Português (Portugal)   →   Inglês ⌄   ⋮   ⌄

Informatics for Musicology (IPM) 2024/25

Jupyter Notebooks

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Oct 15 Class : Exploration of IPM (Haskell) libraries for 'Computer-Aided Musicology'

Repetition as a stylistic resource in music. Introduction to pattern recognition ('motifs') using the `reduce` .

⚠️ **Important** : run without moving the next cells.

In [ ]:
```
: opt  no − lint
: m  Data . Ratio
: m  Data . Char
: m  Date . List
```

In [ ]:
```
: l  ../ src / Cp . hs
: l  ../ src / Reducer . hs
: l  ../ src / Ipm . hs
: l  ../ src / Abc . hs
: l  ../ src / CS . hs
```

🔴The transformation map

5.1 - Back to the names of all the students in this class:

In [ ]:
```
class   =   [
    "Ana Bárbara Francisco Gabriel" ,
    "Dinis Cunha Andrade" ,
    "Inês Beatriz Martins Neves" ,
    "João Jorge Soares Moreira" ,
    "João Henrique Mestre Conceição Inácio" ,
    "João Miguel Pereira de Oliveira" ,
    "Matilde Sampaio Teixeira " ,
    "Mohammad Najib Angar" ,
    "Miguel Pires Santiago"
    ]
```

Evaluate the following pairs of expressions and draw conclusions:

In [ ]:
```
length  class
map  length  class
```

In [ ]:
```
last  class
map  last  class
```

In [ ]:
```
reverse  class
map  reverse  class
```

In [ ]:
```
map  words  class
map  ( length  .  words )  class
```

5.2 - And now what follows, knowing which function `abc` converts each note `(n,d)` to Abc notation:

In [ ]:
```
carnaval_serrano
abc map  carnaval_serrano
```

Write below, in your own words, the difference in meaning between `map  f` and `f` :

> ....

5.3 – In the following definitions, interpret `(n,d)` as a musical event described by a note `n` and a duration `d`. What do they do `aum` and `dim`?

In [ ]:
```
inc ( n , d ) = ( n , 2 * d )
dim ( n , d ) = ( n , d / 2 )
```

5.4 – What stylistic effects do you expect to happen when evaluating the following cells?

In [ ]:
```
map  aum  royalTheme
map  dim  carnaval_serrano
```

View the results in score in the following cell:

In [ ]:

🔴Pattern recognition

➡️ *Repetition* is one of the main stylistic resources in music. It makes sense, therefore, in musical analysis, to identify *motifs* , or repetitive patterns, in a piece of music.

Let's see how this task can be helped by our interpreter.

5.5 – The floor is given `ANABELA` . Run the following cells and investigate the results obtained.

In [ ]:
```
m  =  "ANABELA"
n  =  letters  m
___
m
n
```

In [ ]:
```
reduced  n
```

The word was represented by the so-called **graph** *of its letters* .

5.6 - Anticipate the graph calculated by the next expression, before evaluating:

In [ ]:
```
a  =  "aniline" letters  ─── reduced to
```

5.7 - Do the same for the next cell:

In [ ]:
```
x  =  "Canadian" letters  ─── reduced x
```

The novelty here is to have found a **pattern** P0 that repeats twice. We can also see it as a graph:

In [ ]:
```
sreduced  "P0"   x
```

5.8 - Anticipate the graph calculated by the next expressions, before evaluating:

In [ ]:
```
reduced  ( letters  "potato" )
```

In [ ]:
```
reduced ( words "ba ta ta" )
```

5.9 – Let's now look for patterns (*motifs*) in music, for example in:

In [ ]:
```
fj = [( "F" , 1 % 4 ), ( "G" , 1 % 4 ), ( "A" , 1 % 4 ), ( "F" , 1 % 4 ), ( "F" , 1 % 4 ),
      ( "G" , 1 % 4 ), ( "A" , 1 % 4 ), ( "F" , 1 % 4 ), ( "A" , 1 % 4 ), ( "B" , 1 % 4 ),
      ( "c" , 1 % 2 ), ( "A" , 1 % 4 ), ( "B" , 1 % 4 ), ( "c" , 1 % 2 ), ( "c" , 3 % 16 ),
      ( "d" , 1 % 16 ), ( "c" , 1 % 8 ), ( "B" , 1 % 8 ), ( "A" , 1 % 4 ), ( "F" , 1 % 4 ),
      ( "c" , 3 % 16 ),( "d" , 1 % 16 ),( "c" , 1 % 8 ),( "B" , 1 % 8 ),( "A" , 1 % 4 ),
      ( "F" , 1 % 4 ), ( "F" , 1 % 4 ), ( "C" , 1 % 4 ), ( "F" , 1 % 2 ), ( "F" ,1 % 4 ),
      ( "C" , 1 % 4 ), ( "F", 1 % 2 )]
```
Visualize it m in sheet music in the following cell (F major, quaternary measure):

In [ ]:

5.10 – Can you identify *motifs* in the melody? How many and which ones?

Run to the next cell to see if you identified them correctly.

In [ ]:
```
reduced ( map abc fj )
```

5.11 – How would you see the *motifs* without rhythmic information?

In [ ]:

5.12 – We can inspect each particular pattern:

In [ ]:
```
p0 = abcpattern "P0" fj
---
p0
```

And even view them in Abc:

In [ ]:
```
abcplease  p0
```

Do this for the defaults `P1`, `P2` and `P3`:

In [ ]:

In [ ]:

In [ ]:

5.13 - Obtain the rhythmic and melodic patterns of the well-known *Trumpet Voluntary* by Henri Purcell (1659-1695) shown in the following cell (NB: trumpet in $B\flat$): $B\flat$):

In [ ]:
```
abcPlayM "C" "C" volunteer
```

In [ ]:

In [ ]:

5.14 - Towards the end of his life, Johannes Brahms (1833-1897) wrote several works for clarinet, one of them being the famous quintet opus 115, which follows the beginning of the clarinet part (in `A`) of one of the movements :

```
In [ ]:  brahms  =  [( "f" , 1  %  4 ),( "e" , 1  %  8 ),( "f" , 1  %  8 ),( "d" , 1  %  4 ),( "c" , 1  %  8 ),( "d"
                   ( "A" , 1  %  4 ),( "G" , 1  %  4 ),( "c" , 1  %  4 ),( "d" , 1  %  8 ),
                   ( "e" , 1  %  8 ),( "g" , 1  %  8 ) ,( "f " , 1 % 8 ),( " e" , 1  % 8 ),( "f" , 1 % 8 ), ( "e" , 1
```

Interpret the result in the following cell:

```
In [ ]:  ( m , r )  =  unzip  brahms
         ---
         reduced  m
```

5.15 – What is the difference between the result above and the one in the next cell?

```
In [ ]:  reduced  ( abc brahms map  )
```

5.16 – Show in the following cells, in score, the reasons P0 that P1 were obtained above:

```
In [ ]:  -- P0
```

```
In [ ]:  -- P1
```

5.17 – Repeat in the cells to be created below what you did brahms above, but focusing only on the rhythmic component.

```
In [ ]:
```