



Major Investigation- Math in the sheet music of iconic adventure themes

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Introduction

A close-up photograph of a violin and its bow resting on a sheet of musical notation. The violin is made of polished wood and has a black chin rest and f-hole. The bow is made of wood with black hair. The sheet of music is open, showing several staves with notes and clefs. The background is a dark, textured surface.

- ▶ This investigation based around the different aspects of a violin solo of multiple iconic themes from adventure movies. I have gathered scores for Pirates of the Caribbean (Hans Zimmer), the main Star Wars theme (John Williams) and The Raiders March (John Williams) from Indiana Jones to examine the different bowing techniques and notes used. This is so we can work out mean, median, mode and averages for this genre of music, breaking down the statistics and percentages as well as studying the patterns in the music.

Sampled Violin Solos

Pirates of the
Caribbean

The Raiders March

Star Wars Theme



Pirates of the Caribbean

He's a Pirate

He's a Pirate or The Pirates of the Caribbean Theme was written by Hans Zimmer and released in 2003 for The Curse of the Black Pearl movie out of the Pirates of the Caribbean franchise. Here I have a violin solo for the song and have analysed the variations of notes and different components of the piece that are necessary to the character of the song. This piece includes varied bowing techniques, notes of many different lengths, repeats, a time signature of $\frac{3}{4}$, rests of different lengths and it's in the F major scale. This piece moves at a pace of 180 beats per minute.

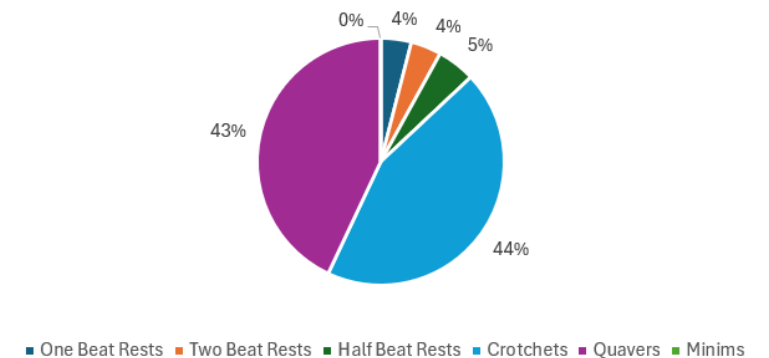
The image displays a musical score for the piece "He's a Pirate" by Hans Zimmer. The title "PIRATES of the CARIBBEAN" is prominently displayed at the top, with "Hans Zimmer" written in smaller text to the right. The score is written in treble clef with a 3/4 time signature. It begins with a tempo marking of "♩ = 180". The music is composed of a single melodic line, likely for a violin, featuring a mix of eighth and sixteenth notes, rests, and dynamic markings such as "p" (piano) and "f" (forte). The score is arranged in ten staves, showing the progression of the theme.

Pirates of the Caribbean

- ▶ This sheet music has a total of 84 bars with the time signature of $\frac{3}{4}$, this means that the piece will have an overall beat value of (84×3) 252.
- ▶ Out of the 252 available beats, there are;
 - 13 two-beat rests
 - 12 one-beat rests
 - 14 half-beat rests
 - 132 crochets (1/4 notes)
 - 129 quavers (1/8 notes)
 - 2 minims (1/2 note)
 - 10 dotted notes
 - 1 slur (bowing technique)
 - 16 staccato notes (bowing technique)



Pirates Of The Caribbean- % of each note in the piece (rounded)



The Raiders March

- ▶ The Raiders March is the most well known and iconic theme from the Indiana Jones Movie Franchise, most of the scores being written by John Williams. This score was written for the release of Raiders of the Lost Ark in 1981 and continued through all of the movies. This score is significantly more intricate than the Pirates Theme and more varied bowing techniques but still a similar structure with many of the same notes. This song has been written in B flat Major scale with a time signature of 4/4 (aka common time). There are 60 bars with 4 beats per bar and no specified beats per minute. The bowing techniques in this piece include; staccato, slurs, tenuto, up bows, down bows and accents.

From RAIDERS OF THE LOST ARK
RAIDERS MARCH

PART 2
Violin

By JOHN WILLIAMS
Arranged by PAUL LAVENDER

Steady March

The musical score is written in B-flat major (two flats) and 4/4 time. It begins with a dynamic marking of *f* (forte) and a tempo marking of "Steady March". The score is divided into measures, with bar numbers 5, 13, 21, 29, 35, 43, and 53 indicated. The piece concludes with a dynamic marking of *mf* (mezzo-forte). The score includes various bowing techniques such as staccato, slurs, tenuto, up bows, and down bows. The score is arranged by Paul Lavender.

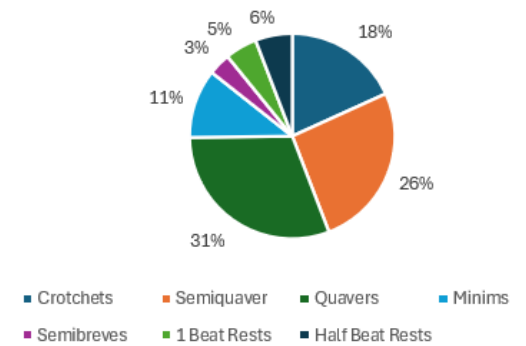
Overall, there are 258 notes/ rests in this piece.
Here are the specific amounts of each note/ rest

- Crotchets 47
- Semiquaver 67
- Quavers 79
- Minims 28
- Semibreves 9
- 1 Beat Rests 13
- Half Beat Rests 15

In this piece, there were many notes that were dotted, so I have some extra statistics on what percentage of those individual notes were dotted or not.

