$

Constraints

1 Each artist is associated with exactly one genre, song, and length

$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{1jkl} = 1$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{2jkl} = 1$$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{3jkl} = 1$$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{4jkl} = 1$$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{5jkl} = 1$$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{6jkl} = 1$$

2 Each song is associated with exactly one artist, genre, and length

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} x_{ij1l} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} x_{ij2l} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} x_{ij3l} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} x_{ij4l} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} x_{ij5l} = 1$$

3 Each genre is associated with exactly one artist, song, and length

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{i1kl} = 1$$

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{i2kl} = 1$$

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{i3kl} = 1$$

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{i4kl} = 1$$

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{i5kl} = 1$$

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} x_{i6kl} = 1$$

4 Each length is associated with exactly one artist, song, and genre

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{k=1}^{6} x_{ijk1} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{k=1}^{6} x_{ijk2} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{k=1}^{6} x_{ijk3} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{k=1}^{6} x_{ijk4} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{k=1}^{6} x_{ijk5} = 1$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{k=1}^{6} x_{ijk6} = 1$$

Artist "Higher Days" canot have "Ceiling" or "Seven Years" as a song

$$\sum_{j=1}^{6} \sum_{k=1}^{6} x_{2j2l} = 0$$
$$\sum_{j=1}^{6} \sum_{k=1}^{6} x_{2j6l} = 0$$

Artist "Higher Days" cannot have a song that is 2:34 long

$$\sum_{j=1}^{6} \sum_{l=1}^{6} x_{2j1l} = 0$$

Artist "Higher Days" cannot have a song in EDM genre

$$\sum_{k=1}^{6} \sum_{l=1}^{6} x_{22kl} = 0$$

Artist "Mark A Day" canot have "Ceiling" or "Seven Years" as a song

$$\sum_{j=1}^{6} \sum_{l=1}^{6} x_{3j2l} = 0$$

$$\sum_{j=1}^{6} \sum_{l=1}^{6} x_{3j6l} = 0$$

Artist "Mark A Day" cannot have a song that is 2:34 long

$$\sum_{j=1}^{6} \sum_{l=1}^{6} x_{3jk1} = 0$$

Artist "Mark A Day" cannot have a song in EDM genre

$$\sum_{j=1}^{6} \sum_{l=1}^{6} x_{32kl} = 0$$

"Ceiling" and "Seven Years" cannot be 2:34 long

$$\sum_{i=1}^{6} \sum_{j=1}^{6} x_{ij21} = 0$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} x_{ij61} = 0$$

"Ceiling" and "Seven Years" cannot be EDM genre

$$\sum_{i=1}^{6} \sum_{l=1}^{6} x_{i22l} = 0$$

$$\sum_{i=1}^{6} \sum_{l=1}^{6} x_{i26l} = 0$$

Of "Dear Daisy" and the song by Mark A Day, one is 3:36 long and the other is a Pop song.

dear_daisy_3_36 = $\sum_{i=1}^{6} \sum_{j=1}^{6} x_{ij34}$

dear_daisy_pop = $\sum_{i=1}^{6} \sum_{j=1}^{6} x_{i53l}$

mark_a_day_pop = $\sum_{k=1}^{6} \sum_{l=1}^{6} x_{35kl}$

mark_a_day_3_36 = $\sum_{k=1}^{6} \sum_{j=1}^{6} x_{3jk4}$

dear_daisy_3_36 + dear_daisy_pop = 1

mark_a_day_3_36 + mark_a_day_pop = 1

dear_daisy_3_36 + mark_a_day_3_36 = 1

"On The Edge" plays for longer than Toni Travis's track

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} L_l * x_{ij5l} \geq \sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{6jkl}$$

The Country song has a shorter duration than Steps Away's offering.

$$\sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{i1kl} \leq \sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{4jkl}$$

It's no accident that "On The Edge" is precisely 4 minutes long, with the artist being a fan of round numbers

$$\sum_{i=1}^{6} \sum_{k=1}^{6} x_{ij55} = 1$$

No song starts with the first letter of its artist's name.

$$\sum_{j=1}^{6} \sum_{k=1}^{6} x_{24kl} = 0$$
$$\sum_{j=1}^{6} \sum_{k=1}^{6} x_{46kl} = 0$$

Of "Ceiling" and the Higher Days song, one is a Folk song and the other is 2:58 long.

$$\sum_{i=1}^{6} \sum_{k=1}^{6} x_{i2k2} + \sum_{i=1}^{6} \sum_{l=1}^{6} x_{i23l} = 1$$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} x_{2jk2} + \sum_{j=1}^{6} \sum_{l=1}^{6} x_{2j3l} = 1$$

There is a difference in duration of 1 minute 2 seconds between the Hip Hop song and the song by The Filaments.

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} L_l * x_{ij4l} - \sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{i23l} \leq 62 * n$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} L_l * x_{ij4l} - \sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{i23l} \leq -62 * n$$

$n = 1 \ or \ 0$

The Rock song is 14 seconds longer than the Country song

$$\sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} L_l * x_{ij6l} \ - \ \sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} L_l * x_{ij1l} = 14$$

Far Eastern's song is 24 seconds longer than "Heaven"

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{1jkl} \ - \ \sum_{i=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{i4kl} = 24$$

"Dear Daisy" is not a Hip Hop nor a Folk song.

$$\sum_{i=1}^{6} \sum_{l=1}^{6} x_{i33l} = 0$$
$$\sum_{i=1}^{6} \sum_{l=1}^{6} x_{i34l} = 0$$

Far Eastern's song is longer than the Pop song but shorter than Steps Away's song

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{1jkl} \ \geq \sum_{i=1}^{6} \sum_{j=1}^{6} \sum_{l=1}^{6} L_l * x_{ij5l}$$

$$\sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{1jkl} \ \leq \sum_{j=1}^{6} \sum_{k=1}^{6} \sum_{l=1}^{6} L_l * x_{4jkl}$$

"All For Love", which is not a Hip Hop song, was not recorded by The Filaments, Toni Travis, nor Mark A Day.

$$\sum_{i=1}^{6} \sum_{l=1}^{6} x_{i14l} = 0$$

$$\sum_{k=1}^{6} \sum_{l=1}^{6} x_{i13l} = 0$$

$$\sum_{k=1}^{6} \sum_{l=1}^{6} x_{i15l} = 0$$

$$\sum_{k=1}^{6} \sum_{l=1}^{6} x_{i16l} = 0$$