- Quavers; there is a total of 79 quavers in this piece with 59% of them being dotted (47/79)
- Minims; There are a total of 28 minims and 54% of them are dotted (15/28)

The Raiders March- % of each note/rest in the piece (rounded)



From RAIDERS OF THE LOST ARK
RAIDERS MARCH
By JOHN WILLIAMS
Arranged by PAUL LAVENDER

PART 2
Violin
Steady March

Star Wars Theme

- ▶ This theme from Star Wars can be heard in all 9 main movies. It was first written in 1977 by John Williams for the release of the first star wars movie, A New Hope, and managed to win him an Oscar. This piece does not have a specified beat count but is worked in a 4/4 time signature and in the same key as Pirates of the Caribbean (F Major). The bowing techniques include legato, accents, slurs and retakes. The notes include minims, triplets, semibreves, crotchets and quavers with 1 beat and half beat rests.

1/1 From the Lucasfilm Ltd. Productions "STAR WARS", "THE EMPIRE STRIKES BACK" and "RETURN OF THE JEDI" - Twentieth Century-Fox Releases.

STAR WARS
(Main Theme)

Music by
JOHN WILLIAMS

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Majestically

The musical score for the Star Wars Main Theme is presented on a single page. It features a treble clef, a key signature of one flat (Bb), and a 4/4 time signature. The tempo/mood is marked 'Majestically'. The score consists of 10 staves of music. The first staff starts with a treble clef, a key signature of one flat, and a 4/4 time signature. The music is written in a single melodic line. The score includes various note values such as minims, crotchets, and quavers, along with rests. There are also triplets and slurs. The score ends with a double bar line.

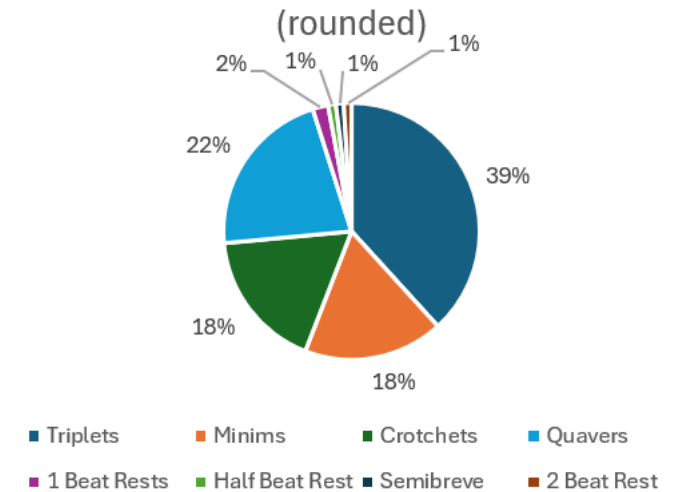
Star Wars

There are 28 bars in this score with a time signature of 4/4. This means that there are 112 beats available. This piece is also significantly shorter than the other pieces which can be an outlier when calculating mean, median and mode or other averages. Here are the individual counts for each note and rest. There were 131 notes/ rests total in this piece.

- ▶ 51 triplets (17 x 3)
- ▶ 23 minims
- ▶ 23 crotchets
- ▶ 29 Quavers
- ▶ 2 1 beat rests
- ▶ 1 2 beat rest
- ▶ 1 half beat rest
- ▶ 1 semibreve

This piece was unique with having a large chunk taken up by a different bowing pattern. 27% was put towards legato.

Star Wars Theme- % of each note/ rest in the piece



1/1 From the Lucasfilm Ltd. Productions "STAR WARS", "THE EMPIRE STRIKES BACK" and "RETURN OF THE JEDI" - Twentieth Century-Fox Releases.

STAR WARS
(Main Theme)

Music by JOHN WILLIAMS

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Majestically

Mean, Median, Mode

Mean- Out of all three music pieces there was a total of 691 scored notes with 230 notes being the average amount of notes per song.

Median- There were many different amounts of notes including; 234 crotchets, 186 quavers, 53 minims, 7 semibreves, 67 semi quavers and 51 triplets. The median of all these different length notes is the crotchet.

Mode; The mode of these pieces is the 234 crotches. The crotchet was the most common note found in the combined pieces.



Conclusion

- ▶ Through this investigation, I have learnt plenty more about how Maths and Music are interconnected. It has really surprised me with how many different aspects of maths are contained in sheet music. Even though my investigation has been focusing on patterns, averages and other statistics there are still many more aspects that I have noticed in even just three pieces. E.g. The beats and rhythm, the dynamics of the sounds, how different sizes and lengths of the violin can affect the sound, the measurement of the symbols, and so many more. I look forward to continuing to learn maths through my journey in music and learning more about how mathematics can be part of anything and everything.



Thank you!

By Gabi Leitch WWoM